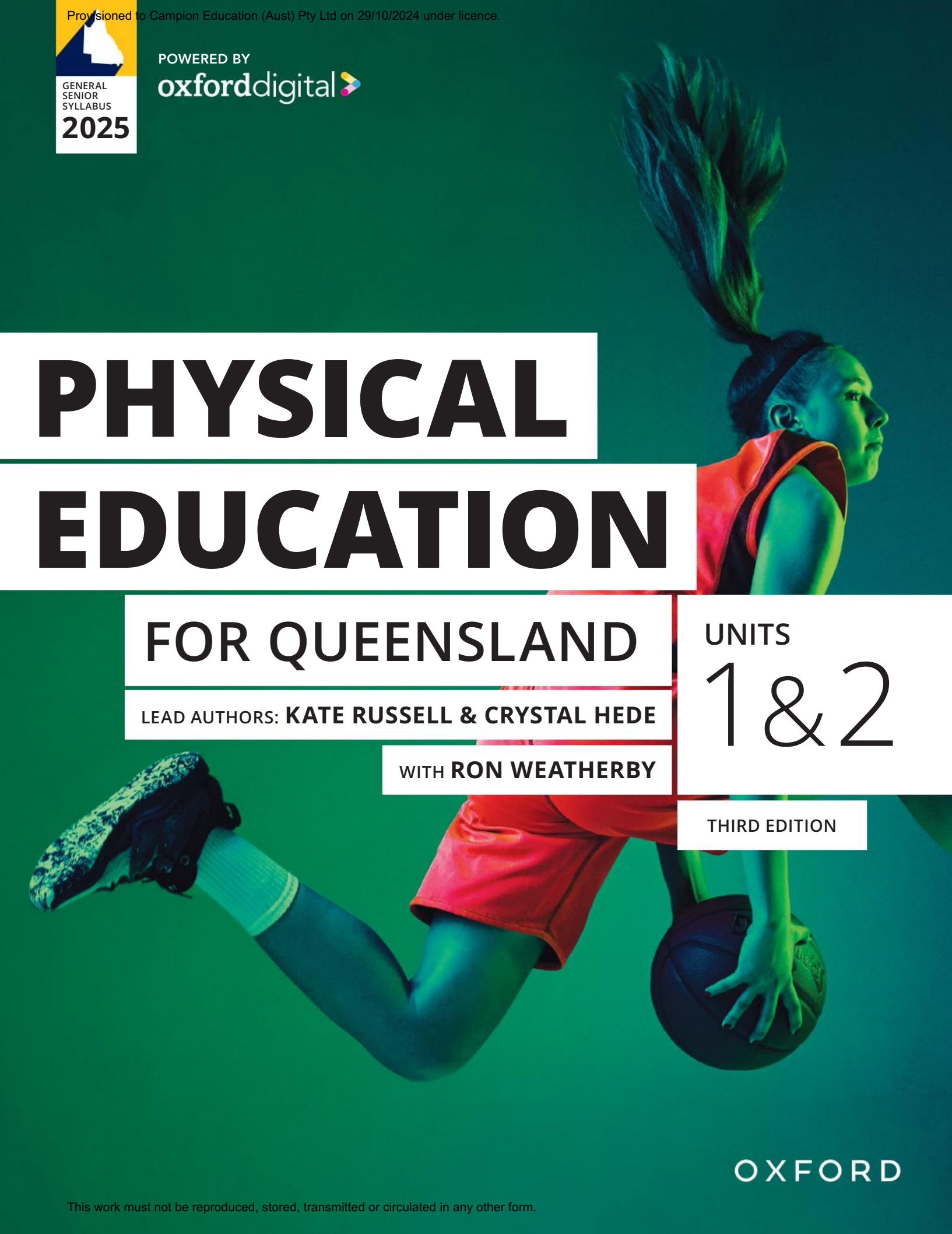
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PHYSICAL EDUCATION

FOR QUEENSLAND

UNITS 1&2

LEAD AUTHORS: **KATE RUSSELL & CRYSTAL HEDE**

WITH **RON WEATHERBY**

THIRD EDITION

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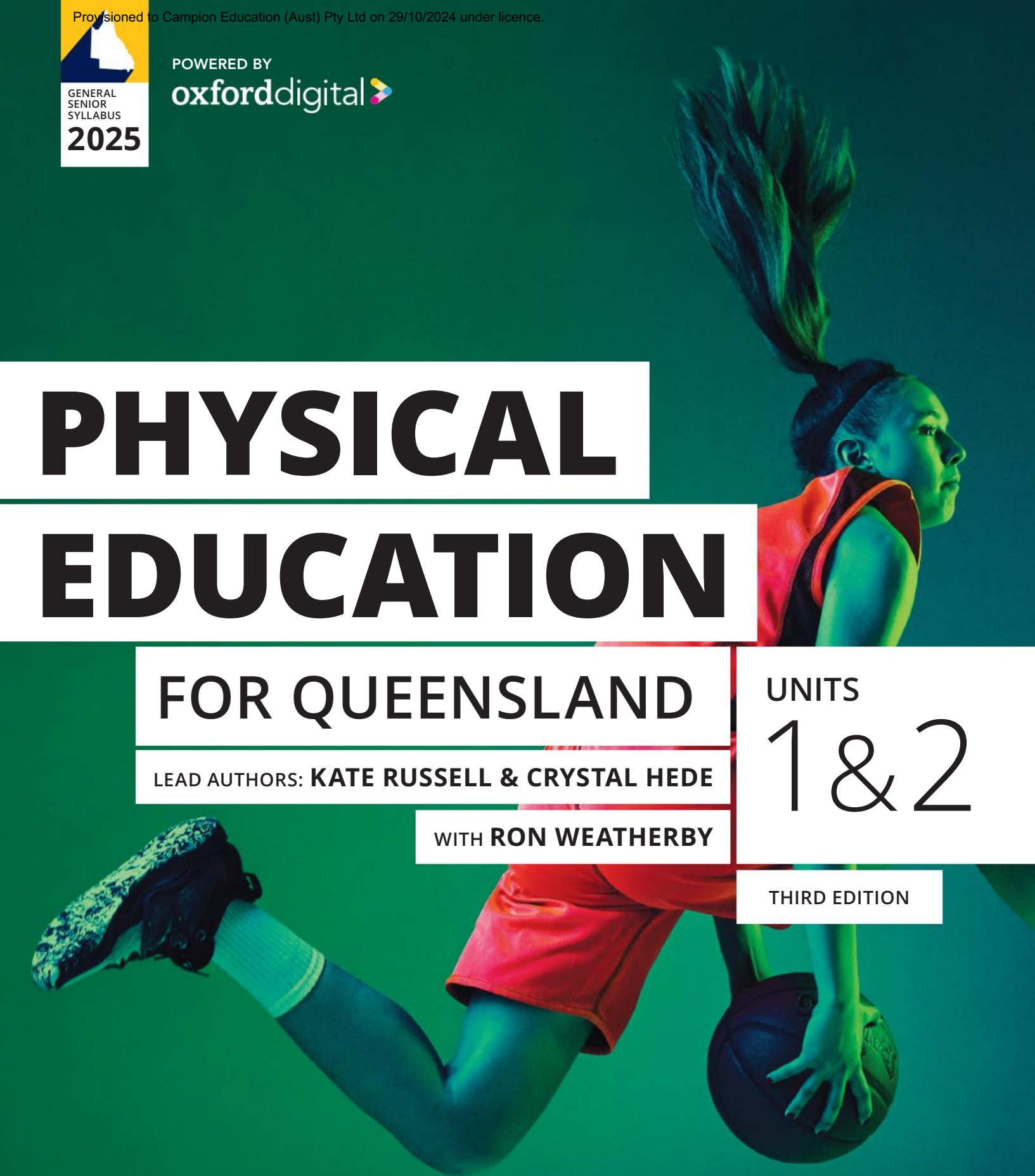
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Published in Australia by
Oxford University Press
Level 8, 737 Bourke Street, Docklands, Victoria 3008, Australia.

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First published 2011
Third Edition

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Proofread by Linden George and Natasha Broadstock
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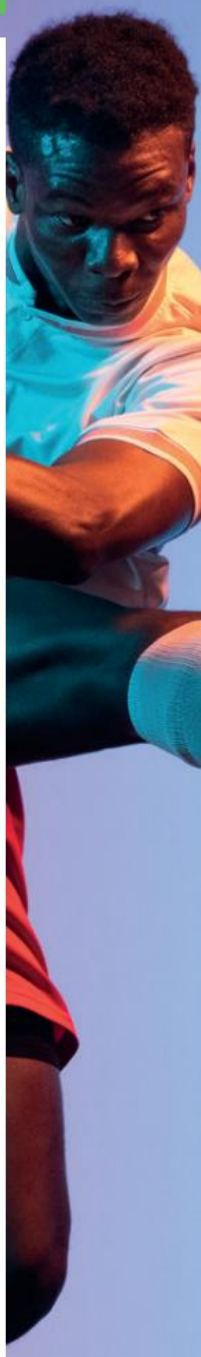
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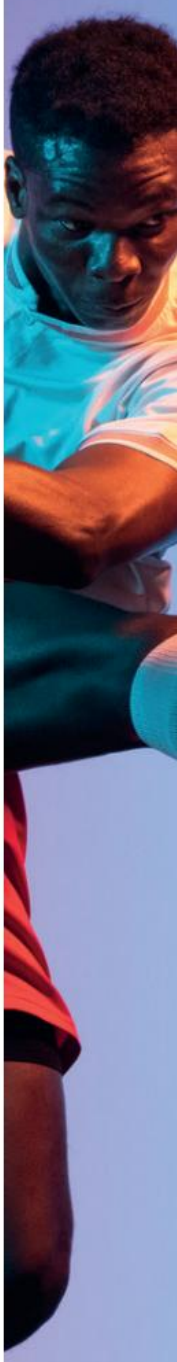
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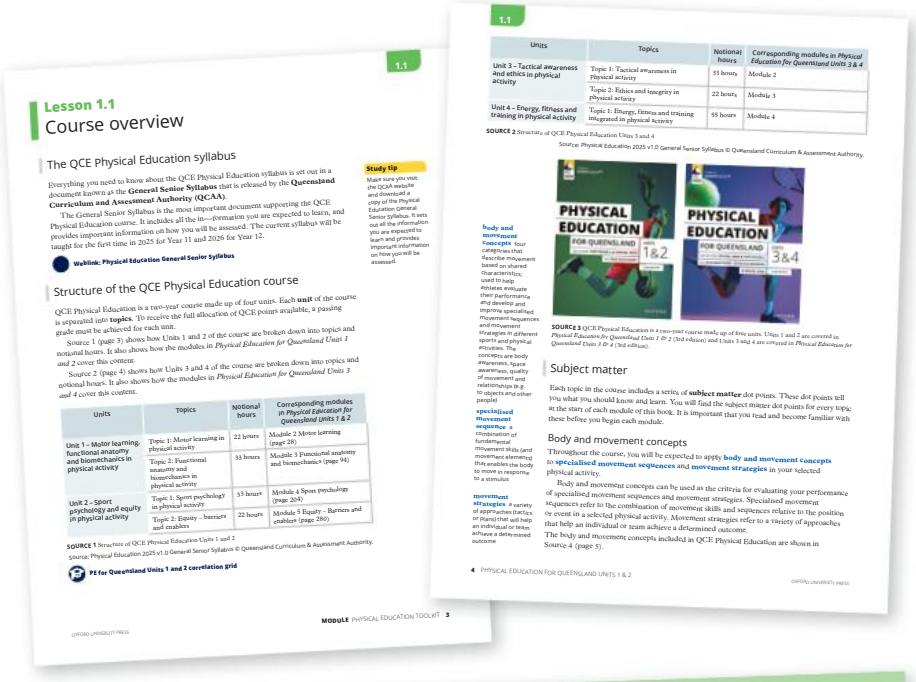
Introducing *Physical Education for Queensland Units 1&2* (Third edition)

Congratulations on choosing *Physical Education for Queensland Units 1&2* (Third edition) as part of your studies this year!

Physical Education for Queensland Units 1&2 (Third edition) has been purpose-written to meet the requirements of the QCAA Physical Education 2025 General Senior Syllabus. It includes a range of flexible print and digital products to suit your school and incorporates a wide variety of features designed to make learning fun, purposeful and accessible to all students!

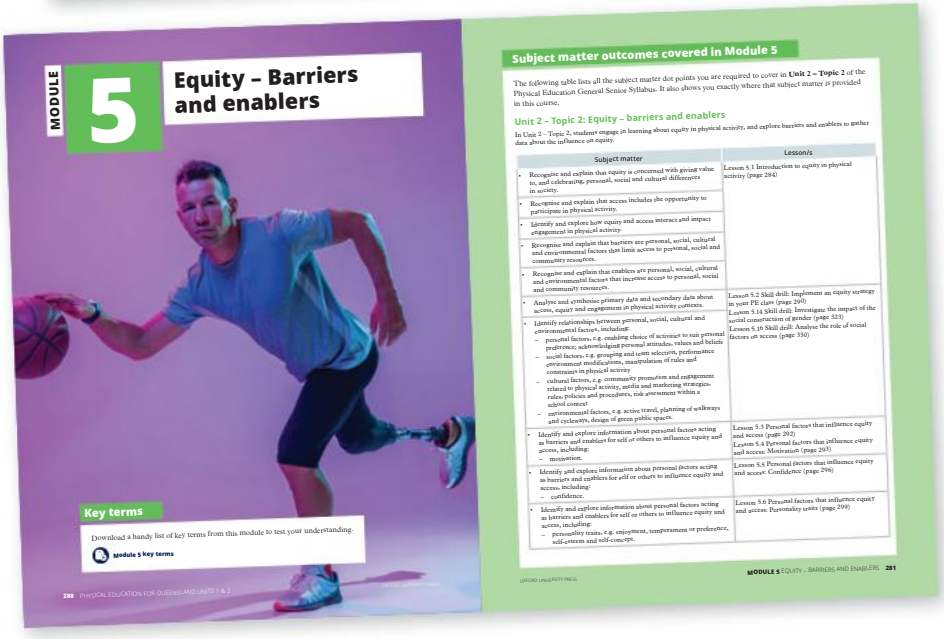
Key features of Student Books

The Physical Education toolkit module provides an overview of the syllabus, tips for success on assessment tasks, advice on understanding cognitive verbs and a summary of the importance of data in the QCE Physical Education course.



Each module begins with a module opener that includes:

- key terms from the syllabus
- a content grid that shows the coverage of all subject matter outcomes from the syllabus.



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Lesson 4.6
Attention and concentration

Key ideas
→ Attention is the ability of an athlete to respond to specific internal and external stimuli during training and competition.
→ Concentration is the everyday term used to describe how a person focuses their mental energy.

Defining attention and concentration

Attention and concentration are two more key concepts in sport psychology. In simple terms, attention and concentration are both concepts used to describe the level of focus and attentiveness a person dedicates to a particular task or stimulus.

People often use these terms interchangeably, but when examining attention and concentration in the context of sport psychology, it is helpful to distinguish between them. In sport psychology:

- attention is the technical term used to refer to the specific ability of an athlete to attend and respond to appropriate internal stimuli (e.g. thoughts or feelings) and external stimuli (such as the starter's gun or an opponent) during training and competition
- concentration is the everyday term used to describe how effectively a person focuses their mental energy and is attentive to useful stimuli. Strong performances are often said to be the result of "good concentration" and poor performances the product of "lapses of concentration".

To maintain the highest levels of attention and concentration, players must use selective attention. This is where they narrow their focus to the specifics of the task required (known as relevant cues) and block out distractions (known as irrelevant cues). For example, as relevant cues) and block out distractions (known as irrelevant cues). For example, during play a soccer goalkeeper will focus on relevant cues (such as the position of the ball, the speed of its approach and the location of other players on the field) and ignore irrelevant cues (e.g. a bird flying overhead, taunts from opponents, cheers from the crowd).

SOURCE 1 Successful athletes use selective attention to block out distractions and focus closely on the task at hand.

attention a technical term used by sports psychologists to refer to the specific ability of an athlete to attend and respond to appropriate internal (e.g. thoughts or feelings) and external (e.g. the starter's gun, an opponent) stimuli during training and competition

concentration an everyday term used to describe how a person focuses their mental energy

selective attention the ability to process and react to certain stimuli selectively (when several stimuli occur simultaneously)

relevant cues essential (important) information that an athlete needs to focus on

irrelevant cues extraneous (unnecessary) information that can distract an athlete

Learning intentions and success criteria

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Achieving and maintaining optimum attention and concentration

Sport psychologists generally agree that achieving optimum performance is dependent on an athlete focusing on the right thing at the right time. Many theories have been developed to explain the relationship between attention and performance, but the most popular and widely accepted theory is known as Nideffer's attentional model.

Nideffer's attentional model

Nideffer's attentional model (see Source 2 (page 229)) was developed in 1981 by US sport psychologist Robert Nideffer. It helps to define and explain attention and concentration behaviours in athletes by proposing that attention exists in two dimensions:

- Width relates to the amount of information or number of cues an athlete perceives. These cues exist on a continuum from narrow focus (i.e. a single cue) through to broad focus (i.e. many cues).
- Direction relates to the source of stimuli that an athlete perceives. These sources also exist on a continuum from internal (e.g. an athlete's own thoughts and feelings) through to external (e.g. an opponent, the wider environment).

Source 2 (page 229) shows the attentional model's four distinct types of attentional focus:

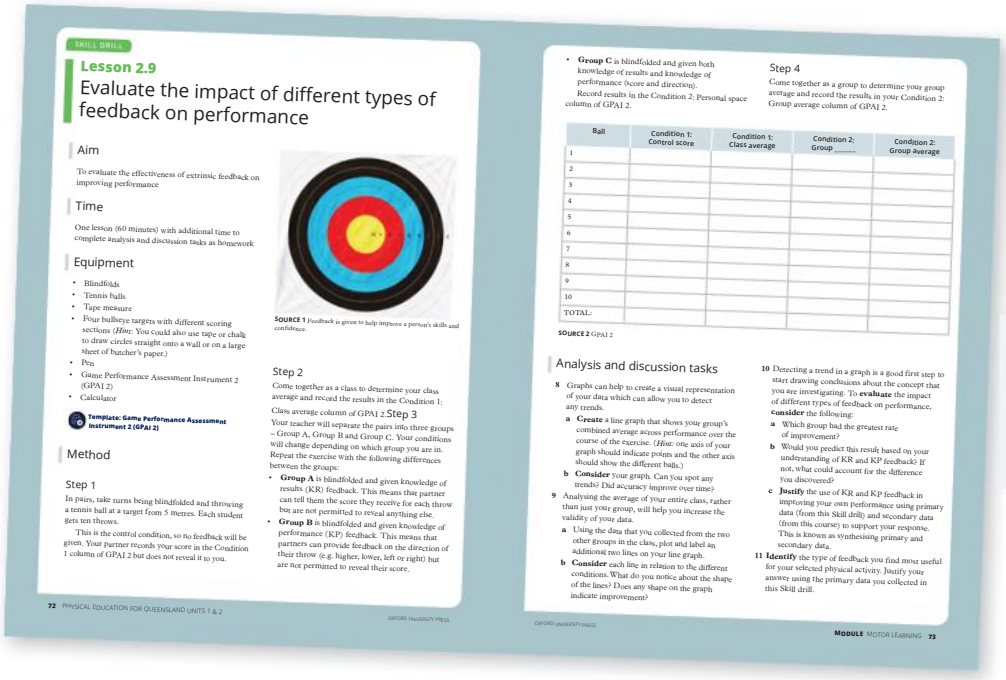
- broad–external – athletes with this focus are often referred to as "aware"; for example, a volleyball setter who scans the defence before setting up the play
- broad–internal – athletes with this focus are often referred to as "strategic"; for example, a golfer carefully considering shot selection prior to addressing the ball
- narrow–external – athletes with this focus are often referred to as "focused"; for example, a tennis player focusing on their toss as they begin to serve
- narrow–internal – athletes with this focus often referred to as "systematic"; for example, a basketball player reviewing their self-talk prior to taking a free throw.

SOURCE 2 Nideffer's attentional model has four distinct types of attentional focus, with a number of characteristics common to each type.

retrieve it! How many stages are there on the arousal continuum? Check back to Lesson 4.4 Arousal (page 220) to see if you retrieved the information correctly.

Study tip Keeping a video log of your performance can be a great way to assess your levels of attention and concentration. Store video clips of your performance in a folder on your computer and add either a voiceover or a short written analysis of each one as you go. Look beyond physical performance; for example, note changes in your attention and concentration. Make a note of any links between strategies you have been implementing off court (such as mental rehearsal and meditation) and changes in performance on court.

MODULE 4 SPORT PSYCHOLOGY 229



SKILL DRILL

Lesson 2.9
Evaluate the impact of different types of feedback on performance

Aim

To evaluate the effectiveness of extrinsic feedback on improving performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Blindfolds
- Tennis balls
- Tape measure
- Four bullseye targets with different scoring sections (*Hint*: You could also use tape or chalk to draw circles straight onto a wall or on a large sheet of butcher's paper.)
- Pen
- Game Performance Assessment Instrument 2 (GPAI 2)
- Calculator

Template: Game Performance Assessment Instrument 2 (GPAI 2)

Method

Step 1

In pairs, take turns being blindfolded and throwing a tennis ball at a target from 5 metres. Each student gets ten throws.

This is the control condition, so no feedback will be given. Your partner records your score in the Condition 1 column of GPAI 2 but does not reveal it to you.

SOURCE 1 Feedback is given to help improve a person's skills and confidence.

Step 2

Come together as a class to determine your class average and record the results in the Condition 1: Class average column of GPAI 2.

Step 3

Your teacher will separate the pairs into three groups – Group A, Group B and Group C. Your conditions will change depending on which group you are in. Repeat the exercise with the following differences between the groups:

- **Group A** is blindfolded and given knowledge of results (KR) feedback. This means that partner can tell them the score they receive for each throw but are not permitted to reveal anything else.
- **Group B** is blindfolded and given knowledge of performance (KP) feedback. This means that partners can provide feedback on the direction of their throw (e.g. higher, lower, left or right) but are not permitted to reveal their score.
- **Group C** is blindfolded and given both knowledge of results and knowledge of performance (score and direction).

Record results in the Condition 2: Personal space column of GPAI 2.

Step 4

Come together as a group to determine your group average and record the results in your Condition 2: Group average column of GPAI 2.

Ball	Condition 1: Control score	Condition 1: Class average	Condition 2: Group _____	Condition 2: Group average
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTAL:				

SOURCE 2 GPAI 2

Analysis and discussion tasks

8 Graphs can help to create a visual representation of your data which can allow you to detect any trends.
a **Create** a line graph that shows your group's combined average across performance over the course of the exercise. (*Hint*: one axis of your graph should indicate points and the other axis should show the different balls.)
b **Consider** your graph. Can you spot any trends? Did accuracy improve over time?

9 Analysing the average of your entire class, rather than just your group, will help you increase the validity of your data.
a Using the data that you collected from the two other groups in the class, plot and label an additional two lines on your line graph.
b **Consider** each line in relation to the different conditions. What do you notice about the shape of the lines? Does any shape on the graph indicate improvement?

10 Detecting a trend in a graph is a good first step to start drawing conclusions about the concept that you are investigating. To **evaluate** the impact of different types of feedback on performance, **consider** the following:
a Which group had the greatest rate of improvement?
b Would you predict this result based on your understanding of KR and KP feedback? If not, what could account for the difference you discovered?
c **Justify** the use of KR and KP feedback in improving your own performance using primary data (from this Skill drill) and secondary data (from this course) to support your response. This is known as synthesising primary and secondary data.

11 **Identify** the type of feedback you find most useful for your selected physical activity. Justify your answer using the primary data you collected in this Skill drill.

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MODULE MOTOR LEARNING 73

Each lesson includes:

- key ideas signposted at the beginning of each lesson
- clearly structured content written in clear, concise language
- definitions for all key terms on the page
- engaging, relevant and informative images and illustrations
- a range of tips and features designed to bring course content to life including **case studies, study tips, news articles, and retrieval prompts** to help students consolidate knowledge in their long-term memory.
- links to supporting **digital resources**, including **learning intentions and success criteria**
- **Check your learning** activities organised according to **Marzano and Kendall's taxonomy and incorporating cognitive verbs**.

Each module contains a range of skill drills designed to reinforce the theoretical aspects of the syllabus.

Find out more

For a complete overview of all the features and benefits of this Student Book, as well as helpful videos showing you how to get the most out of the series:

> activate your digital access (using the instructions on the inside front cover of this book) and click on *"Introducing Physical Education for Queensland Units 1&2* (Third edition)*"* in the Course menu.

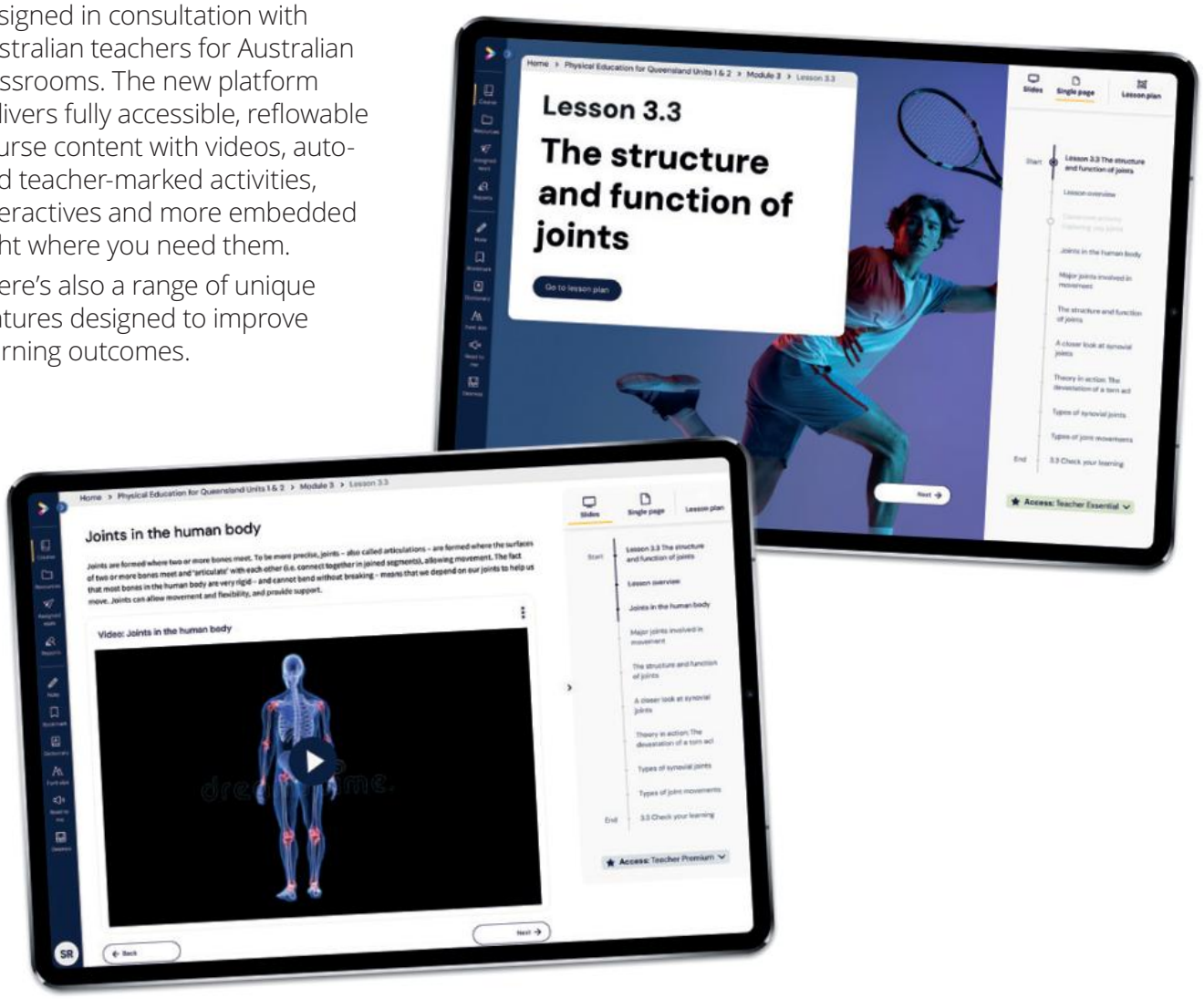
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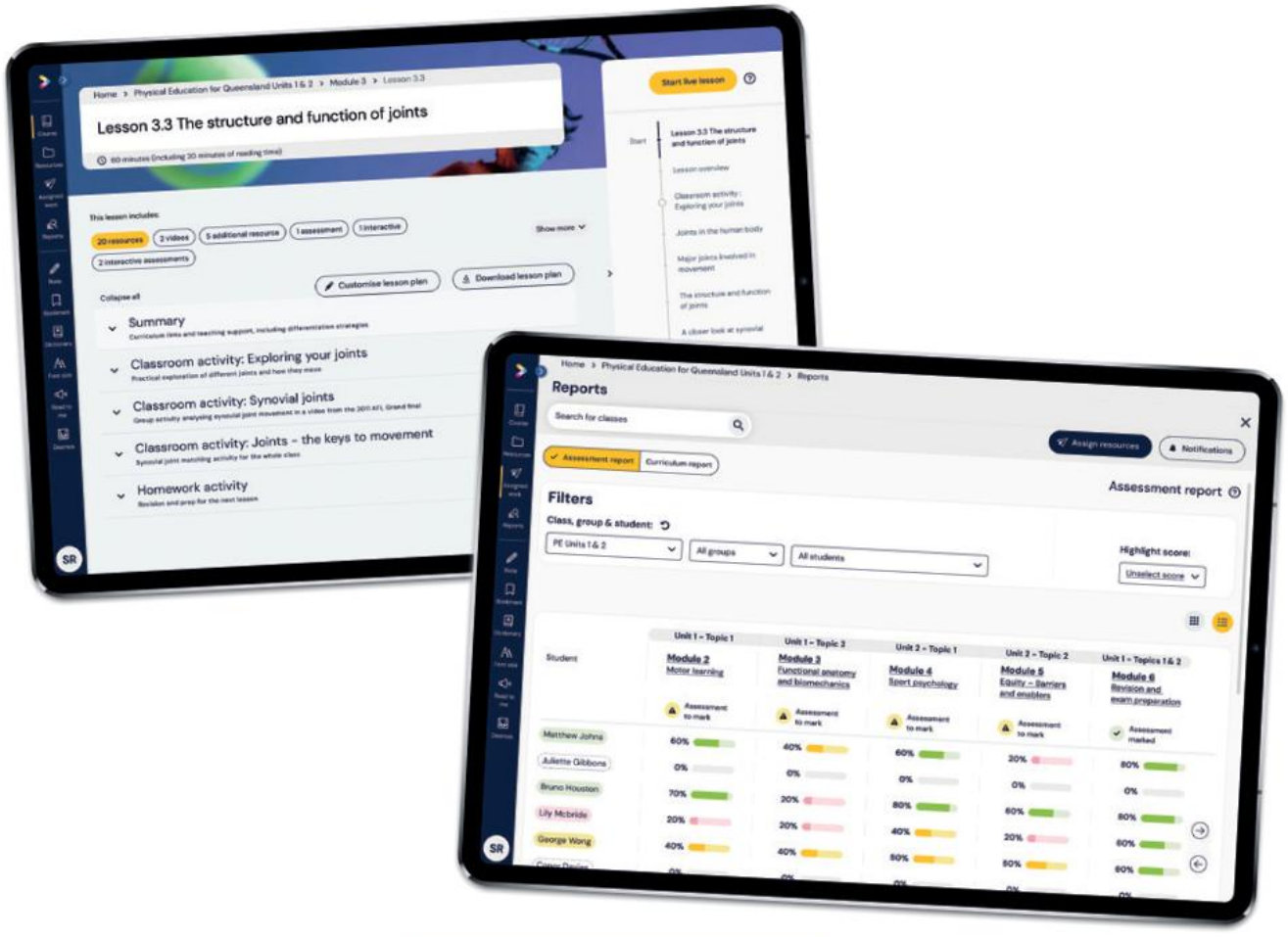
- **view** all course content in a **fully accessible**, reflowable format that's delivered in bite-sized chunks so you can work at your own pace
- use the "Read to me" button to have any part of the course read aloud to you
- **highlight, take notes, bookmark pages**, or define words with the built-in **Australian Oxford Dictionary**
- **watch video tutorials** to help you revise anything you don't understand, catch up on things you've missed, or help you with your homework
- **complete** hundreds of interactive questions and quizzes as you work through the content and get the answers and results sent to you.

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MODULE 1

Physical Education toolkit



Welcome to Physical Education Units 1 and 2

Congratulations on choosing Physical Education as part of your QCE studies! Physical Education is an exciting, relevant and engaging subject that allows you to gain a deeper understanding of the importance of health and physical activity in the context of a diverse and changing world.

Physical Education for Queensland Units 1 and 2 – and the many resources that support it – has been specifically written to meet the requirements of the QCAA Physical Education 2025 v1.0 General Senior Syllabus. It includes all the content you are required to cover in Units 1 and 2.

QCE Physical Education involves more than just learning about theoretical subject matter in a classroom. You will also learn practical subject matter in physical activity contexts. Furthermore, it involves making connections between the two – that is, how theoretical concepts and ideas can be used to improve your performance.

This Physical Education toolkit contains a range of useful and relevant information to help you achieve these goals and get the most out of QCE Physical Education. It can be used as an introduction and overview to the course, but it is also designed as a handy reference that can be revisited throughout the year. It includes the following topics:

- Course overview
- Assessment overview
- Tips for success on the Project – folio
- Tips for success on the Investigation – report
- Tips for success on the Examination – combination response
- Understanding cognitive verbs
- The importance of data
- Putting data to use.

Best of luck in your studies this year,

Crystal Hede, Kate Russell and Ron Weatherby

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Lesson 1.1
Course overview

The QCE Physical Education syllabus

Everything you need to know about the QCE Physical Education syllabus is set out in a document known as the **General Senior Syllabus** that is released by the **Queensland Curriculum and Assessment Authority (QCAA)**.

The General Senior Syllabus is the most important document supporting the QCE Physical Education course. It includes all the information you are expected to learn, and provides important information on how you will be assessed. The current syllabus will be taught for the first time in 2025 for Year 11 and 2026 for Year 12.

Weblink: Physical Education General Senior Syllabus

Study tip

Make sure you visit the QCAA website and download a copy of the Physical Education General Senior Syllabus. It sets out all the information you are expected to learn and provides important information on how you will be assessed.

Structure of the QCE Physical Education course

QCE Physical Education is a two-year course made up of four units. Each **unit** of the course is separated into **topics**. To receive the full allocation of QCE points available, a passing grade must be achieved for each unit.

Source 1 shows how Units 1 and 2 of the course are broken down into topics and notional hours. It also shows how the modules in *Physical Education for Queensland Units 1 and 2* cover this content.

Source 2 shows how Units 3 and 4 of the course are broken down into topics and notional hours. It also shows how the modules in *Physical Education for Queensland Units 3 and 4* cover this content.

Units	Topics	Notional hours	Corresponding modules in *Physical Education for Queensland Units 1 & 2*
Unit 1 – Motor learning, functional anatomy and biomechanics in physical activity	Topic 1: Motor learning in physical activity	22 hours	Module 2 Motor learning (page 28)
	Topic 2: Functional anatomy and biomechanics in physical activity	33 hours	Module 3 Functional anatomy and biomechanics (page 94)
Unit 2 – Sport psychology and equity in physical activity	Topic 1: Sport psychology in physical activity	33 hours	Module 4 Sport psychology (page 204)
	Topic 2: Equity – barriers and enablers	22 hours	Module 5 Equity – Barriers and enablers (page 204)

SOURCE 1 Structure of QCE Physical Education Units 1 and 2

Source: Physical Education 2025 v1.0 General Senior Syllabus © Queensland Curriculum & Assessment Authority.

PE for Queensland Units 1 and 2 correlation grid

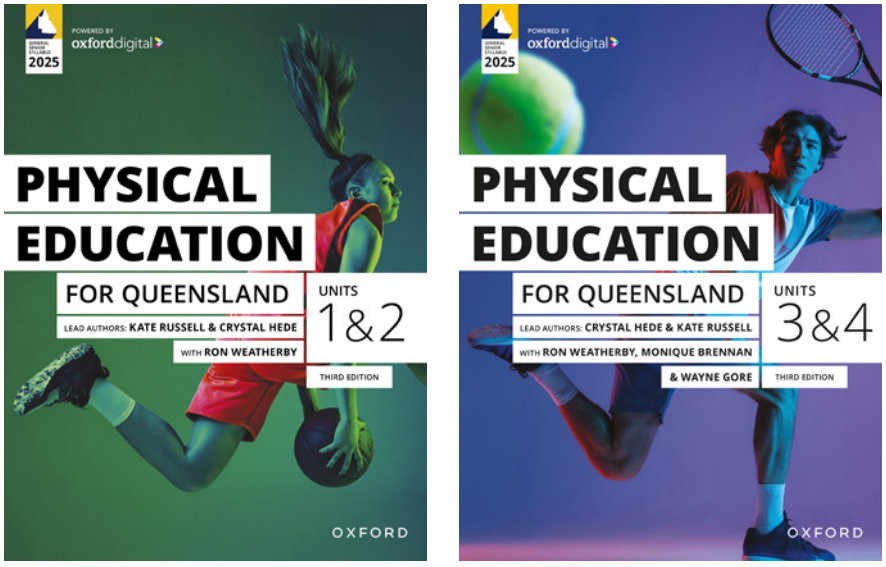
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Units	Topics	Notional hours	Corresponding modules in *Physical Education for Queensland Units 3 & 4*
Unit 3 – Tactical awareness and ethics in physical activity	Topic 1: Tactical awareness in physical activity	33 hours	Module 2
	Topic 2: Ethics and integrity in physical activity	22 hours	Module 3
Unit 4 – Energy, fitness and training in physical activity	Topic 1: Energy, fitness and training integrated in physical activity	55 hours	Module 4

SOURCE 2 Structure of QCE Physical Education Units 3 and 4

Source: Physical Education 2025 v1.0 General Senior Syllabus © Queensland Curriculum & Assessment Authority.



SOURCE 3 QCE Physical Education is a two-year course made up of four units. Units 1 and 2 are covered in *Physical Education for Queensland Units 1 & 2* (Third edition) and Units 3 and 4 are covered in *Physical Education for Queensland Units 3 & 4* (Third edition).

body and movement concepts four categories that describe movement based on shared characteristics; used to help athletes evaluate their performance and develop and improve specialised movement sequences and movement strategies in different sports and physical activities. The concepts are body awareness, space awareness, quality of movement and relationships (e.g. to objects and other people)

specialised movement sequence a combination of fundamental movement skills (and movement elements) that enables the body to move in response to a stimulus

movement strategies a variety of approaches (tactics or plans) that will help an individual or team achieve a determined outcome

Subject matter

Each topic in the course includes a series of **subject matter** dot points. These dot points tell you what you should know and learn. You will find the subject matter dot points for every topic at the start of each module of this book. It is important that you read and become familiar with these before you begin each module.

Body and movement concepts

Throughout the course, you will be expected to apply **body and movement concepts** to **specialised movement sequences** and **movement strategies** in your selected physical activity.

Body and movement concepts can be used as the criteria for evaluating your performance of specialised movement sequences and movement strategies. Specialised movement sequences refer to the combination of movement skills and sequences relative to the position or event in a selected physical activity. Movement strategies refer to a variety of approaches that help an individual or team achieve a determined outcome.

The body and movement concepts included in QCE Physical Education are shown in Source 4.

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Quality of movement	Body awareness	Space awareness	Relationships
How the body moves	**What movements the body can perform**	**Awareness of where the body can move**	**Connections with objects**
• accuracy • continuity and outcome of movement • effect • efficiency • effort • flow • force development • sequence • time and speed	• balance • flight • stability • transfer of weight • weight bearing	• direction • levels and planes of movement • pathways of movement • using general space • using personal space	• interaction with opponents • interaction with other players • interaction with implements and objects

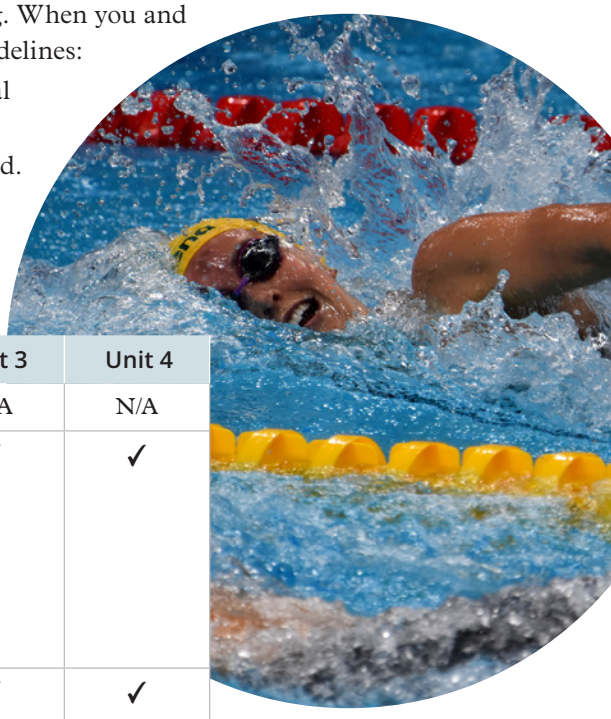
SOURCE 4 Body and movement concepts

Source: Physical Education 2025 v1.0 General Senior Syllabus © Queensland Curriculum & Assessment Authority.

Categories of physical activity

Over the course of your studies in Physical Education you will be required to participate in different physical activities and integrate these into your theoretical learning. When you and your teacher select physical activities, you must take care to follow these guidelines:

- The selected physical activities must come from the categories of physical activities in Source 5.
- In Units 1 and 2, at least two categories of physical activity must be selected.
- In Units 3 and 4, physical activities must be selected from different categories – one physical activity for each unit from the "Invasion", "Net and court" or "Performance" categories.



SOURCE 6
Swimming is one of the physical activities in the QCE Physical Education syllabus.

Category	Physical activities	Units 1 & 2	Unit 3	Unit 4
Aesthetic	• Aerobic gymnastics (sport aerobics)	✓	N/A	N/A
Invasion	• Australian football • Basketball • Futsal • Netball • Soccer • Touch football • Water polo	✓	✓	✓
Net and court	• Badminton • Tennis • Volleyball	✓	✓	✓
Performance	• Duathlon, aquathlon, triathlon • Swimming • Track and field – jump • Track and field – throws • Track and field – track	✓	✓	✓
Striking and fielding	• Cricket • Softball	✓	N/A	N/A
Target	• Archery • Golf • Lawn bowls	✓	N/A	N/A

SOURCE 5 Categories of physical activities

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Lesson 1.2
Assessment overview

Structure of assessment in the QCE Physical Education course

Units	Topics	Types of assessment
Unit 1 – Motor learning, functional anatomy and biomechanics in physical activity	• Topic 1: Motor learning in physical activity	**Internal assessment(s)** For reporting purposes, schools should develop at least one assessment per unit, with a maximum of four assessments across Units 1 and 2. All assessments that you complete in QCE Physical Education Units 1 and 2 will be developed and assessed within your school. Note: if your school is studying the Alternative Sequence, use the alternative structure provided.
	• Topic 2: Functional anatomy and biomechanics in physical activity	
Unit 2 – Sport psychology and equity in physical activity	• Topic 1: Sport psychology in physical activity	
	• Topic 2: Equity – barriers and enablers	

SOURCE 1 Structure of assessment for QCE Physical Education Units 1 and 2

Source: Physical Education 2025 v1.0 General Senior Syllabus © Queensland Curriculum & Assessment Authority.

Units	Topics	Types of assessment
Unit 3 – Tactical awareness and ethics in physical activity	• Topic 1: Tactical awareness in physical activity • Topic 2: Ethics and integrity in physical activity	**Internal assessment 1:** Project – folio (25%)
		Internal assessment 2: Investigation – report (25%)
Unit 4 – Energy, fitness and training in physical activity	• Topic 1: Energy, fitness and training integrated in physical activity	**Internal assessment 3:** Project – folio (25%)
		External assessment: Examination – combination response (25%)

SOURCE 2 Structure of assessment for QCE Physical Education Units 3 and 4

Source: Physical Education 2025 v1.0 General Senior Syllabus © Queensland Curriculum & Assessment Authority.

Types of assessment in Units 1 & 2

As you complete Units 1 and 2 of the QCE Physical Education course, your teacher will use a variety of learning activities and assessment tasks to assess your knowledge and understanding of key knowledge and key skills.

- Your level of knowledge and understanding of the topics in each unit will be demonstrated through the completion of assessment tasks. Each unit objective (see Unit 1 objectives on page 26 and Unit 2 objectives on page 202) will be assessed at least once.
- The types of assessment you will complete throughout Units 1 and 2 will not contribute to your ATAR but will still be important for achieving points towards your QCE. They

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will also help you practise, and will provide feedback to you and your teacher about your progress throughout the year, ahead of entering your Year 12 study year.

- In Units 1 and 2, your teacher should provide opportunities for you to experience and respond to the types of assessment you will encounter in Units 3 and 4 (see Source 2). As a result, it is very likely that types of assessment tasks that you will be required to complete in Units 1 and 2 will include:
  - Project – folio
  - Investigation – report
  - Examination – combination response.

Each of these types of assessment will be discussed in more detail in Lesson 1.3 Tips for success on the Project – folio (page 8), Lesson 1.5 Tips for success on the Investigation – report (page 10) and Lesson 1.7 Tips for success on the Examination – combination response (page 12).

- All assessment tasks that you complete in QCE Physical Education Units 1 and 2 will be developed and assessed within your school.
- In Units 1 and 2, your level of achievement will not be reported to the QCAA and there is no external end-of-year examination.

Note: if your school is studying the Alternative Sequence, use the alternative structure provided.

Units 1 and 2 assessment structure: alternative sequence



SOURCE 3 All assessment tasks that you complete in QCE Physical Education Units 1 and 2 will be developed and assessed within your school. These assessment tasks are likely to take the form of a Project – folio, an Investigation – report, or an Examination – combination response, as these are the types of assessment tasks you will be expected to complete in Units 3 and 4.

Reporting standards

Throughout Units 1 and 2, your teacher will use a tool known as an **instrument-specific marking guide (ISMG)** to make judgments about your performance on internal (i.e. school-based) assessments. Each internal assessment in a syllabus is accompanied by an ISMG (similar to marking criteria). The ISMG for each internal assessment:

- aligns with the assessment objectives for the task
- describes the qualities of different levels of student work (and assigns possible marks or grades available for each level).

instrument-specific marking guide (ISMG) a tool for marking that describes the characteristics evident in student responses and aligns with the identified objectives for the assessment

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Lesson 1.3
Tips for success on the Project – folio

Planning and structuring your Project – folio

multimodal presentation a presentation composed of more than one type of media or component

As part of your assessment for Physical Education Units 1 and 2, you may need to create and submit a **Project – folio**. This requires you to create a **multimodal presentation**. The presentation can take a number of different forms, such as:

- a pre-recorded presentation submitted to your teacher electronically
- a presentation you give in front of an audience (such as other students in your class)
- a digital portfolio of videos, images, diagrams and annotations you compile and curate
- a movie or slideshow you create and narrate.

Whatever form your Project – folio takes, it must combine **at least two** modes of communication: visual, written or spoken. For example, you might provide **verbal narration** combined with **visual images**, or **written text** combined with **video footage**. Typically, you will be required to create a presentation that is up to 11 minutes long.

In each unit in Physical Education, you will do the following:

1. Recognise and explain skills and concepts associated with the theoretical and practical subject matter of the unit.
2. Demonstrate and apply the knowledge, skills and concepts you have learnt to devise and implement strategies or solutions to different kinds of movement problems. Typically, these movement problems involve improving your performance in whatever physical activity you are studying in the unit.
3. Evaluate and justify how well your strategy worked and reflect on how it could be improved.

Project – folio assignments will always ask you to **evaluate** the effectiveness of the strategy you devised and implemented during the unit and **justify** your evaluation using the data you gathered during the unit as evidence. This will take the form of a presentation. The idea is that by evaluating and justifying the strengths and weaknesses of the strategy you applied, you will also demonstrate to your teacher what you learnt in the earlier stages of the inquiry process.

So, whenever you are asked to complete a Project – folio, it can be useful to plan and structure your presentation using the following questions:

1. What are your areas for potential growth in your performance?
2. How do you know this?
3. How do specific content features (e.g. biomechanical concepts, sport psychology concepts, psychology concepts, feedback and practice) affect your performance?
4. How do you know this?
5. What strategy did you devise and implement?
6. Why did you devise and implement your strategy in this way?
7. Which parts of your strategy were effective?
8. How do you know these parts of your strategy were effective?
9. Which parts of your strategy were ineffective?
10. How do you know these parts of your strategy were ineffective?
11. How would you change your strategy if you were to repeat the process?
12. Why would you make these changes?

Study tip

Data is key to your success!
To perform well on your Project – folio, you will be required to gather, record, analyse, evaluate and justify a range of primary and secondary data relating to your performance of specialised movement sequences and movement strategies. For more information about all things data, go to Lesson 1.10 The importance of data (page 17) and Lesson 1.14 Putting data to use (page 19).

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The advantage of being guided by questions such as those above is that you will respond to all elements of the assessment task. For example, Questions 7 and 9 prompt you to make **evaluations** (i.e. judgments of value or merit), while Questions 2, 4, 6 and 8 prompt you to **justify** your evaluations by providing reasons that are supported by evidence (i.e. the data you collected during the unit).

For more information about primary and secondary data, and to find out how you can best incorporate data into your Project – folio, go to Lesson 1.14 Putting data to use (page 19).

Creating and presenting your Project – folio

When you are creating your Project – folio, you will need to make the best possible use of the time limit set in the task conditions. A common mistake that students make is spending too much time telling the audience everything there is to know about the topic (e.g. defining all the concepts) and too little time reflecting on and justifying the strengths and weaknesses of the strategies they developed and put into practice.

To maximise your chance of success, it is important for you to carefully read the instrument-specific marking guide (ISMG) that your teacher will use before you begin work. Make sure you organise your presentation according to the structure and mark allocation provided in the ISMG.

For more advice and practical tips on how to capture video data and use it to create and present your Project – folio, complete Lesson 1.4 Skill drill: Planning, creating and presenting a Project – folio.



SOURCE 1 The Project – folio requires you to create a multimodal presentation (it must combine **at least two** modes of communication) that is up to 11 minutes in length.

Skill drill

Lesson 1.4
Planning, creating and presenting a Project – folio

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Lesson 1.5
Tips for success on the Investigation – report

Planning and researching your Investigation – report

As part of your assessment for Physical Education Units 1 and 2, you may need to create and submit an **Investigation – report**. This requires you to research a particular topic (by gathering, analysing and synthesising relevant primary and secondary data) and produce a written report.

The process of researching, collecting, examining and combining a range of information about a topic that goes beyond what you already know is the "investigation" aspect of the task. Once your investigation is complete, you are required to produce a report of up to 2000 words.

In Unit 2 – Topic 2, you may be asked to create and submit an Investigation – report in which you investigate an equity dilemma, and devise, justify and evaluate an equity strategy to optimise engagement and access to sport and physical activity in a class, school or community context. In this case, to complete the Investigation – report, you would need to collect, analyse and synthesise primary and secondary data related to:

- the equity dilemma
- barriers and enablers
- personal, social, cultural and environmental factors limiting access to personal, social and community resources in the class, school or community physical activity context
- strategies that have been used in response to similar equity dilemmas.

Creating and presenting your Investigation – report

Unlike Project – folio assignments, Investigation – report assignments tend to have a specific format you must follow. Your Investigation – report should include the following sections.

Section	Description
Title page	In this section you should: • include the full title of your Investigation – report • include your name, class and school.
Table of contents	In this section you should: • reference the headings of each section of your report and list the corresponding page numbers.
Introduction	In this section you should: • introduce the topic and frame the investigation by defining its focus (e.g. equity strategies for optimising engagement) • identify the context (i.e. are you investigating an equity dilemma within a class, school or community context?).

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Section	Description
Discussion	In this section you should: • analyse a variety of factors related to the equity issue identified • use your analysis to devise a strategy that provides a course of action to address identified equity issues • explain the strategy you devised and implemented and justify why you chose it • evaluate the effectiveness of this strategy and justify your appraisal of its strengths, weaknesses and means for improvement • base your justifications on the relevant primary and secondary data you collected, analysed and synthesised throughout the topic. This should be the largest section of your report.
Conclusion	In this section you should: • summarise (or briefly re-state) the main points you presented in the introduction and discussion sections.
Reference list	In this section you should: • acknowledge all the sources you cited in your report.

SOURCE 1 An Investigation – report should include these sections.

Note that the title page, table of contents and reference are not included in the word count of your report.

Referencing and crediting sources in your Investigation – report

Since a lot of the information you present in your Investigation – report will come from sources other than your own knowledge and research, it is crucial that you use conventions such as in-text citations and reference lists to acknowledge all the sources you have used. A link is provided to show you how to do this.

Weblink: Referencing

Crediting and acknowledging secondary data sources are part of "ethical scholarship". Every time you make a claim in your report, you should support it with an in-text citation. That way, if the assessor asks themselves, "Says who? Why should I believe you?", your in-text citation will reference all the other secondary data from authoritative people who have made the same claim. In other words, it will help persuade the reader to accept your evaluation of the strategy you are discussing. Using primary data to support your research serves a similar function. It helps to convince the reader that your arguments are based on evidence, rather than opinion. The other, equally important, reason for citing your sources is to acknowledge that you are using the research of others. Not doing this is plagiarism and can result in very serious consequences.

For more information about primary and secondary data, and to find out how you can best incorporate data into your Investigation – report, go to Lesson 1.14 Putting data to use (page 19).

For more advice and practical tips on how to create and present your Investigation – report, complete Lesson 1.6 Skill drill: Creating and presenting an Investigation – report.

Study tip

Data is key to your success!
To perform well on your Investigation – report, you will be required to gather, record, analyse, evaluate and justify a range of primary and secondary data relating to your performance of specialised movement sequences and movement strategies. For more information about all things data, go to Lesson 1.10 The importance of data (page 17) and Lesson 1.14 Putting data to use (page 19).

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Skill drill

Lesson 1.6
Creating and presenting an Investigation – report

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Lesson 1.7
Tips for success on the Examination – combination response

The structure of the Examination – combination response

As part of your assessment for Physical Education Units 1 and 2, your teacher may also require you to complete an **Examination – combination response**. The examination will ask you to demonstrate your knowledge and understanding of the subject matter in a particular unit by providing answers to a range of questions. During an examination, you will be asked to respond to unseen questions (i.e. questions you have never seen before) about subject matter from the Unit or Topic you have studied.

There are three parts you may encounter in Physical Education examinations:

- **Part 1: Multiple-choice questions** – In this part of the exam you will be presented with a series of multiple-choice questions. Your task will be to select the most correct answer to each question.
- **Part 2: Short-response questions** – In this part of the exam, you will be presented with short-response questions. Your task will be to answer each question with a short response, such as a single word, a sentence, a paragraph or a diagram.
- **Part 3: Extended response to stimulus** – In this part of the exam, you will be presented with an extended-response question that includes a stimulus (e.g. a quote, data table, graph, image or illustration). Your task will be to compose an extended response to the stimulus.

Study tip

Cognitive verbs are important!
To perform well in your examination, you will need to understand the meaning of a number of cognitive verbs.

For more information about cognitive verbs, go to Lesson 1.9 Understanding cognitive verbs (page 16).

Conditions of the Examination – combination response

You will be required to respond to the questions on the examination on your own, under supervised conditions, and in a set time frame. You will have 2 hours (plus 5 minutes of perusal time) to complete the examination. During the perusal time, you are permitted to read the whole examination paper from start to finish and start planning your responses. You are not permitted to start writing until instructed.

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SOURCE 1 The Physical Education examination will ask you to demonstrate your knowledge and understanding of the subject matter in a particular unit by providing answers to a range of multiple-choice, short-response and extended-response questions.

In Units 1 and 2, examinations will be developed by your teacher. They will be marked internally at your school. If you are completing an Alternative Sequence course, you may be required to complete an External Assessment (Examination) on Unit 1 Biomechanics and motor learning in physical activity. In Units 3 and 4, examinations will be developed by the QCAA and will be completed by all students under the same conditions, at the same time and on the same day. They will be marked externally.

The importance of cognitive verbs in the Examination – combination response

Understanding the **cognitive verbs** used in Physical Education can help you do well in examinations. Short-response and extended-response questions, in particular, will often be structured so that the cognition (i.e. thinking skill) appears at the very beginning of the question. For example, you might be presented with a table of a player's performance data before and after implementing a given feedback strategy. The question may then ask you to:

cognitive verbs task words that give information about what students are expected to provide in an answer to a question

> **Analyse** the data provided to explore the relationship between the task, the player's results, and the feedback strategy they implemented.

Being able to correctly respond to a question like this requires you to know that the cognitive verb "analyse" means to: "examine or consider something in order to explain and interpret it, for the purpose of finding meaning or relationships and identifying patterns, similarities and differences".

Source: Glossary of cognitive verbs, January 2018, Queensland Curriculum & Assessment Authority

So if you encountered this question in the examination, your answer should explain the links between the player's data, the task through which they generated this data, and the strategy they implemented that was aimed at improving their performance in the task.

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Following instructions in the Examination – combination response

It is important that you read and follow the instructions provided on the examination carefully, so that you give yourself the best chance of doing well.

Tips for answering multiple-choice questions

Understanding the structure and requirements of multiple-choice questions can help you improve your chances of success in the examination. Each multiple-choice question on the examination will require you to select **one** option only. Your task will be to select the most correct answer to each question.

- **Pay careful attention to the wording of each question** – Reading the question carefully will ensure you have the best chance of answering it correctly, so do not rush. Some questions also include particular wording, so be careful of questions that include:
  - negative phrases (e.g. Choose the answer that **does not** describe …)
  - subjective phrases (e.g. Choose the option that **best** describes …)
  - judgment phrases (e.g. Choose the **most correct** answer …)
- **Beware of distractors** – It is common for multiple-choice questions to contain a number of distractors (i.e. incorrect options). In Physical Education examinations, it is unlikely that you will see any distractors that are obviously wrong. Instead, it is more likely that the question writer will be looking to test your knowledge by including distractors that include common student errors and misconceptions, or that are almost correct.
- **Do not leave any questions unanswered** – Unless the examination paper specifically states that there will be a penalty for incorrect answers, you should always answer every multiple-choice question. If you are not completely sure of the answer, make an educated guess.



SOURCE 2 Examinations will be taken under supervised conditions.

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Tips for answering short-response questions and extended response to stimulus questions

- **Pay attention to the amount of space that has been allowed for your response** – If you have only written enough to fill about half the available space, there is a good chance that you are not on the right track. On the other hand, if you find yourself writing too much, you should look at what has been asked of you and focus on providing a clear, concise response. Avoid writing everything you know about a topic.
- **Refer directly to the stimulus** – If the question asks you to respond to a stimulus (e.g. a quote, data table, graph, image or illustration), it is essential that you do so in your answer. Most extended response to stimulus questions are designed to allow you to demonstrate your knowledge and understanding of a topic by applying it to the example provided. Whether you agree or disagree with the stimulus is not important. What is important is your ability to back up your point of view using what you have learnt.
- **Structure your responses clearly** – Whether you are writing a short answer or an extended response, begin with a very clear statement that directly responds to the question. If you are writing a number of paragraphs, begin each one with a clear topic sentence that explains the main point that you will develop. Use cue phrases – such as "for example", "another example", or "in contrast" – to highlight the fact that you are using specific evidence to support your ideas.
- **Do not just list facts** – Responses that include a long string of facts generally will not receive high marks. To impress the marker, you need to interpret, synthesise and apply these facts to a range of relevant examples to show how they support your opinion.

For more advice and practical tips on how to maximise your chances of success in the Examination – combination response, complete Lesson 1.8 Skill drill: Strategies for improving your results on the Examination – combination response.

Skill drill

Lesson 1.8

Strategies for improving your results on the Examination – combination response

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Lesson 1.9
Understanding cognitive verbs

What are cognitive verbs?

In all the assessments you are asked to complete throughout Units 1 and 2, it is likely that questions and tasks will include an action word (e.g. "define", "discuss", "analyse"). In most cases, this action word is a **cognitive verb** (i.e. it is a "doing" word that describes a particular mental process or procedure). In simple terms, cognitive verbs are words that tell you what to do to demonstrate your understanding of the subject matter in the syllabus.

Some cognitive verbs are simple to understand and master (such as "define"), while others are more challenging to understand and will take time and practice to master (such as "synthesise"). The table in Source 1 lists some common cognitive verbs and their definitions. It also provides examples of questions and tasks so that you can see how each cognitive verb is used in context. In addition, you can refer to the complete list of all cognitive verbs provided on the QCAA website.

Weblink: Cognitive verbs

Term	Explanation	Example of question/task using cognitive verb
analyse	examine or consider something in order to explain and interpret it, for the purpose of finding meaning or relationships and identifying patterns, similarities and differences	**Analyse** the influence of motor learning concepts and principles on your demonstration of the forehand in lawn bowls.
define	give the meaning of a word, phrase, concept or physical quantity; state the meaning and identify or describe the qualities	**Define** the term "sport psychology".
describe	give an account (written or spoken) of a situation, event, pattern or process, or of the characteristics or features of something	**Describe** the main purpose of performance segmenting.
discuss	examine by argument; sift the considerations for and against; debate; talk or write about a topic, including a range of arguments, factors or hypotheses; consider, taking into account different issues and ideas, points for and/or against, and supporting opinions or conclusions with evidence	**Discuss** possible reasons for the lower participation rates in sporting clubs among girls aged 10–14.
evaluate	make an appraisal by weighing up or assessing strengths, implications and limitations; make judgments about ideas, works, solutions or methods in relation to selected criteria; examine and determine the merit, value or significance of something, based on criteria	**Evaluate** the effectiveness of a sport psychology strategy in optimising your attention while batting in cricket.
explain	make an idea of situation clear by describing it in more detail or revealing relevant facts; give an account; provide additional information.	**Explain** that equity is concerned with giving value to and celebrating personal social and cultural differences in society.
identify	distinguish; locate, recognise and name; establish or indicate who or what someone or something is; provide an answer from a number of possibilities; recognise and state a distinguishing factor or feature	**Identify** personal factors acting as barriers and enablers to your participation in sport aerobics.

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Term	Explanation	Example of question/task using cognitive verb
investigate	carry out an examination or formal inquiry in order to establish or obtain facts and reach new conclusions; search, inquire into, interpret and draw conclusions about data and information	**Investigate** the use of different types of practice and feedback on archery performance.
justify	give reasons or evidence to support an answer, response or conclusion; show or prove how an argument, statement or conclusion is right or reasonable	**Justify** modifying or maintaining the motor learning strategy you implemented to optimise your badminton performance.
reflect on	think about deeply and carefully	**Reflect on** the primary data you gathered about your implemented equity strategy.
synthesise	combine different parts or elements (e.g. information, ideas, components) into a whole, in order to create new understanding	**Synthesise** primary and secondary data about access, equity and engagement in the sport of basketball in your local community.

SOURCE 1 Cognitive verbs

Source: Glossary of cognitive verbs, January 2018, Queensland Curriculum & Assessment Authority

Lesson 1.10
The importance of data

Defining data

Data is a key element of the QCE Physical Education syllabus. In fact, the ability to analyse and synthesise data is one of the objectives of the course, and references to data are present in many of the subject matter dot points at every stage of inquiry across Units 1 to 4. This means that throughout your studies this year (and next), you will be required to gather, record, analyse, evaluate, synthesise and reflect on several different types of data. Your ability to do this well will have a huge impact on your overall performance in the subject. So, what is data and why is it so important?

data information collected for reference, analysis and evaluation

The word "data" is the plural form of the word "datum", which means "a piece of information". In general, data is any set of information that has been gathered for some purpose – usually analysis. It can include text and numbers, pictures, sound or video.

Data is an important component of the Physical Education syllabus because gathering and analysing data on your performances in your selected physical activities can help you develop an accurate picture of your strengths and identify areas for improvement. Knowing how to collect, analyse and draw appropriate conclusions from your data will also help you to evaluate whether the training programs and strategies for improvement you have put in place have been successful.

Types of data

There are many different types of data that you will be expected to work with in Physical Education. These include the following:

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Primary and secondary data

- **Primary data** is any data that you collect and record yourself. Primary data can relate directly to your performance or the performance of another person that you have observed. Examples of primary data in Physical Education include video footage or photographs of your performance, sketches you make of another person's performance, the results of an interview you have conducted, personal performance statistics, or reflections you record in your journal.
- **Secondary data** is any data that you did not collect or record yourself. Secondary data is any information that was gathered and recorded by someone else. Examples of secondary data in Physical Education include video footage or photographs of elite athletes recorded by other people, sketches or visual analysis performed by other people, text or statistics published in newspapers, books, magazines or journals.

When completing your assessments this year, you will be expected to draw on a combination of primary and secondary data. Secondary data should never replace primary data in your assessments. Instead, it should be included to provide supporting evidence to help you justify the conclusions you have made based on your primary data.

Qualitative and quantitative data

- **Qualitative data** is any type of data that can be recorded in **words**. Examples of qualitative data in Physical Education include describing aspects of performance – such as personal feelings, "quality" of movement, smells, colours, textures, tastes and thoughts – and recording them in a journal or diary.
- **Quantitative data** is any type of data that can be recorded in **numbers**. Examples of qualitative data in Physical Education include measuring aspects of performance – such as heart rate, height, speed, stride length, distance covered and time spent in the air – and recording them in a Game Performance Assessment Instrument (GPAI).

When completing your assessments this year, you will be expected to draw on a combination of qualitative and quantitative data.



SOURCE 1 Data can be found all around us, but not all of it is good quality.

Assessing the quality of your data

Data can be found all around us, but not all of it is good quality. To ensure that you are working with the best data possible, make sure that it has the following characteristics. Your data should be:

- **reliable** – reliable data is consistent and can be replicated under stable conditions (e.g. data collected by a student every day over five days under the same conditions that yields similar results each time is considered reliable, whereas data collected by a student each day over five days under different conditions – and when the student is sick – that yields different results each time is considered unreliable)
- **valid** – valid data has a sound basis in logic and fact and is actually testing what it is supposed to be testing (e.g. data collected in an authentic game environment will be more accurate than data collected in a controlled environment such as a classroom or lab)

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- **accurate** – accurate data has been checked for errors and is precise and exact (e.g. start and finish times collected during a race using a state-of-the-art computer timing system will generally be more accurate than start and finish times collected by a person using an old stopwatch)
- **relevant** – relevant data is closely connected or appropriate to what is being investigated (e.g. data linking heart rate to levels of arousal during a soccer game would be considered relevant, while data linking heart rate to levels of intelligence would not)
- **credible** – credible data comes from reliable and trustworthy sources (e.g. data published by a renowned and experienced sports psychologist in a medical journal would be considered more credible than data published by an unidentified person on a commercial blog).

Lesson 1.11
Putting data to use

Key stages of data analysis

There are three key steps you need to follow to ensure that you have the data you need to help you devise strategies about body and movement concepts that will help you optimise your performance and engagement. These are outlined in Source 1. If you follow these steps, you will have good-quality data to incorporate into your assessments in Physical Education this year and will maximise your chance of performing well in the subject.

Step	Description
Step 1: Gather, record and organise data	• Before you begin gathering your data, you need to understand what you want it for. Ask yourself what you want to do with the data, and exactly what you want to find out. Once you have established this, you can decide on the best method of gathering and recording the data you need (e.g. video recordings, journal entries, observation, etc.). A number of methods of data collection and tools used for recording this data are discussed in more detail below. • Once you have collected and recorded all your data, it can be helpful to organise it. To do this, you can group your data into different categories, making sure it is all complete and in the correct format. Having your data well organised will help make Step 2 of the process run more smoothly.
Step 2: Analyse and synthesise data	• Once you have collected and recorded your data, you need to analyse and synthesise it. • To analyse data, you need to examine and inspect what you have gathered to make sure it is valid, reliable and credible. To do this, you will often need to break information down into smaller parts, and look for relationships, patterns, trends, similarities and differences in what the data is saying. The goal of analysis is to be able to clearly explain and interpret the data you have collected. • To synthesise data, you need to combine information and data from different sources (that you have already analysed) to produce new information or ideas. Synthesis is often the stage at which you put all the smaller pieces of data together and draw conclusions about the bigger picture.
Step 3: Communicate your findings	• Communicating your findings is the final step of the process. It involves converting the data into formats that can be easily understood by the people you are communicating with. • There are many ways to effectively communicate your findings. Think about converting data tables into graphs, editing raw video footage into a shorter highlights reel, presenting your journal entries in an interactive presentation, or creating infographics, flowcharts or short films. • The main goal of communication is to get your message across clearly and effectively in a way that engages your audience.

SOURCE 1 The key stages of data analysis

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Gathering primary data

There are several different ways of gathering and recording primary data. These are described in the following sections.

Observation

Observation is one of the most common and useful methods for gathering data in Physical Education. Observation is a way of gathering data by watching behaviours or events in authentic environments and making notes about what you see and hear. Recording sheets and checklists are the most common and useful ways of collecting observation data. They should be prepared ahead of your observation session to help focus your attention on the key characteristics you are interested in. It is important to stay focused during observations. Any distractions will decrease the reliability and validity of your data.

Useful tools for gathering data during observations

- **Game performance assessment instrument (GPAI)** – This is an observation tool that includes a range of criteria and is used to record information relevant to the performance of an athlete during a game or physical activity (e.g. data relating to skill execution, game involvement, game performance and performance analysis). A sample GPAI is available to download.



Template: Sample GPAI

- **Data collection instrument (DCI)** – This is an observation tool that includes a range of criteria and is used to record information relevant to an athlete but not directly related to their performance (e.g. data related to demographics, motivation, participation, environmental factors and fairness). A sample DCI is available to download.



Template: Sample DCI

Video recordings

Video recordings are an important and powerful method for collecting primary data relating to your performance. Video can be used to capture data about your performances (and the performances of others) so that it can be incorporated into your assessments. In fact, there is a requirement for you to create a folio of video recordings as part of your assessment in Physical Education in Units 3 and 4, so it is helpful to gain some experience with this in Units 1 and 2. You will use these recordings to demonstrate your ability to devise and apply strategies designed to optimise your performance.

Useful tools for gathering data during video recordings

- **Digital video equipment** – This can include smartphones, digital cameras or GoPro.
- **Continuous high-speed photography** – This can include smartphone "burst" mode or digital cameras.
- **Video analysis apps** – This can include apps such as Coach's Eye, Spark Motion, Coach My Video or Dartfish.
- **Camera drone** – This can include a mobile drone fitted with video camera to capture gameplay from above.

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For more advice and practical tips on how to capture and analyse video footage of physical performances, complete Lesson 1.12 Skill drill: Capturing and analysing video footage of physical performances.

Personal reflection

Personal reflection is one of the most important ways of collecting primary data relating to your performance. It is a record of your feelings, thoughts and opinions on how you are performing throughout the year. Although this data is mostly qualitative, it can give clear indications about your strengths and areas for development. A personal reflection should also include information about the context, a review of your performance, and information about the playing conditions, team dynamics, your mood and your physical condition.

Useful tools for gathering personal reflections

- **Personal journal** – A journal is the best way to record your reflections (see Source 2). Every time you perform, you should get into the habit of making an entry in your journal. By combining quantitative data gathered about a performance (using a GPAI or DCI) with qualitative data gathered about the same performance (using a journal entry), you will have a complete picture and a lot of great data to include in your assessments. A template that you can use to create a personal journal is provided. This template will help you to record important aspects of your performance and keep your notes consistent.

Personal journal template

Journal Template- completed

Name: Crystal Hede
Date: 28/2/2019
Physical activity: Badminton
Topic: Motor learning
Dependent variable: Performance summary (Link to data collected if available):
Excellent Good ok Poor

My performance today was mostly good. I played 4 games of singles and 2 doubles. I won 3 out of 4 of my singles and 1 of my doubles. In the games I won, I was able to perform a range of shots effectively but my net kills were particularly good. My GPAI shows that of the 23 net kill opportunities I had in my matches, 18 were winners. My poorest shot was my backhand clear. I was only successful in those 20 out of 47 attempts.

Independent variables	Summary (Include a brief description that provides context and relevance of the information)
Lesson experiences	We played a round robin in both singles and doubles. I was paired with Kate Russell for doubles who is about the same ability as me. My opponents in 3 of the singles games were cognitive learners and in the other match I played the best kid in the class.
Playing conditions (Weather, equipment etc)	It was really hot and stuffy in the gym as usual. I played at the 'good end in 3 out of the 6 matches (the good end does not have the windows right behind the back of the opponent's court making it hard to see the shuttle)
Position played	NA
Mood (arousal, motivation, confidence, concentration etc)	I was in a good mood today. I felt pumped for the tournament and love playing badminton so was easily able to concentrate. I won my first 2 games easily which meant my confidence was high and stayed high all the way through even after the losses I had.
Physical condition (health, fitness, injury status etc)	My physical condition was pretty good because I am a swimmer and have a lot of stamina and strength. I didn't have any injuries and I felt healthy.
Team dynamics	I get on really well with Kate. We are able to read each other's minds and communicate well on court. Because we play a similar way and at the same level, we have respect for each other and can trust each other to make shots when needed.

SOURCE 2 An example of an entry from a personal journal

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Interviews and surveys

Interviews and surveys are helpful ways to collect data from an individual or group of people.

- **Interviews** are generally conducted as a face-to-face discussion and are designed to help you gather detailed qualitative data about a particular topic. They can also be recorded (audio or video) and used in your assessments. You should prepare some questions ahead of time and have a good idea of the information you are looking for in the interview, but you should also be responsive to issues that arise during the discussion and be prepared to ask questions on the spot, if required, to get the best information possible.
- **Surveys** (also known as questionnaires) contain a set of questions that participants are required to complete in writing. Depending on the questions you ask, surveys generally produce a good range of qualitative and quantitative information. As you may not be present when your survey is completed, it is important that your questions are clear and cannot be misinterpreted. A weblink to help you write good survey questions is provided.



Weblink: Writing good survey questions

Useful tools for interviews and surveys

- **Online surveys** – Websites such as SurveyMonkey and Typeform are a free and easy way of gathering large numbers of responses in a short period of time. They can also help you increase the reliability and validity of the data you collect, and make it easier for you to analyse and graph the results.

  For more advice and practical tips on how to conduct a survey and present the results, complete Lesson 1.13 Skill drill: Conducting a survey and presenting the results.

Gathering secondary data

Secondary data can be gathered and recorded in various ways, which are described in the following sections.

Published sources

Published secondary sources include textbooks, newspapers, magazines, government reports, television news reports and journals.

Useful tools for gathering data from published sources

- **School, local and state libraries** – Even in the digital age, libraries can be a great source of secondary data. Many libraries, including the State Library of Queensland, also offer services that you may not be aware of (such as shipping books to you for free), so give them a try. This can be a great way to get valid and reliable data if you are short on time or live in a regional area.

Online sources

Although printed sources such as books and newspapers are valuable sources of secondary data, most research today is conducted online. Online sources include websites, social media groups, online journals, news sites and blogs.

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To ensure that sources gathered online are accurate, reliable and relevant, you should always:

- verify that the information is supported by evidence that is referenced
- check and verify the information against other sources to make sure it aligns with the findings of similar research
- check that the author is qualified, credible and not associated with any commercial company (i.e. not biased)
- check to see if the material has been checked and edited by a professional publisher.

You should never cut and paste information from the internet straight into your own work. Taking someone else's work, ideas or words and using them as if they were your own is called plagiarism and can result in very serious consequences.

In the past few years, there has been an explosion in the availability of **artificial intelligence (AI)** tools. Any AI tool that can follow prompts to produce various types of content – such as text, images and audio – is known as **generative AI (GenAI)**. While GenAI presents opportunities for students to deepen their learning and extend their thinking, the use of GenAI in summative assessments can compromise the authenticity of a student's work and is considered academic misconduct in most schools. Therefore, you should consult your school's academic and assessment policies to ensure that you know the rules and limitations relating to GenAI.

Useful tools for gathering data from online sources

- **Search engines** – When using search engines such as Google, be sure to define your search using keywords. Remember that while search engines are useful for research, much of the material found using these tools may be unreliable; it may contain inaccuracies, false and misleading information, or material that is out of date.
- **Online educational databases** – A reliable way of searching for sources is to use sites linked to educational institutions, government departments, reputable companies, museums, universities and educational institutions. A quick way of telling whether a site is reputable is to look at the domain name in the URL (internet address). Some of the most common domain names are listed in Source 3, along with some information about their reliability.

Domain	Description
.edu	The site is linked to an educational institution such as a university or school. These sites are generally very reliable.
.gov	The site is linked to a government institution. These sites are generally very reliable.
.net	The site is linked to a commercial organisation or network provider. Anyone can purchase this domain name and generally there is no one to regulate the information posted on the site. As a result, these sites may be unreliable.
.org	The site is linked to an organisation. Generally, these organisations are not for profit (e.g. Greenpeace, World Vision International, ACHPER). If the organisation is reputable and can be contacted, it generally means that the information provided has been checked and verified by that organisation. You need to be aware of any special interests that the organisation may represent (e.g. particular religious, commercial or political interests) as this may influence what it has to say on a particular issue. If you are unsure about the reliability of information found on a website with this domain name, check with your teacher or librarian.
.com	The site is linked to a commercially based operation and is likely to be promoting certain products or services. These domain names can be purchased by anyone, so the content should be carefully checked and verified using another, more reliable source.

SOURCE 3 Domain name descriptions

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Citing secondary sources

As you identify and locate relevant sources, it is essential that you record details to include in your reference list or bibliography.

Citing published sources

When citing (mentioning) a **published source** in a bibliography, include the following in this order, if available:

1 author surname(s) and initial(s)
2 year of publication
3 title of book (in italics)
4 edition (if relevant)
5 publisher
6 place of publication
7 page number(s).

Example

Russell, K., Hede, C. & Weatherby, R., 2024, *Physical Education for Queensland Units 1 & 2 Third edition*, Oxford University Press, Melbourne, pp. 18–19.

Citing online sources

When citing an **online source** in a bibliography, include the following information, if available:

1 author surname(s) and initial(s) or organisation name
2 year of publication or date of web page (last update)
3 title of document (article) enclosed in quotation marks
4 date of posting
5 organisation name (if different from above)
6 date you accessed the site
7 URL or web address enclosed in angle brackets <…>.

Example

Australian Psychological Society, "Sport and exercise psychologists", accessed 20 August 2024, <www.psychology.org.au/for-the-public/about-psychology/types-of psychologists/Psychologists-with-an-Area-of-Practice-Endorsement/Sport-and-exercise-psychology>.

Finding credible sources online

For more advice and practical tips on how to use the internet to find relevant, credible and reliable sources, complete Lesson 1.14 Skill drill: Using the internet to find relevant, credible and reliable sources.

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SOURCE 4 The internet is a useful tool for finding relevant, credible and reliable sources.

Skill drill

Lesson 1.12

Capturing and analysing video footage of physical performances

oxforddigital **This lesson is available on Oxford Digital.**

Skill drill

Lesson 1.13

Conducting a survey and presenting the results

oxforddigital **This lesson is available on Oxford Digital.**

Skill drill

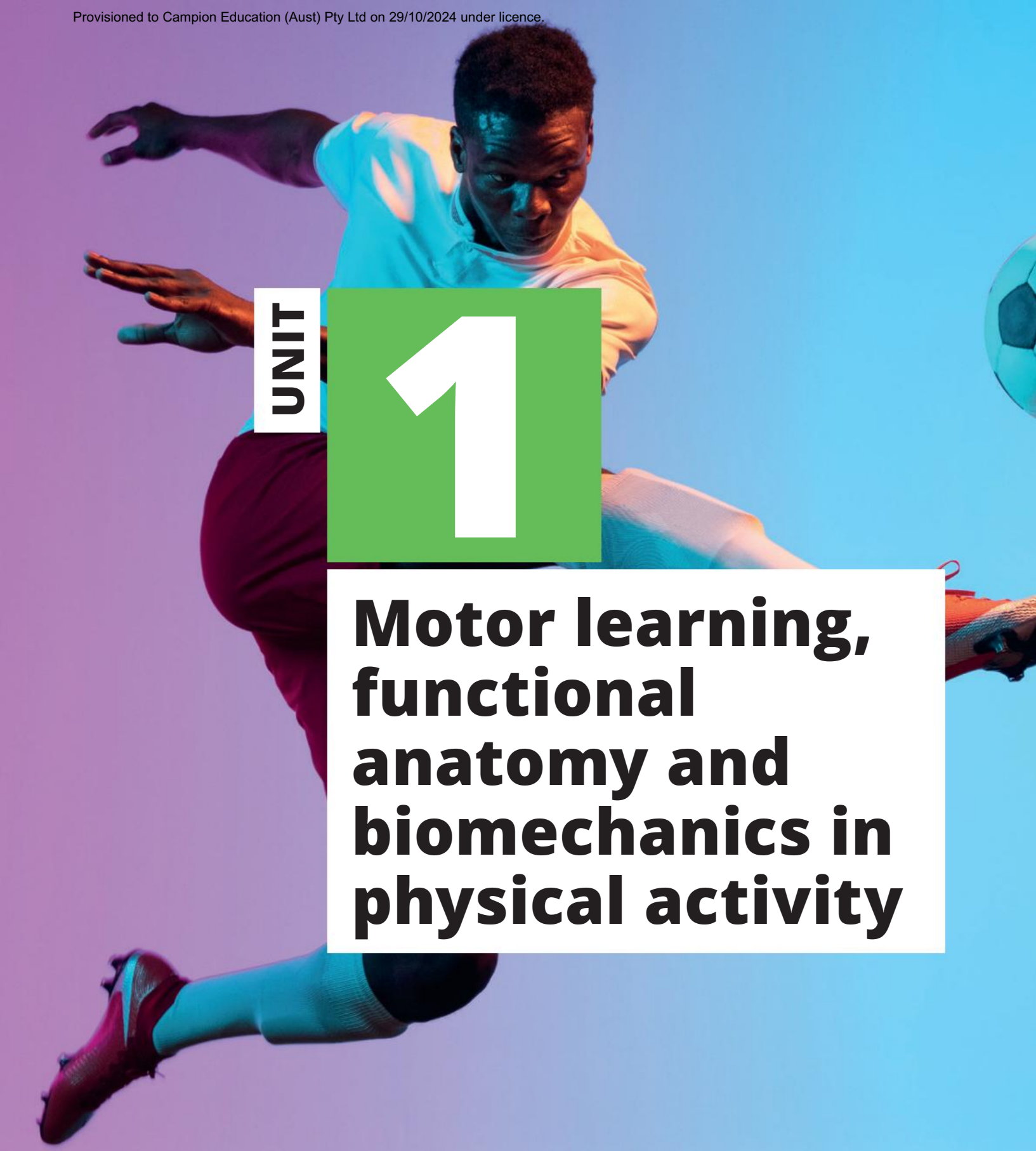
Lesson 1.14

Using the internet to find relevant, credible and reliable sources

oxforddigital **This lesson is available on Oxford Digital.**

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UNIT 1

Motor learning, functional anatomy and biomechanics in physical activity

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Unit 1 objectives



In this unit you will:

1. Recognise and explain motor learning, functional anatomy and biomechanical concepts and principles about selected physical activities.
2. Demonstrate specialised movement sequences and movement strategies in selected physical activities.
3. Apply concepts to specialised movement sequences and movement strategies in selected physical activities.
4. Analyse and synthesise data to devise strategies about motor learning, functional anatomy and biomechanics.
5. Evaluate motor learning, functional anatomy, biomechanical concepts and principles and movement strategies.
6. Justify motor learning, functional anatomy, biomechanical concepts and principles and movement strategies.
7. Make decisions about and use language, conventions and mode-appropriate features for particular purposes and contexts.

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Unit 1 topics



The learning for this unit has been divided into two topics. The table below shows how each topic aligns with the modules in this course and lists the notional hours of teaching time for each topic.

Syllabus topic	Course module	Notional hours
Topic 1 Motor learning in physical activity	Module 2 Motor learning (page 28)	22
Topic 2 Functional anatomy and biomechanics in physical activity	Module 3 Functional anatomy and biomechanics (page 94)	33

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MODULE 2

Motor learning



Key terms

Download a handy list of key terms from this module to test your understanding.

Module 2 key terms

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Subject matter outcomes covered in Module 2

The following table lists all the subject matter outcomes you are required to cover in **Unit 1 – Topic 1** of the Physical Education General Senior Syllabus. It also shows you exactly where that subject matter is covered in this course. The full syllabus is available on the QCAA website.

Weblink: Physical Education General Senior Syllabus

Unit 1 – Topic 1: Motor learning in physical activity

In Unit 1 – Topic 1, students engage in learning that includes the integration of motor learning subject matter and selected physical activities.

Subject matter	Lesson/s
• Recognise and explain that motor learning is a discipline concerned with the learning of skilled movements through biophysical knowledge about neural, muscular and sensory systems, practice and feedback.	Lesson 2.1 Introduction to motor learning (page 32)
• Recognise and explain motor learning concepts, including: – motor skills – activities that involve voluntary muscular movement to complete a predetermined task.	Lesson 2.2 Motor skills (page 35)
• Recognise and explain motor learning concepts, including: – motor programs – a movement plan that contains all the commands for the muscles to execute motor skills.	Lesson 2.1 Introduction to motor learning (page 32)
• Recognise and explain classifications of motor skills to include: – fine and gross motor skills – as determined by the size of the muscles involved in the movement – open and closed motor skills – as determined by the stability of the environment – discrete, continuous and serial skills – as determined by whether the movement has a specific beginning and ending.	Lesson 2.2 Motor skills (page 35)
• Recognise and explain characteristics of motor skill learning and performance to include improvement, consistency, stability, persistence and adaptability.	Lesson 2.2 Motor skills (page 35)
• Recognise and explain that two major approaches to investigate motor learning have developed over time: – the cognitive systems approach, also referred to as the cognitive model, which is considered the more traditional approach, involves a hierarchical model of control where higher control centres pass commands to lower control centres resulting in linear changes in movement; it requires an understanding of the process that occurs in making decisions, planning and executing movement.	Lesson 2.3 The cognitive systems approach to motor learning (page 43)
• Recognise and explain that two major approaches to investigate motor learning have developed over time: – the dynamic systems approach, also referred to as the ecological approach, where movements emerge or self-organise through the dynamic interaction of the environment, the task being performed and the individual; movements are not organised hierarchically, involve non-linear and unpredictable changes, and emerge as part of a complex dynamic system.	Lesson 2.4 The dynamic systems approach to motor learning (page 52)
• Identify and explore cognitive models of learning, including: – the information processing model, which assumes that the central nervous system controls the movements of the body. This model describes separate cognitive stages involving perception, decision-making and response execution to enable a performer's decision-making to occur prior to any action.	Lesson 2.3 The cognitive systems approach to motor learning (page 43)

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Subject matter	Lesson/s
• Identify and explore cognitive models of learning, including: – Fitts and Posner's (1967) stage model of motor learning, based on learning as a continuous process of information processing and gradual change as learning progresses; the stage model includes the: » cognitive stage, e.g. identifying the goal, rapid performance gains, error-ridden and inefficient movement sequences » associative stage, e.g. associating environmental cues with actions, achieving consistency, refinement, fewer errors, errors can be detected and corrected » autonomous stage, e.g. almost automatic, habitual, sub-conscious control, multitask, minimal performance variability and few errors.	Lesson 2.3 The cognitive systems approach to motor learning (page 43)
• Recognise and explain that rate limiters are factors that have an effect on the learning processes of an individual and may restrict performance; rate limiters can include technical, perceptual, tactical, psychological, physical and physiological factors.	Lesson 2.4 The dynamic systems approach to motor learning (page 52)
• Investigate rate limiters in relation to personal motor learning and performance in physical activity.	Lesson 2.4 The dynamic systems approach to motor learning (page 52)
• Recognise and explain that practice of skills is necessary for optimal performance and can be classified into different types, including: – massed practice and distributed practice – whole practice and part practice – blocked practice and random practice – constant practice and varied practice – drills and problem-solving – specificity and variability of practice.	Lesson 2.6 Types of practice (page 61)
• Recognise and explain that feedback is all the information an individual receives about the performance of a skill and is organised into two categories: – intrinsic feedback – the sensory information that occurs during and after a movement – extrinsic feedback – the augmented feedback that is received at the completion of a movement, including knowledge of results and performance.	Lesson 2.8 Types of feedback (page 69)
• Identify and explore how body and movement concepts interact to develop specialised movement sequences and movement strategies in physical activity. Body and movement concepts are: – body awareness – what movements the body can perform: balance, weight bearing, stability, transfer of weight and flight – space awareness – where the body can move: using general or personal space, direction, pathways of movement, and levels and planes of movement – quality of movement – how the body moves: time and speed, accuracy, force development, effort, efficiency, effect, flow, sequence, continuity and outcome of movement – relationships – connection with implements, interaction with opponents and other players.	Lesson 2.10 Body and movement concepts (page 74)
• Investigate the use of different types of practice and feedback in relation to personal motor learning and performance in physical activity.	Lesson 2.7 Skill drill: Investigate the impact of types of practice on performance (page 67)
• Gather primary data about the influence of motor learning concepts and principles, including rate limiters, practice and feedback, on personal performance of specialised movement sequences and movement strategies in authentic performance environments.	Lesson 2.6 Types of practice (page 61)

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Subject matter	Lesson/s
• Analyse and synthesise primary data and secondary data about the influence of motor learning concepts and principles on specialised movement sequences and movement strategies to ascertain the most significant relationships between the motor learning strategy and movement strategies, concepts and principles, and personal performance.	Lesson 2.5 Skill drill: Assess the impact of rate limiters on performance (page 59) Lesson 2.7 Skill drill: Investigate the impact of types of practice on performance (page 67) Lesson 2.9 Skill drill: Evaluate the impact of different types of feedback on performance (page 72) Lesson 2.11 Skill drill: Investigate how body and movement concepts can be used to assess and improve performance (page 83) Lesson 2.13 Review: Motor learning Practice assessment task (page 93)
• Devise a personal motor learning strategy to optimise performance in physical activity that considers: – stage of learning – rate limiters – types of practice suitable to the requirements of the physical activity and the individual – feedback suitable to the requirements of the physical activity and the individual – relevant body and movement concepts, specialised movement sequences and movement strategies.	
• Justify the development of the motor learning strategy and movement strategies using evidence from primary data and secondary data.	
• Implement the motor learning strategy and movement strategies to gather primary data about the outcomes and limitations of decisions.	
• Reflect on primary data and secondary data to evaluate the effectiveness of the motor learning strategy and movement strategies to achieve a determined outcome, including: – meeting the learning requirements of the individual – using suitable types of practice and feedback for physical activity – optimising performance of specialised movement sequences and movement strategies.	
• Make decisions to maintain or modify the motor learning strategy and movement strategies.	
• Justify maintenance or modification of the motor learning strategy and movement strategies using evidence from primary data and secondary data.	

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Lesson 2.1
Introduction to motor learning

Learning intentions and success criteria

Key ideas

- → Motor learning is a field of science that studies many aspects of human movement. The aim is to understand how humans learn and remember the skills required to perform specialised movements.
- → Motor skills are voluntary movements that involve the use of specific muscles with the goal of achieving a specific purpose or goal.
- → Motor programs are movement plans that contain all the commands from the brain to the muscles that are needed to perform complex motor skills.

What is motor learning?

motor learning a field of science that investigates human movement with the goal of understanding how humans acquire and retain the motor skills needed to perform specialised movements (i.e. through practice, experience and/or feedback)

nervous system a body system made up of organs, cells and fibres (including the brain, spinal cord and nerves) that collects information (stimuli) from different parts of the body and processes that information before transmitting impulses to activate responses in the muscles

musculoskeletal system a body system that is a combination of both the muscular system and the skeletal system; the musculoskeletal system provides support, stability, structure and movement in the body through the bones and muscles

Motor learning is a field of science that studies and explains many aspects of human movement. It aims to understand how humans learn (acquire) and remember (retain) the skills needed to perform specialised movements. Motor learning researchers do this by:

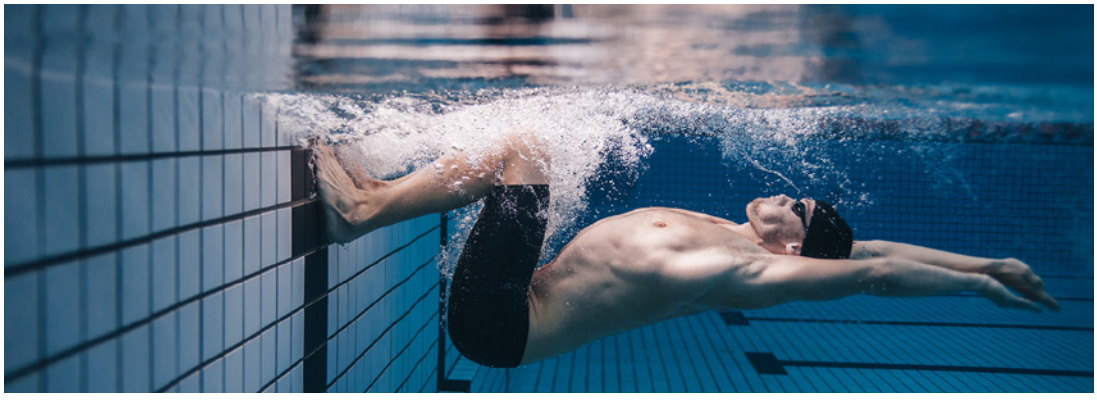
- studying different organs and systems in the body – such as the **nervous system** and **musculoskeletal system** – and understanding the relationship between them
- investigating the stages that people go through to learn and master a new movement or skill – including practice and feedback.

We have all heard the saying "Practice makes perfect", but many scientists who study motor learning believe this approach is too simplistic. While science supports the idea that the more times you do something, the better you become at it, there are also many other factors that influence the acquisition and retention of complex movement patterns. These include:

- previous experience
- physical characteristics
- psychological characteristics
- skill complexity and difficulty.

These factors help to explain why some people seem to pick up certain sports or physical activities more easily than others (or can play more than one sport to a high level of proficiency).

To better understand and describe the many different types of movements and processes involved in motor learning, researchers use a number of specific terms and concepts. Some of the most fundamental concepts include motor skills, motor reflexes and motor programs.



SOURCE 1 Being able to execute a tumble turn in swimming requires both practice and physical skill.

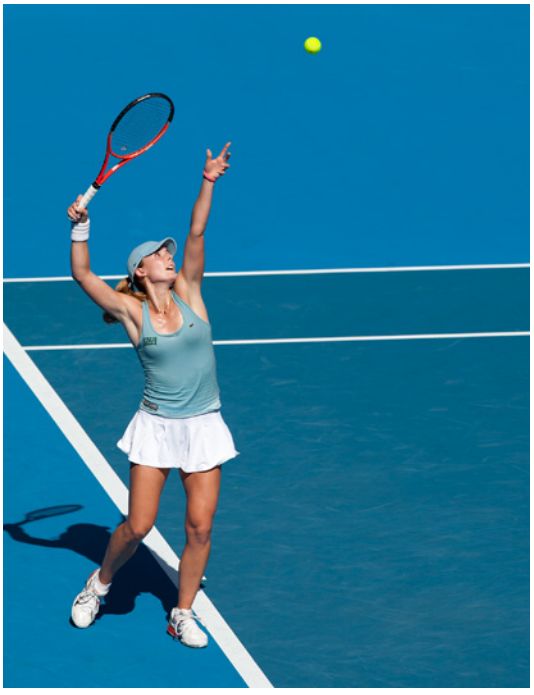
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What are motor skills and motor reflexes?

There are two broad categories of movement that human bodies perform:

- **motor skills** – voluntary movements that involve the use of specific muscles with the goal of achieving a predetermined purpose or goal (e.g. catching a ball, doing a push-up, running a race). Motor skills can be learnt and improved with practice (such as performing a punt kick in Australian football or a somersault in gymnastics). They can also be classified according to how difficult they are to perform. Simple motor skills require a low degree of coordination and thought processing (such as a pass in basketball). Complex motor skills require a higher degree of coordination and thought processing (such as a lay-up in basketball).
- **motor reflexes** – involuntary movements that are not consciously controlled and are not designed to achieve an intended goal (e.g. the knee-jerk reflex movement produced when the patella tendon is tapped).



SOURCE 2 Serving a ball is a complex motor skill commonly performed in tennis. It is made up of several simpler motor skills performed in a specific sequence (e.g. grip, stance, ball toss, back swing and forward swing). These specific motor skills are also referred to as sub-routines.

Both motor skills and motor reflexes are a result of the nervous system and musculoskeletal system working together to create motion.

motor skill a voluntary movement that involves the use of specific muscles with the aim of achieving a defined purpose or goal; motor skills can be learnt and improved with practice

motor reflex an involuntary movement that is not consciously controlled and is not designed to achieve a particular purpose or goal

For the record!

The word "motor" is derived from a Latin word meaning "motion". Research indicates that you can develop a motor skill memory by completing 300 to 500 repetitions of the same skill or technique. The same research suggests that it can take more than 3000 repetitions to correct a skill or technique that was learnt incorrectly!

What are motor programs?

A **motor program** is a movement plan (i.e. a plan of action) that contains all the commands from the brain to the muscles that are needed to perform a complex motor skill. Motor programs are made up of some simple motor skills put together in a specific sequence to produce the successful and controlled execution of a more complex motor skill. These simple motor skills are often referred to as **sub-routines**. Source 3 shows the sub-routine sequence involved in a motor program for a tennis serve.

Motor program	Sub-routines
Tennis serve	• Grip • Stance • Ball toss • Back swing • Forward swing • Impact • Follow-through

SOURCE 3 A motor program for a tennis serve is made up of smaller motor skills that are referred to as sub-routines.

Each of these sub-routines is critical to the overall performance of the skill. For example, the accuracy of the ball toss can dictate the overall outcome of the serve.

motor program a movement plan (i.e. a plan of action) that contains all the commands from the brain to the muscles that are needed to perform a motor skill

sub-routine a simple motor skill that – when combined with a number of other simple motor skills and sequenced in a specific order – is part of a motor program

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Retrieve it!

Explain the features of a motor skill. Check back to earlier in this lesson to see if you retrieved the information correctly.

Why study motor learning?

Understanding the theories that explain motor learning can give you a better idea of what is required to improve your own skills as an athlete. In this module, you will learn that skill development requires time and specific practice to ensure the human body can produce controlled and purposeful movements. By the end of this module, you will:

- be able to identify the different stages of learning a person goes through when acquiring a new skill
- develop an understanding of how skills can be transferred from one sport to another
- learn to modify training drills to cater for different skill levels
- understand the two main models (theories) that scientists have proposed to help explain motor learning
- learn how specific types of practice can help us make better decisions under pressure that result in better outcomes
- learn how types of feedback can affect learning
- learn how to develop a personal motor learning strategy to optimise performance based on:
  - stage of learning
  - rate limiters
  - appropriate types of practice
  - appropriate feedback
  - relevant body movement concepts, specialised movement sequences and movement strategies.

Study tip

Throughout this module, you will come into contact with the terms "skill" and "ability". While they are related, and sometimes used interchangeably, it is important to recognise the difference.

Having the ability to do something means that you can perform it, but having the skill means that you have the ability to perform it well. Therefore, you need ability to have skill.

Check your learning 2.1

Check your learning 2.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which of the following best describes a motor program?

A A set of specific muscles involved in performing a motor skill

B A movement plan containing all brain-to-muscle commands needed for a skill

C A conscious awareness of how to perform a motor skill

D A fixed sequence of movement steps that never changes

2 Choose the correct answer. Which of the following best describes the term "motor skill"?

A A reflex action involving involuntary muscle movement in response to a stimulus

B A coordinated action involving multiple body parts but lacking a specific purpose

C A complex mental calculation required to plan and execute a specific movement

D A voluntary movement that involves the use of specific muscles with the aim of achieving a defined purpose

3 Choose the correct answer. Which of the following best describes the term "motor reflex"?

A A reflex action involving involuntary muscle movement in response to a stimulus

B A coordinated action involving multiple body parts but lacking a specific purpose

C A complex mental calculation required to plan and execute a specific movement

D A voluntary movement that involves the use of specific muscles with the aim of achieving a defined purpose

4 **Identify** the two body systems that interact to move the human body.

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Analytical processes

5 A volleyball serve can be performed in a variety of different ways, some of which are less complex than others. For example, serving underarm is simpler than performing a topspin jump-serve. Using the table below, **identify** one simple skill and one complex skill from the five different sports and **determine** the key differences between each.

Sport	Simple skill	Complex skill	Key differences
badminton			
soccer			
Australian football			
tennis			
aerobic gymnastics			

6 A tennis serve motor program is made up of the following sub-routines: grip, stance, ball toss, back swing, forward swing, impact and follow-through. **Select** a motor program from a physical activity of your choice and break it down into sub-routines.

Knowledge utilisation

7 **Consider** the old saying "Practice makes perfect" in relation to motor learning. Conduct some additional research and decide whether you agree or disagree with this saying. **Justify** your point of view in a written response of 200 words.

Lesson 2.2
Motor skills

Key ideas

→ There are three categories of motor skills: fine and gross motor skills; open and closed motor skills; and discrete, continuous and serial motor skills.

→ The five characteristics used to assess the development of motor skills are improvement, consistency, stability, persistence and adaptability.



Learning intentions and success criteria

Types of motor skills

As discussed in Lesson 2.1 Introduction to motor learning (page 32), motor skills are voluntary movements that involve using specific muscles to achieve a defined purpose or goal. You have seen that motor skills can be classified based on how simple or complex they are. In addition to this, motor skills are often grouped into the following categories according to characteristics they have in common:

- fine and gross motor skills – this category is based on the size of the muscles involved in the skill
- open and closed motor skills – this category is based on the stability of the environment in which the skill is being performed
- discrete, continuous and serial skills – this category is based on whether the skill has a specific beginning and end point.

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SOURCE 1 Hockey involves both gross motor skills (for example, sprinting down a pitch) and fine motor skills (for example, intricate stick work).

fine motor skills skills that require precise movements and use smaller muscle groups (e.g. writing with a pen)

gross motor skills skills that do not require a great deal of precision and use larger muscle groups or the whole body (e.g. running)

Classifying skills in this way helps coaches, teachers and trainers to determine how particular motor skills are best learnt, controlled and analysed. It can also help you understand how to tailor your practice to the nature of the skill you are trying to learn.

We will now look at each of these categories in more detail.

Fine and gross motor skills

Fine and gross motor skills are determined based on the size of the muscles involved in the skill.

Fine motor skills are very precise and require the movement and use of smaller muscle groups. The following activities require the use of fine motor skills:

- writing with a pen or typing on a keyboard
- threading a needle
- spinning a yoyo
- putting spin on a cricket ball
- hitting a backhand serve in badminton.

Gross motor skills are less precise and require the movement and use of larger muscle groups (or even the whole body). The following activities require the use of gross motor skills:

- throwing a ball
- walking or running
- digging a ball in volleyball
- throwing a discus
- jumping and skipping.

Many sports and physical activities require athletes to use a combination of both fine and gross motor skills to be successful. For example, a good softball pitch involves gross motor skills for movements of the shoulder, arm, back and legs, but it also involves fine motor skills for the movement of hands and fingers.

Retrieve it!

What is the difference between a motor skill and a motor program? Check back to Lesson 2.1 Introduction to motor learning (page 32) to see if you retrieved the information correctly.



SOURCE 2 This basketballer is using a combination of gross and fine motor skills to perform a free throw. The free throw action (A) relies on gross motor skills, but adding spin to the ball by flicking the wrist and using the fingers (B) relies on fine motor skills.

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Open and closed motor skills

Open and closed motor skills are determined based on the stability and predictability of the environment in which the skill is being performed. When discussing open and closed motor skills, the "environment" can refer to:

- an object or piece of sporting equipment (such as a racquet or ball)
- the context or situation (e.g. weather conditions, other players/competitors, condition of the playing surface or venue, mood of the spectators).

Open motor skills are affected by the environment. They require the athlete or person performing the skill to make decisions and adapt their skills in contexts that are unstable or unpredictable. Team games such as basketball, netball, soccer and rugby all involve the use of open motor skills because they are externally paced by factors mostly out of the athletes' control. Such factors can include opponents, teammates, the speed of the ball, weather conditions and condition of the playing surface.

open motor skills skills that are performed in unstable, unpredictable or changing environments and require the person performing the skill to react to many different variables (such as passing the ball or shooting for goal in a netball game)

Closed motor skills are not affected by the environment. They are performed in environments that are stable and predictable and do not require the athlete or person performing the skill to make decisions or adapt their skills in response to stimuli. The athlete or person performing a closed skill is in control of their actions and can use learnt skills or movement patterns without making major changes to allow for a changing environment. They can also begin to complete the skill in their own time. Closed motor skills can be found in solo sports such as archery, weightlifting, diving and gymnastics. They can also exist within team sports. For example, a serve in volleyball or tennis can be considered closed, as there is much less influence from environmental factors than the other skills within these physical activities.

closed motor skills skills that are performed in stable and predictable environments and where the person performing the task is in control of the timing of the movement sequence and does not need to consider other variables (e.g. serving a ball in tennis)

It is important to note that motor skills are not always classified purely as open or closed. Many sports and physical activities have skills that fall onto a continuum, as illustrated in Source 3.

However, the same skill can vary in its placement along the continuum depending on:

- the environment (e.g. how windy it is, the position of the sun)
- psychological factors (e.g. the impact of the crowd on concentration levels, confidence of the performer)
- physical factors (e.g. the ability of the performer to apply their chosen strategy).



SOURCE 3 Physical activities sit on a continuum from closed to open when the motor skills within them are considered as a whole. For example, although basketball uses some closed skills (such as the free throw), most skills are open. So when we consider basketball as a whole, it is far more unpredictable than, say, diving, and is therefore more open.

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Discrete, continuous and serial motor skills

Discrete, continuous and serial skills are determined based on whether the skill has a specific beginning and end point.

discrete motor skills skills that have a clearly defined start and finish point (e.g. throwing a ball)

Discrete motor skills have a clearly defined start and finish point. Examples of discrete motor skills include:

- throwing a ball
- diving off a block
- kicking a ball
- swinging a bat.

continuous motor skills skills that do not have a clearly defined start and finish point and are made up of discrete motor skills linked together continuously (e.g. running)

Continuous motor skills do not have a clearly defined start and finish point. They consist of discrete motor skills linked together and repeated continuously. The start and finish points of continuous motor skills are determined by the athlete or person performing the skill, rather that the skill itself having a natural beginning and end point. Examples of continuous motor skills include:

- swimming
- running
- cycling
- steering a car.

serial motor skills skills that are made up of a group (series) of different, discrete skills linked together to create a more complex movement sequence (e.g. a floor routine in gymnastics)

Serial motor skills consist of a group (series) of different, discrete skills linked together to create a more complex movement sequence. Examples of serial motor skills include:

- dance routines
- gymnastics routines
- ice-skating programs
- playing the piano.



SOURCE 4 Serial motor skills involve the linking of several separate skills, as shown in this gymnast's routine.

Characteristics of motor skill learning

Learning is defined as the acquisition of knowledge as a result of study, experience, teaching or coaching. Whether you are a student, teacher or coach, it is important to be able to assess the motor skill learning that has occurred for an athlete.

There are five characteristics of motor skill learning. These characteristics provide a framework for understanding where an individual is in their learning journey and give direction for modifying specialised movement sequences and strategies. They include:

- improvement
- consistency
- stability
- persistence
- adaptability.

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Improvement

The characteristic of **improvement** refers to the ability of an individual to improve their performance of a motor skill over time. Significant improvement is typical of athletes at their early stages of motor skill learning, and obvious signs of improvement tend to reduce as performance becomes more consistent. Gathering statistics is a popular indicator for measuring learning and improvement. If a netball shooter increases the percentage of goals scored in each game over the season, this would indicate that they have improved. However, it is also important to take variables into account when using statistics to measure improvement. For example, playing while unwell, against a very tall defender, or outdoors on a very windy day will probably reduce the number of goals the shooter scores. This subsequent reduction in goals would therefore not be a solid indicator that the athlete has not improved. To measure improvement accurately, coaches and athletes should use a few different indicators and methods of data collection.

improvement a characteristic of motor skills; improvement refers to the ability of an individual to get better at performing a motor skill over time

Some examples of data that could be collected include statistics on scores, errors or successful attempts. This data can be collected over a period of time and plotted on a performance-time graph to show rates of improvement and identify plateaus or declines. Collecting information at the same time about motivation and health might also be useful to help explain the results.

Consistency

As athletes improve over time, their performance of motor skills becomes more consistent. The characteristic of **consistency** refers to the ability of an individual to perform a particular motor skill reliably and dependably over time. That is, their performance will become more consistent in terms of the processes (i.e. the quality of their technique) and the outcomes (i.e. the number of successful attempts or winning points scored). Beginners generally show a greater variation in their movement patterns, which often leads to inconsistent results. For example, a beginner rugby league player might be capable of kicking some goals in a match, but repeated efforts do not yield the same results.

consistency a characteristic of motor skills; consistency refers to the ability of an individual to perform a particular motor skill reliably and dependably over time

Stability

When a learner has been practising and develops an ability to control the influence of internal and external factors on their performance of a motor skill they are said to have **stability**. Factors such as stress, anxiety, weather conditions, crowd noise and refereeing decisions can all have an impact on a player's ability to perform a particular motor skill. With practice, athletes can learn to control the influence of these factors on their ability to perform. By practising motor skills under different conditions and learning psychological techniques to improve focus (see Module 4 Sport psychology, page 204), an athlete can improve their stability.

stability the ability of an individual to control the influence of internal and external factors on their performance of a motor skill

Persistence

Through repetition of motor skills over time, neural pathways in the brain are developed and strengthened, and motor programs are formed. At the point an athlete has practised enough that they can retain (or keep) and perform a motor skill after a period of time away from performing, it is said that they have attained **persistence**. This not only applies to sporting skills but also to all motor skills acquired throughout life.

persistence a characteristic of motor skills; persistence refers to the increasing ability of an individual to retain (keep) and perform a motor skill over time

An advantage of playing sport and learning motor skills as a child is the ability to perform them in adulthood. The skill and performance level may not remain the same, but adults who have mastered a motor skill as children are generally far better at it as an adult than if they had never learnt the skill. This is because training effects are relatively long-lasting.

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Adaptability

adaptability a characteristic of motor skills; adaptability refers to the ability of an individual to perform a particular motor skill in response to what is required in a given situation

The ultimate goal for learning motor skills is being adaptable enough to be able to perform the skills within the unpredictable and ever-changing nature of authentic environments. The characteristic of **adaptability** refers to the ability of an individual to perform a particular motor skill in response to what is required in a given situation. Being adaptable is crucial in team sports and game situations where circumstance dictates which motor skill is required. For example, in a rugby union match, an athlete needs to constantly assess where a teammate is, or what the wind conditions are like, and adapt accordingly.



SOURCE 5 These rugby union players have developed the motor skills necessary to perform at a consistently high level, regardless of the conditions in which they play. This is an example of adaptability.

Measuring motor learning

To determine whether motor learning is taking place, we can use a range of tests to measure:

- proficiency, or how well the athlete performs a particular skill after practice
- growth, or how much the athlete's performance of a skill has changed after a period of practice.

Athletes should always begin a period of learning by conducting a baseline test, also known as a pre-test. This typically occurs at the very start of a training/learning cycle and allows for comparisons to be made when tests are repeated.

Some possible test instruments for baseline and ongoing motor learning tests include, but are not limited to:

- Games Performance Assessment Instruments (GPAI) in the form of a criteria sheet or rubric
- rating scales, which typically measure the extent to which a skill is evident or how effective a skill is on a scale of 1 to 5, with 1 being "not at all" and 5 being "very evident" or "very effective" (see Source 6)
- practice checklists, on which skills and sub-routines that comprise a specialised movement sequence are listed for the assessor to "check off" when the athlete's performance is consistently effective.

Each of these instruments can be used by either the coach or the athlete self-assessing their performance via video playback.

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Rating scale: tennis serve					
	Not evident	Rarely evident	Occasionally evident	Mostly evident	Consistently evident
Preparation phase					
Stance:					
Feet shoulder-width apart, open stance (45 to 90 degrees)	1	2	3	4	5
Knees slightly bent, good posture	1	2	3	4	5
Dominant shoulder behind non-dominant shoulder	1	2	3	4	5
Racquet head held high behind back	1	2	3	4	5
Grip:					
Consistent continental or semi-western grip	1	2	3	4	5
Firm hold, relaxed fingers	1	2	3	4	5
Ball toss:					
Consistent toss height and trajectory	1	2	3	4	5
Toss slightly ahead and above non-dominant shoulder	1	2	3	4	5
Ball toss alignment with intended serve direction	1	2	3	4	5
Body weight transfer:					
Weight shifted onto back leg during wind-up	1	2	3	4	5
Controlled forward weight transfer during hitting motion	1	2	3	4	5
Acceleration phase					
Leg drive:					
Powerful push off the ground with both legs	1	2	3	4	5
Hips rotate and open towards court	1	2	3	4	5
Arm swing:					
Backswing smooth and controlled, racquet head lagging behind	1	2	3	4	5
Arm accelerates forward with increasing speed	1	2	3	4	5
Torso rotation:					
Torso rotates aggressively towards the court	1	2	3	4	5
Rotation creates torque for power transfer	1	2	3	4	5
Contact phase					
Racquet contact:					
Ball contacted at the highest point of swing	1	2	3	4	5
Contact point slightly in front of body	1	2	3	4	5
Racquet face perpendicular to desired ball direction	1	2	3	4	5
Wrist snap:					
Slight flexion of the wrist at contact for added power	1	2	3	4	5
Follow-through:					
Racquet continues swinging across your body	1	2	3	4	5
Balanced finish with good posture	1	2	3	4	5

SOURCE 6 A sample rating scale to indicate learning of the tennis serve. The assessor could complete this after a period of practice to ascertain the level of skill learning. Repeated usage of this scale (after periods of practice) could indicate the athlete's growth in each area.

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Check your learning 2.2

Check your learning 2.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. **Identify** the type of motor skill that does not have a clearly defined start and finish point.
   - **A** Continuous
   - **B** Discrete
   - **C** Fine
   - **D** Serial

2 Choose the correct answer. As a characteristic of motor skill learning, "adaptability" refers to:
   - **A** the ability of an individual to replicate a motor skill precisely without deviation.
   - **B** the innate biological predisposition for performing specific motor skills.
   - **C** the cognitive understanding of how to perform a motor skill, regardless of physical execution.
   - **D** the ability of an individual to perform a particular motor skill in response to what is required in a given situation.

Analytical processes

3 **Compare** and **contrast** the motor skills of swimming breaststroke and taking a penalty shot in soccer. For each activity, **identify** the type of motor skill.

4 Source 2 (page 36) shows a basketballer using both fine and gross motor skills when performing the free throw. **Identify** three examples from other physical activities that use a combination of fine and gross motor skills.

5 The characteristics of motor skill learning can be used as assessment criteria when evaluating an individual's performance in sport. **Consider** the assessment criteria "consistency". **Determine** why weekly match statistics cannot be the only data used to assess consistency, using examples from your selected physical activity.

6 **Classify** the following motor skills along a continuum from closed to open. **Explain** your reasoning in each case.
   - **a** surfing
   - **b** snooker
   - **c** javelin throwing
   - **d** high jump
   - **e** aerial skiing
   - **f** taking a penalty stroke in hockey

7 Gathering statistics is a popular indicator for measuring an athlete's improvement. **Reflect on** and **discuss** with a partner your improvement in a chosen physical activity using three points of valid data. (*Note*: this can be hypothetical.)

Knowledge utilisation

8 **Design** a checklist or rating scale to measure either proficiency or growth in a specialised movement sequence from a physical activity of your choice.

Study tip

Throughout this course, you will be asked questions to check your understanding of the content. Wherever possible, look for additional secondary data (other than this course) to support your answer. This is a good way to practise referencing for your internal assessments. You can make statements such as, "According to Hede & Russell (2025) ..." or "Hede & Russell (2025) state that ..." to begin answering your questions.

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Lesson 2.3
The cognitive systems approach to motor learning

Key ideas

- → Scientists have developed two major frameworks to explain how we learn and remember motor skills and complex movement sequences.
- → One of these is the cognitive systems approach to motor learning, in which the brain acts as the central command system for the body.
- → Within the cognitive systems approach are two models: the information processing model and Fitts and Posner's stage model of motor learning.

Learning intentions and success criteria

Approaches to motor learning

Learning is an extremely complex process that involves multiple organs and systems in the body. For centuries, scientists have investigated the process of learning and developed many different theories that attempt to explain exactly how we learn and remember the thousands of motor skills and complex movement sequences we perform every day.

Over the centuries, two major approaches have been developed to help explain how the process of motor learning takes place. These are known as:

- the **cognitive systems approach** – this is an older, more traditional approach involving a hierarchical model of control where higher control centres pass commands to lower control centres, resulting in linear changes in movement. The cognitive systems approach will be discussed in this lesson.
- the dynamic systems approach – this is a newer, less traditional approach to studying and understanding motor learning. The dynamic systems approach will be discussed in Lesson 2.4 The dynamic systems approach to motor learning (page 52).

cognitive systems approach a theoretical framework used to help explain the processes involved in motor learning; according to this approach, the brain acts as the central command centre for the body. It creates action plans for movements based on information it receives from the body's senses, and it instructs the muscles to perform these actions in a linear order (i.e. step-by-step)

An "approach" is a broad theoretical framework that has developed over time. Think of both the approaches listed above as "big ideas" that try to explain the entire process of learning. Within these approaches or "big ideas" there are several smaller, more specific models and theories that explain smaller parts of the process. Because we do not yet understand everything about the process of learning, both approaches (and some of the theories within them) have different explanations for parts of the learning process.

It is important to keep in mind that these approaches and models are all just tools that can be used as frameworks to help us talk and learn about the process of learning.

Introduction to the cognitive systems approach

The basic idea behind the cognitive systems approach – also known as the cognitive model – is that the brain works like a computer that controls the body. According to this approach, a part of the brain (the prefrontal cortex) acts as the central command centre and creates an action plan for movement based on information it receives from the body's various senses. Once the action plan is in place, the brain informs the relevant muscles to carry out the plan one step at a time.

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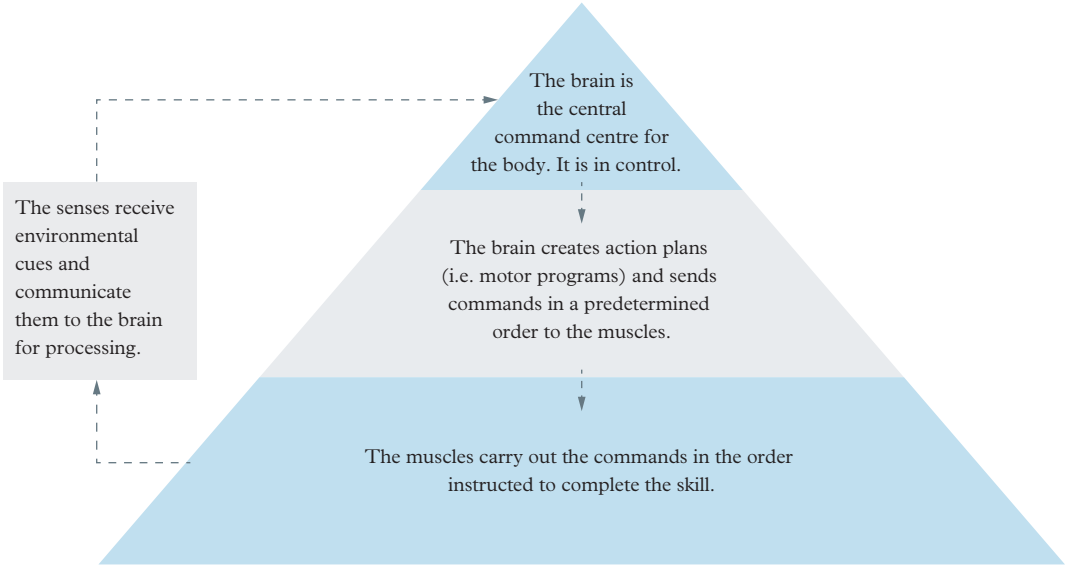
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hierarchical a term used to describe the process in which a higher control centre (i.e. the brain) passes commands down to lower control centres (i.e. the muscles and nerves) in order to control movements

linear a term used to describe the process in which commands are carried out one after the other in sequential order

For these reasons, the cognitive systems approach is often described as:

- **hierarchical** or "top down" – it assumes that higher control centres (i.e. the brain) pass commands down to lower control centres (i.e. the muscles and nerves)
- **linear** – it assumes that the commands are sent from the brain in a predetermined order (i.e. step-by-step, one command after the other).



SOURCE 1 The cognitive systems approach is used to explain the process of motor learning. It is described as hierarchical and linear.

For the record!

How good is your reaction time?

- The average speed of a professional male tennis player's serve is around 181 km/h. This allows their opponent 0.47 seconds to return the serve.
- The average speed of a professional female tennis player's serve is around 140 km/h. This allows their opponent 0.55 seconds to return the serve.

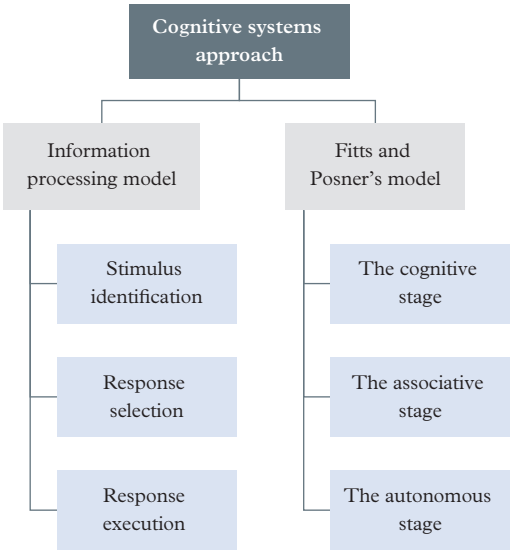
In both cases, there is not a lot of time for processing environmental cues!

For example, according to the cognitive systems approach, the brain creates an action plan (motor program) to perform a serve in tennis. That action plan lists all the necessary movements (sub-routines) required to complete the serve. It then sends each of these commands (in a predetermined order) to the relevant muscles that are needed to perform the skill and complete the task.

Cognitive models of learning

Within the broader cognitive systems approach to learning, there are two main models (i.e. theories) that are used to explain how we process and learn motor skills (see Source 2). These include:

- the information processing model
- Fitts and Posner's (1967) stage model of motor learning.



SOURCE 2 The cognitive models of learning include the information processing model and Fitts and Posner's model. These approaches to learning will be further explored in this lesson.

While both these models fit within the cognitive systems approach to learning, there are some differences in the way they explain the process and stages of learning.

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The information processing model

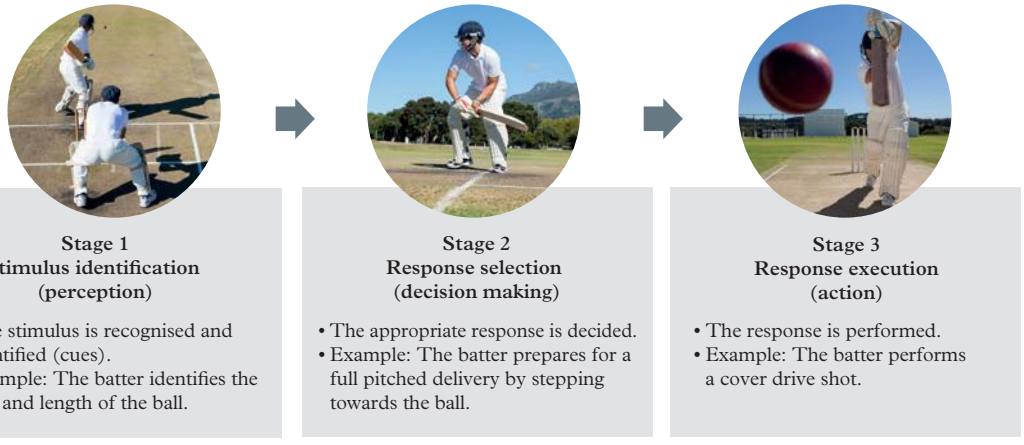
The **information processing model** proposes that humans receive, process and store information from their environment via the **central nervous system** (the brain and spinal cord).

According to this model, information (referred to as **input**) is received by the brain from the body's senses (sight, touch, taste, smell and hearing). It is then processed and a plan is prepared. Finally, a response or action is executed (referred to as **output**). A piece of information received by the body is often referred to as a stimulus (plural "stimuli"). Stimuli can come from inside or outside the body. Stimuli from inside the body (e.g. the tickle in our throat that urges us to cough) are known as **internal stimuli**. Stimuli from outside the body (e.g. the urge to move your hand away from a hot surface) are known as **external stimuli**.

As shown in Source 3, there are three separate stages involved in performing an action:

- Stage 1 – stimulus identification (perception)
- Stage 2 – response selection (decision making)
- Stage 3 – response execution (action).

We will now look more closely at each of these stages.



SOURCE 3 The information processing model has three stages – stimulus identification, response selection and response execution.

Stage 1 – Stimulus identification

Stimulus identification is the first stage of the information processing model. It is when the learner recognises and identifies the input. This cognitive process is often referred to as perception. For example, during a game of volleyball, a serve receiver uses their sight to receive information about the kind of serve coming from the server (i.e. whether it is it fast, slow, short or deep). A player's ability to identify the relevant external stimuli (also known as **environmental cues**) is often the difference between success and failure. Identifying relevant environmental cues is dependent on a range of factors such as:

- how long the cue is present (e.g. the longer it is detectable, the easier it is to identify)
- the intensity of the cue (e.g. more obvious cues are easier to identify)
- the level of irrelevant background distractions present (e.g. the level of noise can make it more difficult to identify a relevant audio cue)

information processing model a theory that suggests humans receive, process and store information from their environment via the central nervous system (i.e. the brain and spinal cord)

central nervous system part of the larger body system known as the nervous system, the central nervous system consists only of the brain and spinal cord (i.e. the central part of the system). It does not include the network of nerves that run throughout our bodies (referred to as the peripheral nervous system)

input information received by the brain from the body's senses (such as sight, touch, taste, smell and hearing) according to the information processing model

output in the information processing model, a physical response or action executed by the body

internal stimuli information or cues that come from inside the body (e.g. thoughts, feelings, urges)

external stimuli information or cues that come from outside the body (e.g. changes in the environment such as sounds, sights, smells)

stimulus identification the first stage of the information processing model; the stage when the learner recognises and identifies the input

environmental cues the relevant information from the environment

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- physical characteristics of the player (e.g. some athletes have naturally sharper senses than others)
- the level of experience of the player (e.g. more experienced players can know what to look for).

Stage 2 – Response selection

response selection the second stage of the information processing model; the stage when the learner makes a decision by comparing information in stored memory

Response selection is the second stage of the information processing model. It is when the learner makes a decision or develops a motor program in response to the input. For example, the volleyball player in the Stage 1 example detects that the ball is dropping short and decides to move forward to prepare for a dig.

There are two types of processing that can occur at the response selection stage:

- **serial processing** – where one piece of information is processed before moving onto the next piece
- **parallel processing** – where more than one piece of information can be processed simultaneously. Our senses often perceive a range of information at any given time, so parallel processing can help us to make a faster decision and, subsequently, a faster response.

serial processing the act of processing one piece of information at a time

parallel processing the act of processing multiple pieces of information at the same time



SOURCE 4 This volleyball serve receiver is getting several environmental cues relating to the delivery of the ball from the server. They are receiving information relating to the speed, height, direction and spin of the ball, as well as the body position of the server. In addition to this, memories of prior experience in similar situations are being triggered before a movement is made in response.

In this situation, the player would probably be comparing information with similar experiences held in their long-term memory to determine the best course of action.

Retrieve it!

Give two examples of fine motor skills. Check back to Lesson 2.2 Motor skills (page 35) to see if you retrieved the information correctly.

Both serial and parallel processing can sometimes be a challenge at the response selection stage due to the limited time available. Serial processing can be slower, while parallel processing can be more difficult. While it can be difficult to make multiple decisions at once, decisions and subsequent actions can often become automatic through practice. We can perform these automatic responses due to our ability to develop a link between a particular stimulus and a successful action.

Stage 3 – Response execution

response execution the third stage of the information processing model; the stage when the learner produces a response or action by implementing a developed motor program

Response execution is the third stage of the information processing model. It is when the learner produces (or executes) a response or action. For example, in the previously mentioned volleyball serve-receive, the player executes a motor program, bending their legs and taking a long step forward before using their arms to perform a dig. Based on the sensory information received in the stimulus identification stage, a decision has already been made about where to direct the pass. By this stage, a motor program has been selected and is executed.

The information processing model in sport

Applying the information processing model to different training contexts can have a number of benefits for athletes (of all abilities) and coaches.

How well a skill is executed depends on how well each of the information processing stages is completed. If you are distracted by the crowd watching you during Stage 1 (stimulus

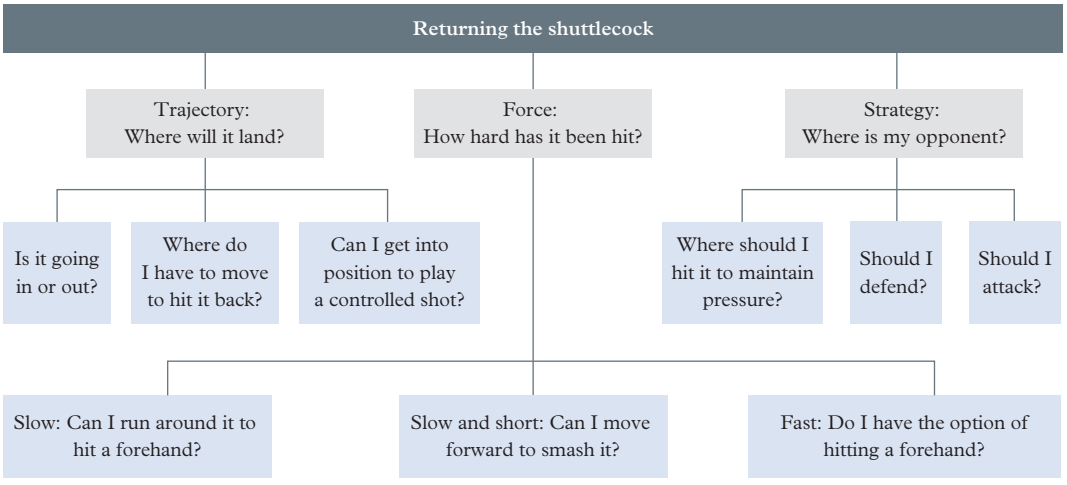
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identification), there is an increased chance of missing the vital information cues that will enable you to complete Stages 2 and 3 successfully.

Your performance can be improved by looking at your decision-making processes. Responses become more successful when you can identify which environmental cues (Stage 1) are linked to specific skill responses (Stage 3). Source 5 identifies three environmental cues that you may encounter during a game of badminton. These cues would all need to be received in Stage 1 and processed in Stage 2 before a response could be put into action in Stage 3.

Once a player has completed these three stages of the information processing model, the brain will be given feedback about the success of the action performed. If it worked, great! The player knows that they can repeat the action in similar situations. If it did not work, the player will have to consider which option would be better. Keeping a mental record of choices can help in future skill selections when facing a similar situation.



SOURCE 5 This mind map shows the information processing required for returning a shuttlecock in badminton.

Study tip

Using mind maps is an excellent way to organise your knowledge and to help you understand relationships between concepts. Explaining relationships between concepts is an essential element in the syllabus objective of insightful analysis of primary and secondary data to devise strategies about movement.

Fitts and Posner's (1967) stage model of motor learning

Another model used to explain the process of learning motor skills is known as the **stage model of motor learning**. It was proposed by US psychologists Paul Fitts and Michael Posner in 1967 and is still one of the most widely taught theories used to explain the process of motor learning today.

stage model of motor learning a theory developed by Fitts and Posner in 1967 that explains the process of learning a motor skill in three stages – cognitive, associative and autonomous

According to Fitts and Posner's model, there are three stages of learning:

- Stage 1 – the cognitive stage
- Stage 2 – the associative stage
- Stage 3 – the autonomous stage.

Stage 1 – The cognitive stage

The **cognitive stage** is the first stage of Fitts and Posner's stage model. It can be thought of as the "understanding" stage. During this stage, the learner is trying to understand the skill and work out exactly what needs to be done in order to perform it.

cognitive stage the first stage of Fitts and Posner's stage model of learning; during this stage, the learner is trying to understand the skill and work out exactly what needs to be done in order to perform it

Learners do a lot of thinking during this stage. Neural pathways for specific motor programs are still forming, so a large amount of thought is required to work through the technical requirements of a skill. As a result, the movement sequences are often slow, inconsistent and inefficient with a large number of errors.

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The characteristics of a learner's performance during the cognitive stage are:

- considerable inaccuracy, slowness and stiff-looking movements
- difficulty detecting cues during the stimulus identification stage
- difficulty selecting the appropriate response to a situation
- knowing that what they are doing is not producing the desired result, but being unsure of how to correct it.

The length of time spent in this stage can vary, but generally it is relatively short. With regular trial and error through practice, a learner's proficiency will improve quickly. Learners at this stage can become frustrated if they do not experience success as quickly as they would like. To increase the chances of success, a coach should teach simple, fundamental skills by giving clear instructions and demonstrating desired techniques. Instructions should be brief and focus on only a few technical points at a time. Ideally, practice will be broken down into parts and distributed so learners do not get too fatigued (see Lesson 2.6 Types of practice on page 61 for more information on distributed practice). It is also important to practise using modified games to ensure learners are being exposed to the same type of stimulus they might receive during a game.

associative stage the second stage of Fitts and Posner's stage model of motor learning; during this stage, the learner has grasped the fundamentals and mechanics of the skill and their performance becomes more consistent with fewer errors

At this stage of learning, verbal feedback alone may not be effective as the learner may not always be able to transfer the feedback into action. Therefore, visual and kinaesthetic demonstrations should also be included to give learners a better idea of what the feedback looks like and feels like (see Lesson 2.8 Types of feedback on page 69 for more on visual and kinaesthetic feedback). The amount of information provided and the pace at which it is given should be reduced to avoid confusing or overloading the learner with too much new information. Learners need specific information and attention paid to the most critical elements of the skill for maximal benefit to their learning progression.



SOURCE 6 Feedback is very important during the cognitive stage of learning and should be provided through a combination of visual and kinaesthetic demonstrations and verbal explanations.

Stage 2 – The associative stage

The **associative stage** is the second stage of Fitts and Posner's stage model. It can be thought of as the "practice" stage. During this stage, the learner's performance typically has the following characteristics:

- more consistent performance, as the learner has grasped the fundamentals and mechanics of the skill
- increased stability in skill performance, which leads to smaller and less frequent errors, and the learner being able to identify and correct them as they occur
- increased cue detection, although the learner may still miss more subtle cues
- generally appropriate response to cues with successful execution, but the learner still lacks the consistency and fluency of a highly skilled performer.

Compared to the cognitive stage, the associative stage is quite long. Many athletes never move beyond the associative stage of learning.

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While they can recognise errors are being made, they are not always able to read the subtleties of play or select and execute the best response. They are still laying down neural pathways for the motor programs and therefore may also lack perception and timing to perform the skill fluently.

The associative stage is when an athlete's confidence and experience build. Practice is critical, because repetition of optimal technique and experience in authentic performance environments strengthens neural pathways and transfers messages to muscles more efficiently. Practice sessions to refine motor skills and movement strategies can be lengthened and include massed practice. The use of **problem-solving drills** with specific practice to ensure focus is on the particular needs of the athlete will help athletes gain experience in detecting and responding to cues. A combination of varied and constant practice can enable athletes to perfect performance of specific specialised movement sequences and strategies and will also train them to respond to the more random demands they might experience in a performance environment. (See Lesson 2.6 Types of practice on page 61 for more information on massed, varied and constant practice.)

Coaches should continue to assist learners to analyse their errors and correct their skills during this stage of learning. Feedback in the associative stage is more likely to be verbal because athletes have a greater understanding of the sport and the movement sequences and strategies involved. They can therefore efficiently execute the required changes. At this stage of learning, many athletes benefit from seeing video recordings of their performances, with specific feedback from a coach.

problem-solving drill a type of task that requires learners to solve common problems (e.g. reading environmental cues) and respond to those problems in the most suitable way

autonomous stage the third stage of Fitts and Posner's stage model of motor learning; during this stage, the learner can perform the skill consistently and fluently in different environments without conscious effort

Stage 3 – The autonomous stage

The **autonomous stage** is the third stage of Fitts and Posner's stage model. It can be thought of as the "automatic" stage.

The characteristics of a learner's performance during the autonomous stage are:

- consistent and fluent performance of the skill with an ability to adapt to different environments without conscious effort
- very few errors made and which are more likely to be related to decision making rather than technical ability
- little attention paid to the skill, but rather to identifying environmental cues, which enhances their decision making
- slow improvements.

For example, a volleyball player performing a spike no longer needs to think about footwork, body position and arm swing. Instead, they can focus on the position of the blockers and finding space on the other side of the court to hit the spike.

Even though players in the autonomous stage can manage their own errors, an experienced coach may often still be necessary to help identify minor technical shortages that have caused an increase in performance errors. This can lead to a skilled performer returning to the associative stage for a brief period while they make minor adjustments to their technique in a skill performance. Feedback is generally verbal and may focus more on cue identification and strategy. Video analysis can be useful to help the coach highlight specific technical issues or missed strategic opportunities.

Generally, a skilled performer will fluctuate between the associative stage and autonomous stage throughout their career. An example of such a regression is discussed in "Theory in action: Ian Healy and the golf ball drill" (page 50).

For the record!

A golf handicap is the average number of shots a golfer makes over par (the expected number of shots for an 18-hole course); the lower the handicap, the better the golfer. While most people can hit a golf ball and achieve some success, only 4 per cent of golfers worldwide achieve a single-digit handicap. For example, the average handicap for males (including social golfers) is around 29. It is therefore fair to say that most golfers never leave the associative stage.

Retrieve it!

Describe three characteristics of a learner in the cognitive stage of learning. Check back to earlier in this lesson to see if you retrieved the information correctly.

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Theory in action Ian Healy and the golf ball drill

Former Australian international cricketer Ian Healy is widely regarded as Australia's best wicketkeeper. He played 119 tests for Australia from 1988 to 1999.

To keep his motor skills at peak performance, Healy developed two techniques to help him improve how he caught the ball.

- The first technique was to "watch the ball into the gloves". Following this simple tip, Healy found that he became more and more consistent.
- The second technique was to develop "soft hands" by listening to the sound of the ball going into the glove with a soft thud.

To practise these two skills, Healy used the "golf ball drill". This involved throwing a golf ball against a wall and concentrating on watching the ball go into the glove and catching it as he would correctly catch a cricket ball.

Healy says he modified this drill throughout his career when he came into contact with different bowlers. His subsequent technique change meant an initial increase in errors, but with persistent practice such changes helped him improve his game on many occasions. This is a great example of how changing a practice technique can take even an elite athlete such as Healy from the autonomous stage to the associative stage, if only temporarily.



SOURCE 7 Ian Healy played 119 tests for Australia from 1988 to 1999. During this time he made 395 dismissals.

Check your learning 2.3

Check your learning 2.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which of the following best describes the role of information processing systems in motor learning?

A Information processing systems in motor learning solely rely on conscious decision making and feedback.

B Information processing systems involve automatic and unconscious processing, excluding any conscious involvement.

C Information processing systems in motor learning encompass both conscious and unconscious processes, involving sensory input, decision making and feedback loops.

D Information processing systems in motor learning are primarily influenced by genetic factors, with minimal involvement of cognitive processes.

2 **Describe** the characteristics of a learner in the cognitive stage of learning. How do these characteristics differ from a performer at the autonomous stage?

3 **Explain** two different types of practice most suited to a learner in the associative stage of learning.

4 According to the information processing model, **describe** the process a volleyball receiver must go through before executing a pass.

5 **Select** a specific game situation or skill from your selected physical activity and **sketch** your own mind map to organise your knowledge. See Source 5 (page 47) for an example.

Analytical processes

6 According to Fitts and Posner's (1967) stage model of motor learning, some learners will never progress beyond the associative stage. **Reflect on**

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why you think this can occur and **discuss** this in a 200-word written response, or with your elbow partner as directed by your teacher.

7 Based on what you have learnt, **consider** whether you think a player could be at different stages of learning for different skills. **Identify** examples from your selected physical activity to support your opinion.

8 **Identify** which cues are required to enhance decision making for your selected physical activity. **Determine** which cue is the most important to perceive in order to choose a successful response.

Knowledge utilisation

9 In your selected physical activity, **evaluate** your stage of learning for a single specialised movement sequence. Use characteristics of your performance to **justify** your decisions.

10 "Athletes operating at the autonomous stage of learning have no need for coaches." Do you agree or disagree with this statement? **Justify** your opinion in a 200-word written response.

11 Based on your identified stage of learning in your selected physical activity, make recommendations for the types of feedback that will optimise your performance. **Justify** your recommendations based on features of your performance, with reference to secondary data.

12 Read "Theory in action: Ian Healy and the golf ball drill". **Decide** which of the following statements best captures how Ian Healy improved his skill level. **Justify** your choice, referencing what you have learnt about the stages of learning.

A A skilled performer can make minor adjustments to a skill where they will fluctuate between the associative and autonomous stages.

B Players can recognise errors being made, but they do not always identify all relevant cues.

C To ensure the fastest possible improvement, practice sessions should be well organised and simulate various real-life situations.

D Learners need specific information and attention paid to the most critical elements of the skill.



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Lesson 2.4

The dynamic systems approach to motor learning

Learning intentions and success criteria

dynamic systems approach a theoretical framework used to help explain the processes involved in motor learning; according to this approach, the intelligence that coordinates and controls body movements is the result of complex interactions between the individual, the environment and the task

dynamic a term used to describe a process or system that is constantly changing

non-linear a term used to describe a process in which commands are not carried out step-by-step in sequential order

constraint any internal or external variable that has an impact on an athlete's performance

task constraint any aspect of a task that an athlete needs to overcome or adapt to (e.g. rule of a game)

environmental constraint any changeable aspect of the environment that an athlete needs to overcome or adapt to (e.g. weather)

individual constraint any individual characteristic that an athlete needs to overcome or adapt to (e.g. height, weight, skill level)

Key ideas

- → The second major framework used to explain how we learn and remember motor skills and complex movement sequences is the dynamic systems approach to motor learning.
- → This dynamic systems approach views motor learning as the result of complex interactions.
- → This approach suggests that motor skills are produced and learnt in response to constraints (task, environmental and individual). Rate limiters are a type of constraint that have a negative impact on learning and restrict performance.

Introduction to the dynamic systems approach

In the previous lesson, you learnt about the cognitive systems approach, which views motor learning as an organised process in which our movements are coordinated exclusively by a single, centralised command centre (i.e. our brain). However, the **dynamic systems approach** views motor learning as a much more complex, unpredictable and constantly changing process (hence the name **dynamic**).

The basic idea behind the dynamic systems approach is that the body is a complex system made up of millions of different parts, which are all constantly interacting with each other and the outside world. The dynamic systems approach suggests that our movements are coordinated and controlled through complex, **non-linear** interactions between all parts of the body. It suggests that motor skills are learnt and carried out dynamically in response to certain variables, known as **constraints**.

The role of constraints in the dynamic systems approach

There are three types of constraints and all are central to the dynamic systems approach. They include:

- **task constraints** – these are the aspects of the task that need to be overcome or adapted to (e.g. the rules of a game, the shape and weight of equipment, the size and shape of the playing surface)
- **environmental constraints** – these are the changeable aspects of the environment that need to be overcome or adapted to (e.g. weather conditions, the condition of playing surface, the number of spectators)
- **individual constraints** – these are the characteristics of the individual that need to be overcome or adapted to (such as height, weight, skill, strength, motivation and confidence).

How the dynamic systems approach works

A good way to understand how the dynamic systems approach works is to apply it to an everyday situation like walking down a hill. As shown in Source 2, people automatically

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change their gait (their way of walking) when they begin to walk down a steep, rocky slope. As they take the first step from a level surface onto the slope, they automatically lean backwards and begin to take smaller, more cautious steps with their knees bent. With each step, they also place more weight on the heel than they normally would on a level surface. All of this happens without conscious thought. Instead, the body self-organises to achieve the most stable state for navigating the surface and steepness of the slope. According to dynamic systems approach, in this situation our body responds in real time to:

- task constraints – such as the need to make it to the bottom of a steep slope
- environmental constraints – such as the unstable, slippery or uneven surface
- individual constraints – such as the height and weight of the person, the length of their legs, and the strength of their muscles and joints.



SOURCE 2 According to the dynamic systems approach, when walking down a steep hill your body responds in real time to task constraints, environmental constraints and individual constraints. It self-organises and changes your movement pattern to become more efficient and stable. As a result, you lean back more and place more weight on your heel as you take each step.



SOURCE 1 Task constraints can include the weight, shape and size of sports equipment.

Self-organisation in the dynamic systems approach

Self-organisation is a key concept in the dynamic systems approach. It refers to the many adjustments that a learner is constantly making in response to the constraints placed on them – without any conscious thought or specific instructions from a coach or teacher. The human body always strives to maintain equilibrium (or balance) – right down to a cellular level. When the body self-organises, it is trying to establish a movement pattern that is stable and balanced. The dynamic systems approach suggests that all parts of the body work together to achieve this stability, as opposed to just the brain and the central nervous system controlling the body (as suggested by the cognitive systems approach). Once a person becomes stable, they become comfortable and can produce a motor skill easily and reliably.

self-organisation a term used to describe a process in which many different systems and organs in the body interact with each other in order to achieve a task and establish a movement pattern that is stable

The dynamic systems approach in sport

When it comes to sport and physical activity, the dynamic systems approach suggests that with a favourable environment and a suitable task to perform, an individual will organically, over time, produce effective and efficient movement sequences. It also suggests that the body will develop efficient movement patterns based on the constraints that it faces.

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For example, an inexperienced netball player who is defending an opponent from shooting for goal will probably start defending with two feet planted on the ground and two hands outstretched. The constraints they face in this situation include:

- task constraints (e.g. the 3-feet rule, the height of their opponent)
- environmental constraints (e.g. whether the surface of the court is wet or dry, the level of noise created by the spectators)
- individual constraints (e.g. their height, level of experience, core strength).

In most cases, these constraints will prompt a response in the body to self-organise and change stance (as shown in Source 3). In an effort to extend their reach towards the ball, the player's body will lean forward, one arm will naturally drop away and one foot will be extended behind them as a counter balance to create stability. This is not generally something netball coaches need to teach young players. Instead, a combination of different constraints elicits this physical response from the individual.



SOURCE 3 According to the dynamic systems approach, a range of different constraints will prompt a response in the body to self-organise and change stance. A netball coach can also manipulate task and environmental constraints to encourage learners to solve movement problems through the exploration of different movement sequences. This can help fast-track their development.

The role of coaches in the dynamic systems approach

At this point you might be wondering whether it is possible for a netballer to become a skilled performer without any coaching. That is, according to the dynamic systems approach, can a player learn everything they need to know and do through experiences only? The answer here is "maybe". However, without any formal instruction or coaching, this would probably require many years of experiential learning. When a learner finds an effective and efficient movement sequence, it does not mean they have mastered that skill. Work is still required to ensure the appropriate neural pathways are established and other relevant body systems are strengthened through ongoing practice.

According to the dynamic systems approach, teachers and coaches still have an important role to play as facilitators helping learners in the acquisition of skills. By manipulating task and environmental constraints, teachers and coaches can encourage learners to solve movement problems through the exploration of different movement sequences.

Referring again to the netball example, a coach might manipulate constraints by having the shooter shoot from a number of different positions while the defender defends. Additional players might also be positioned so that the defender is unable to adopt a traditional front-on stance and is forced to make alterations to their technique. The shooter might also be replaced by a much taller player, forcing the defender to learn how to jump in order to defend the goal. Training in such authentic and dynamic environments is said to have many benefits for the athlete's transferral of skills to gameplay and their overall tactical awareness.

Retrieve it!

Explain the three stages of learning in Fitts and Posner's stage model of motor learning. Check back to Lesson 2.3 The cognitive systems approach to motor learning (page 43) to see if you retrieved the information correctly.

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Constraints

As mentioned earlier, constraints are a central part of the dynamic systems approach. In 1986, motor learning researcher Karl Newell developed the theory of constraints. He proposed that a number of variables – known as constraints – can affect an athlete's motor development. In a sporting context, a constraint is any internal or external variable that has an impact on an athlete's performance. A constraint can do one of two things:

- elicit an adjustment to an athlete's performance
- restrict an athlete's performance.

Source 4 shows how Newell's theory relates to the three constraints – task, environmental and individual.

Task constraints	Environmental constraints	Individual constraints
Characteristics of the task (e.g. rules, goals and equipment)	**Characteristics of the physical and social environment**	**Characteristics of the individual**
• Cannot use hands • Offside rule • No-contact rule • Cannot run with the ball • Playing zones • Aim to score • Keep ball in the court • Opposition • Number of players on court • Size, shape and weight of equipment • Size and shape of playing surface	• Weather (e.g. wind, rain, fog) • Temperature • Noise • Light level • Gravity • Spectators • Friends • Teachers • Family • Cultural norms	• Height • Weight • Body composition • Endurance • Flexibility • Strength • Speed • Technique • Motivation • Confidence • Learning style • Tactical knowledge

Source: Adapted from Spittle, M. (2013) *Motor Learning and Skill Acquisition: Applications for Physical Education and Sport*.

SOURCE 4 Newell's theory of constraints proposed that a number of variables – known as constraints – can affect an athlete's motor development.

Constraints can lead to the development of a new motor skill or the emergence of a new technique as the body self-organises to overcome instability in the task, the environment or the individual. For example, when a touch football match is played in the rain, some players will take advantage of this environmental constraint. A player approaching the try line might decide to use the slippery grass to slide from further out than they normally would. Furthermore, a player who has been previously reluctant to dive for fear of a painful landing might now attempt this skill.

The development of a new motor skill can also be compromised or restricted by one or more of these constraints. For example, a young child will find it difficult to develop basketball shooting and passing skills with a ball that is too large or heavy for them because the physical strength and size of their hands negatively affects their ability to execute the skill.



SOURCE 5 Tennis great Roger Federer demonstrates a common task constraint for young tennis players – the size of the racquet.

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Rate limiters

When constraints have a negative effect on learning processes and restrict performance, they are referred to as rate limiters. Rate limiters can be related to the individual, the environment or the task (see Source 4). Individual rate limiters can be further categorised as:

- **physical rate limiters** – these are related to a learner's physical characteristics (e.g. height, weight, physical strength, fitness)
- **physiological rate limiters** – these are related to the functions of learner's body systems and processes (e.g. strength, speed, stamina)
- **psychological rate limiters** – these are related to the learner's mental state (e.g. confidence, motivation, arousal)
- **perceptual rate limiters** – these are related to the learner's senses (e.g. ability to detect and process cues)
- **tactical rate limiters** – these are related to a learner's knowledge and understanding of individual and team tactics and strategies within a particular sport or physical activity (e.g. a player's understanding of defensive tactics in basketball)
- **technical rate limiters** – these are related to a learner's technique (e.g. a player's foot position in a soccer corner kick).

Rate limiters help to explain why an individual may have difficulty completing a skill, despite a concerted effort.

In the earlier basketball example, the size of the child's hand would be a physical rate limiter to the child shooting a jump shot with a large ball. In the junior leagues, basketball clubs overcome this type of rate limiter by offering different ball sizes for different age groups. Examples of other individual rate limiters that may affect a child's jump shot development include:

- not being physically strong enough to produce the force required to propel the ball to the basket (i.e. physiological rate limiter)



SOURCE 6 Constraints can lead to the development of a new motor skill or the emergence of a new technique. For example, when a touch football match is played in the rain, some players will take advantage of this environmental constraint.



SOURCE 7 When learning motor skills such as a basketball jump shot, task, environmental and individual constraints can have a negative effect on the rate of development. These constraints are known as rate limiters.

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- inability to take in relevant cues such as the open teammate to their right (i.e. perceptual rate limiter)
- limited understanding of options for getting past a tall defender (i.e. tactical rate limiter)
- placing one foot behind the other during the take-off phase (i.e. technical rate limiter).

Working with rate limiters

An understanding of rate limiters can help players maximise their learning potential. It is important to be able to identify constraints that might be negatively affecting their development and then look for ways to compensate for these constraints or overcome them. For example:

- an Australian football player might identify their lack of flexibility as a rate limiter and develop strategies to improve this aspect of their physical ability
- a soccer coach might identify the lack of coordination in a key player's non-dominant leg as a rate limiter and manipulate a task or environmental constraint to restrict the use of the dominant foot for certain activities (to encourage the player to improve coordination in their other leg).

In some cases, it is not possible to change a rate limiter. It might be necessary to find ways to adjust strategies or positioning to work with that constraint. For example:

- a short basketball player may be better off staying outside of the key and instead working on their long-range shot accuracy. Shorter players often find ball carrying suits their short stature as they can keep the ball protected low to the ground and use their agility to avoid the defence.
- a rugby league player with a large and muscular build may experience speed as a rate limiter and adjust their positioning in the game to work through the middle, rather than being on the wing where speed is more typically advantageous.

Retrieve it!

Explain the concept of self-organisation in relation to motor skill learning. Check back to earlier in this lesson to see if you retrieved the information correctly.



SOURCE 8 Rate limiters such as a weaker non-dominant leg can be overcome through the use of specially designed task and environmental constraints activities during practice.

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Check your learning 2.4

Check your learning 2.4: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which statement best characterises the dynamic systems approach to motor learning?

- **A** Motor learning is primarily driven by individual cognitive processes and decision making.
- **B** Motor learning emphasises the role of pre-determined motor programs executed through repetitive practice.
- **C** Motor learning is viewed as a complex interaction of multiple systems, including the individual, the environment and the task, where movements emerge or self-organise.
- **D** Motor learning is solely influenced by external feedback, with little consideration for internal factors.

2 **Identify** and **describe** the three types of constraints that are central to the dynamic systems approach. Provide one example of each.

3 **Explain** the term "self-organising". **Use** an example to support your explanation.

4 **Define** the term "rate limiter".

Analytical processes

5 **Consider** the role of a teacher or coach in the implementation of a dynamic systems approach to motor learning. Is it possible to become a proficient performer without expert guidance? **Justify** your point of view in a written response of no more than 200 words.

6 **Reflect on** whether your teacher or coach has applied the dynamic systems approach or the cognitive systems approach to learning skills this term. Use examples from your classes to support your written response of 150 words.

7 **Categorise** the following rate limiters using Source 9:

- **a** A volleyball spiker's non-hitting arm during the flight phase
- **b** A soccer player not detecting his open teammate in his peripheral vision
- **c** A track runner's lack of self-belief
- **d** A beginner touch football player's lack of team-strategy knowledge
- **e** A backstroke swimmer's inability to see the 5-metre warning flags due to impaired vision
- **f** A triathlete suffering from a chest infection
- **g** A lawn bowler's injured knee
- **h** The leg strength of a triple jumper who continually "buckles" between the hop and step phases of the jump

Type of rate limiter	Example
Physical	
Physiological	
Psychological	
Perceptual	
Tactical	
Technical	

SOURCE 9 Types of rate limiters

Knowledge utilisation

8 **Devise** a constraints-based activity to help you improve a specialised movement sequence or movement strategy in your selected physical activity. **Justify** your design.

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SKILL DRILL

Lesson 2.5
Assess the impact of rate limiters on performance

Aim

To assess the impact of rate limiters on your physical performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Pen
- Data Collection Instrument 1 (DCI 1)
- Game Performance Assessment Instrument 1 (GPAI 1)
- Equipment specific to your selected physical activity

Template: Data Collection Instrument 1 (DCI 1)

Template: Game Performance Assessment Instrument 1 (GPAI 1)

Method

Step 1

Identify three specialised movement sequences that are commonly performed in your selected physical activity (such as returning a serve in volleyball or delivering a leg spin bowl in cricket). Record these in the left-hand column of DCI 1.

Step 2

Take a moment to consider your physical characteristics and how they can work as rate limiters to your selected movement sequences. What impact do you think your height has on your ability to perform the sequence? What about your confidence?

DCI 1 identifies seven individual characteristics that can act as constraints for learning motor skills. A constraint can:

- cause an adjustment to your skill development/ techniquerestrict your performance of the skill (i.e. act as a rate limiter).

Determine the impact these characteristics have on your ability to perform your specialised movement sequences. Your assessment will be based on whether the individual characteristic:

- is a constraint that causes an adjustment to your technique/skill development (+)
- is a constraint that restricts your performance (–)
- makes no difference to performing the skill (0).

Specialised movement sequence	Height	Power	Technique	Flexibility	Agility	Confidence	Tactical knowledge
1							
2							
3							

SOURCE 1 DCI 1

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Step 3

Participate in a game or performance of your selected physical activity for 20 minutes.

Step 4

Analyse your performance of the three selected specialised movement sequences using GPAI 1. Place a tick to indicate whether your performance was excellent (controlled and accurate), good (has sufficient control), ok (more good than bad) or poor (requires considerable improvement).

Specialised movement sequence	Skill analysis (after performance)			
	Excellent	Good	Ok	Poor
1				
2				
3				

SOURCE 2 GPAI 1

Analysis and discussion tasks

1 Collecting primary data about your performance will give you insight into your strengths and weaknesses. This will allow you to make strategies to optimise your performance.

- **a** **Analyse** the data in GPAI 1 and **identify** which specialised movement sequence was (i) your strongest and (ii) your weakest.
- **b** **Explain** possible reasons for your strengths and weaknesses, making reference to the rate limiter assessment you conducted using DCI 1.

2 Rate limiters affect the learning potential of your specialised movement sequence. A consideration of how rate limiters have had an impact on your performance can help you tailor a strategy to suit your personalised needs in your selected physical activity.

- **a** **Describe** how one rate limiter had a negative impact on your performance of one of the three selected specialised movement sequences.
- **b** **Devise** a strategy that you could implement in an authentic environment to overcome this rate limiter. For example, if height was a rate limiter for executing an effective spike in volleyball, you could (i) set the ball deep into the court instead of spiking it, (ii) develop your digging skills to become the team libero, and (iii) hit a spike away from the net and use a topspin to hit with some pace and land inside the court.



SOURCE 3 Rate limiters affect the learning potential of your specialised movement sequence.

3 Any data you analyse (primary or secondary) will have various degrees of validity and reliability. Revisit Module 1 Physical Education toolkit, Lesson 1.10 The importance of data (page 17) to recap your understanding of validity and reliability.

- **a** **Evaluate** the reliability and validity of the data you collected in this Skill drill.
- **b** **Propose** at least two recommendations to increase the reliability of this experiment.

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Lesson 2.6
Types of practice

Key ideas

→ Practice is an essential part of learning and refining a motor skill.

→ There are several different types of practice, including massed practice and distributed practice; whole practice and part practice; blocked practice, serial practice and random practice; constant practice and varied practice; drills and problem solving; specificity of practice and variability of practice.

Learning intentions and success criteria

The importance of practice

Practice is an essential part of learning and refining a motor skill. It is also one of the main ways to develop the five characteristics of motor skill learning: improvement, consistency, stability, persistence and adaptability.

The development of these characteristics through practice will increase a player's confidence and ability to make better decisions under pressure. However, practice will only assist the player when the type of practice is relevant to their particular stage of learning.

Learners who are in the cognitive stage (i.e. beginners) generally need to practise in a closed environment to make their skills more fluent and consistent, whereas learners at the autonomous stage generally need to practise in a range of different environments to develop the consistency required in stressful real-life situations.

Practice can be classified into the following types:

- massed practice and distributed practice
- whole practice and part practice
- blocked practice, serial practice and random practice
- constant practice and varied practice
- drills and problem solving
- specificity of practice and variability of practice.

We will look more closely at each of these now.

Study tip

Develop your own concise study sheet for the major types of practice discussed in this section. In addition to describing each type of practice, determine its suitability for cognitive, associative and autonomous learners.

Retrieve it!

Which type of motor skills have a clear start and finish point? Check back to Lesson 2.2 Motor skills (page 35) to see if you retrieved the information correctly.

Massed practice and distributed practice

Massed practice is when a skill is practised in a continuous constant manner (and rest periods are either very short or non-existent). An example of massed practice is a netball goal shooter practising shooting continuously for 20 minutes. Successful massed practice requires correct technique, high levels of concentration and sufficient fitness to minimise fatigue affecting the performance. For these reasons, massed practice is more suited to highly skilled performers.

Distributed practice is when a skill is practised with periods of rest that are equal to (or longer than) the periods spent training. For example, a netball goal shooter practises shots from the right of goal for 5 minutes, has a break for 5 minutes and then repeats the process with another 5 minutes of goal shooting from a different point.

massed practice when a skill is practised in a continuous and constant manner (and rest periods are either very short or non-existent)

distributed practice when a skill is practised with periods of rest that are equal to (or longer than) the periods spent training

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Both these methods are effective when learning basic skills. However, distributed practice is more effective in improving skills than massed practice because it allows time for feedback and decreases the risk that the learner becomes tired and loses concentration. Distributed practice is also more effective when the energy demands of the skill are high, when the skill being learnt is complex and when the learner's motivation is low.



SOURCE 1 Different types of practice can be used depending on the skill being learnt and the player's stage of learning.

Whole practice and part practice

Whole practice is when a skill is practised as a whole (i.e. in its entirety). **Part practice** is when a skill is practised in its separate parts. For example, a golf swing can be taught in its entirety or broken up into its component parts of grip, stance, takeaway, downswing, impact position and follow-through.

When choosing between whole and part practice, coaches and players need to consider which stage of learning the student is at and the complexity of the skill. Although part practice can make a skill simpler, coaches need to be cautious not to change the nature of the skill. For this reason, when determining "parts" of the skill, they should be the largest component a learner can handle – that is, as many small parts as possible after each other. This will help develop the timing and rhythm required to perform the skill as a whole.

Blocked practice, serial practice and random practice

whole practice when a skill is practised as a whole (i.e. in its entirety)

part practice when a skill is practised in its separate parts

blocked practice when learners repeat an isolated skill for a period of time or number of repetitions

serial practice when a set of skills is performed in a set sequence

random practice when several different sets of skills are practised in an order that is constantly changing

Blocked practice is when learners repeat an isolated skill for a period of time or number of repetitions. For example, blocked practice in volleyball might consist of 10 digs, 10 sets and 10 serves. This is a traditional approach and the intention is to correct errors and refine motor skills. Learners at the cognitive stage gain more confidence from blocked practice, but their ability to retain and adapt these skills does not necessarily carry through to game situations.

Serial practice is when a set of skills is performed in a set sequence, for example, in volleyball repeatedly digging a ball to a setter before moving to the same outside hitting position each time to perform a spike from the subsequent set. This replicates the skills typical to an authentic game situation, yet it lacks the unpredictability found in competitive environments.

Random practice is when several different sets of skills are practised in an order that is constantly changing. In volleyball, random practice would involve a learner switching between performing digs, sets and spikes from different positions on the court. An easy way to achieve randomisation is to vary the position of the fed ball into play and to move blockers each round to force the hitter to hit from different positions.

During random practice, the learner does not practise any one skill for a length of time, but changes from one skill to another until a certain time or number of repetitions has been achieved. Switching from one skill to another develops stronger neural pathways, which increases the chance that the learner will remember and produce the skill in a competitive environment. Random practice is better suited to athletes at the associative and autonomous stages of learning.

Constant practice and varied practice

constant practice when a skill is practised under the same (i.e. constant) conditions

Constant practice is when a skill is practised under the same (i.e. constant) conditions. An example of this is repeatedly catching a basketball and performing a jump shot from the same position for a specific period of time or a specific number of repetitions. This essentially reinforces the motor skill for one specific condition.

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Varied practice is the process of practising the same skill or set of skills with varied demands. For example, throwing a softball over a variety of distances or chipping a golf ball at different targets ranging from 20 to 60 metres.

varied practice when practice sessions incorporate a variety of movement options and context changes

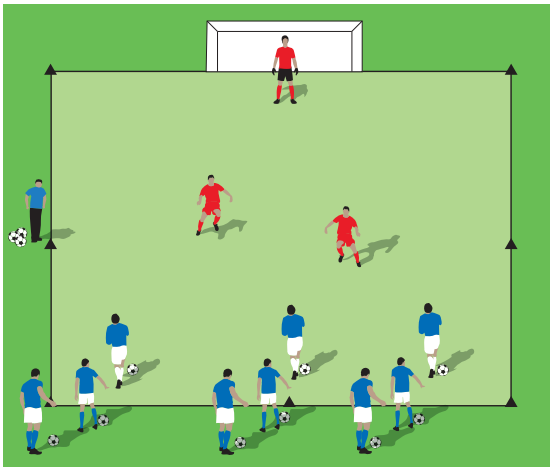
Both constant and varied practice have their advantages, but varied practice can replicate competitive conditions more accurately. In a game situation, it is rare to replay the same variation of a skill consecutively. In a round of golf, you may only get one chance to hit the chip shot of 50 metres, and when throwing a softball from the outfield, the distance to the target will change every time.

It is common to create practice strategies that use combinations of blocked and serial practice with constant or varied application. For example, when practising basketball shooting, you might decide to do blocked and constant practice where you repeatedly shoot jump shots from the same position. Or you might use blocked and varied practice where you repeatedly shoot jump shots from different positions. Similarly, you could use serial and constant practice to repeatedly pass and cut through the keyway, then receive the ball back before making the shot, all while keeping the cutting path and pass positioning constant. On the other hand, you could vary the path of the cutter and passing positions to make this serial practice varied.

Drills and problem solving

drills activities set up to allow for practising skills; they can target the development of one or multiple skills in various environments and can vary from simple to complex

Drills are a common method for developing skills and they provide a more targeted approach to practice than simply training through open match-play. The traditional model for drills is to repeat an isolated individual skill, or small set of skills, in a relatively closed, simple environment. This reinforces the motor program and can be recalled from a player's "bank of skills" as required in various environments. An example of a cricket drill is batting in the nets against a bowling machine to practise front foot drives. Reproducing the same movement that you have been drilling in actual match conditions can be positive (i.e. when it is an automatic response that is executed to suit a specific situation) or negative (i.e. a predictable response that is unsuitable for the situation and that the opponent can read).



SOURCE 2 This problem-solving drill aims to help the three attackers (in blue) increase their chance of dribbling past the defenders (in red) and having a shot at goal. Next, they might use just two balls to score a goal.

Drills that go beyond the basic repetition of a skill and include a focus on **problem solving** can help players practise reading a situation based on environmental cues and respond to those cues in the most suitable way. A player who can do this has greater potential to produce successful performances. Because drills with a focus on problem solving are concerned with adapting to the environment, they reflect the philosophy of the dynamic systems approach (see Lesson 2.4 The dynamic systems approach to motor learning, page 52).

Games and sports often have tactical problems that players need to solve to increase successful outcomes, such as how to create space in invasive games to improve the chance of passing to your teammate or how to isolate a player to create a scoring opportunity. The advantages of problem-solving activities are that they can be modified to suit the learner level. For example, when developing "moving into space" strategies, a larger grid with fewer players can be used for learners at the cognitive stage. The same activity can be used for associative and autonomous learners by decreasing the size of the playing grid and/or increasing the number of players. Modifications to drills to prompt problem solving could include:

problem solving a type of practice task that requires learners to solve common problems (e.g. reading environmental cues) and respond to those problems in the most suitable way

- the skills used (e.g. using handballing only in Australian football practice)
- the size of the field (e.g. shortening and widening the field in touch football practice)

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- the scoring zones (e.g. adding an extra goal for each team in soccer practice, as in "four goal soccer")
- the method of scoring (e.g. scoring by getting the ball to the shooter inside the goal circle in netball practice, instead of by shooting through the hoop)
- the team composition (e.g. reducing or increasing the number of defenders or attackers in basketball practice).

Specificity of practice and variability of practice

Once an athlete or coach has decided what type of activity they will engage in for practice (e.g. massed practice of sideline throw-ins), they need to consider the conditions that they will put in place for the practice. By manipulating the conditions of the task, the coach can emphasise certain aspects of the skill being learnt. Manipulations can include changing the rules, modifying the equipment, changing the number of players in the drill, and so on. There are two types of practice related to conditions: specificity of practice and variability of practice.

Specificity of practice

specificity of practice when skills are practised in an environment that is as close to match conditions as possible and allow for the gathering of highly relevant afferent feedback.

afferent feedback the information sent to the brain when a person moves various parts of their body, such as muscles, joints and skin, about the movements

When task conditions align closely with match play, this is referred to as **specificity of practice**.

When a person moves, the various parts of their body such as muscles, joints and skin send information back to their brain about their movements; this is called **afferent feedback**. In sport, this feedback is crucial as it allows the athlete to make immediate adjustments when they are playing in a match, for example.

When an athlete practises in an environment that very closely resembles normal match conditions, the afferent feedback generated between body and brain is appropriate to those conditions. This enables the athlete to further refine their movements and transfer them directly to match play. This is the purpose of specificity of practice.

The activities selected when seeking a high specificity of practice need to be realistic and mimic those used in a match situation. For example, on match day, a tennis player will have to hit balls with pinpoint accuracy both when standing still and when outstretched and on the run. Training activities that allow the athlete to practise shots on the run regardless of whether they hit these shots inside the boundaries of the singles court lack a specific alignment to match conditions. For a high specificity of practice, the coach would emphasise the requirement for accuracy. Through afferent feedback, the athlete would have a chance to become attuned to the aspects of execution that allowed for that accuracy, such as the speed of their swing, the grip at the time, the angle of the racquet at the time of contact and the degree of wrist versus arm action.

Specificity of practice can speed up an athlete's learning by focusing their adjustments on relevant information, and it can improve their accuracy by providing highly precise afferent feedback under match-like conditions.

Variability of practice

variability of practice when skills are practised in conditions that differ from normal match play

When the learner's experience while practising a skill or strategy includes variations to the context in which they are being practised, as well as variations of the skill or strategy itself, it is called **variability of practice**. This increases the chances for future performance success. The most common task variations include:

- changing the rules; for example, you may only score through the centre corridor of the touch field (i.e. no wings)
- modifying the equipment or playing area; for example, you may not use the backboard when shooting (basketball)
- adjusting the number of players; for example, three players on each team rather than the normal six.

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Earlier, we used the example of a tennis player to explain specificity of practice. We can continue with this example and apply it to variability of practice to better understand the difference. Let's say this tennis player was only hitting lobs when caught in an outstretched position during match play. The coach could vary the rules to force the athlete to remain aggressive in these situations. For instance, the coach could enforce that the athlete can only be awarded a point when they win a rally by hitting a winner on the run. In other words, an ace or a winner from a static baseline or volleying position would not yield a change to the score.

Contextual changes such as this are designed to increase or decrease the complexity and predictability of the environment and can compel athletes to narrow or widen their focus on a particular element of play or afferent feedback. It is believed that variability of practice allows the athlete to strengthen neural pathways and develop schema (how information is organised in the brain), thus increasing their ability to be adaptable when faced with changing stimuli and situations in match play.

Note: Variability of practice (manipulating the task) is not to be confused with varied practice (performing the same skills with varied demands), as explained in "Constant practice and varied practice" (page 62).

Choosing the right types of practice

Retrieve it!

Give two examples of gross motor skills. Check back to Lesson 2.2 Motor skills (page 35) to see if you retrieved the information correctly.

It can be difficult to know what types of practice to select to get the best out of an athlete or team. Williams and Hodges (2023) have developed a guiding framework to assist athletes and coaches in facilitating effective skill learning through practice. The Skill Acquisition Framework for Excellence (SAFE) provides five action points to encourage reflection when making decisions about practice (see Source 3).

Action point	Explanation
1 Find the right balance in practice between focusing on long-term learning and short-term performance.	Over time, athletes should be developing a breadth and depth of skills. While practice sessions should certainly address current and specific areas for improvement, they should also be designed with the bigger picture in mind, e.g. learning about strategy and experiencing different positions on the court/field. This is not only important from the perspective of skill development but also for athlete motivation.
2 Focus on the quality of practice rather than just the quantity.	As Vince Lombardi's famous saying goes, "Practice does not make perfect. Only perfect practice makes perfect". Irrespective of one's interpretation of the concept of perfection, this saying helps highlight that a small amount of highly effective practice will always yield better results than a large amount of mediocre practice.
3 Create practice conditions that are specific to competition.	As discussed above, specificity of practice allows for an athlete to transfer their learning from practice to authentic performance environments. This does not mean that there is no place for variability of practice. Rather, it highlights that all practice should have the overarching purpose of improving the athlete's authentic performance capacity.
4 Consider individual differences in how learners respond to various interventions.	In Lesson 2.3 The cognitive systems approach to motor learning (page 43), we outlined how the approaches to feedback and practice differ based on the stage of learning of the athlete: cognitive, associative or autonomous. However, it is important for a coach of multiple athletes to avoid making complete generalisations. They should carefully observe how individual differences in skill or personality have an impact on the effectiveness of different types of practice and be willing to adjust their training accordingly.
5 Facilitate learning during practice rather than dictate or abdicate.	Traditionally, practice design was considered successful if it involved the coach instructing, demonstrating and providing regular verbal feedback. In more recent years, a lot of evidence has suggested that good practice uses the coach as a "catalyst" or "facilitator" of change rather than the all-wise deliverer of knowledge. This is sometimes referred to as a "hands-off" approach to coaching. This approach is embodied in the constraints-led approach to motor learning which is discussed in depth in Lesson 2.4 The dynamic systems approach to motor learning (page 52).

SOURCE 3 A summary of the Skill Acquisition Framework for Excellence (SAFE) by Williams and Hodges (2023)

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Measuring the effectiveness of practice

In Lesson 2.2 Motor skills (page 35) we outlined the importance of athletes engaging in regular tests to determine their skill proficiency and growth as a learner. It is recommended that athletes and coaches use these tests strategically, throughout and at the end of a certain practice period to make judgments about the effectiveness of practice. This will help highlight aspects of practice to maintain, modify or strengthen.

Check your learning 2.6

Check your learning 2.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Learners in the autonomous stage:
   - **A** generally need to practise in a range of different environments to develop the consistency required in stressful real-life situations.
   - **B** can achieve consistency in stressful situations without any further practice.
   - **C** mostly need to practise in familiar environments to develop consistency.
   - **D** mostly need to practise in controlled environments to refine specific skills.

2 Choose the correct answer. A swimmer practising their tumble turn continuously for 20 minutes is engaging in which type of practice?
   - **A** serial practice
   - **B** random practice
   - **C** massed practice
   - **D** distributed practice

3 Consider your stage of learning in a physical activity of your choice, then:
   - **a** **explain** why or why not random practice is an effective choice for you.
   - **b** **describe** the conditions that would lead you to select whole or part practice.

4 **Identify** the variables that can be used in problem-solving drills.

Analytical processes

5 **Select** a drill from your current physical activity. Provide conditions for this drill to satisfy each of the following types of practice:
   - **a** blocked
   - **b** random
   - **c** constant
   - **d** varied.

6 **Identify** errors in one motor skill from your selected physical activity. **Reflect on** the various types of practice and identify which one would best help you correct these errors.

Knowledge utilisation

7 "Specificity of practice is better than variability of practice for open environment games." Do you agree or disagree? **Justify** your response using what you have learnt in this lesson.

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SKILL DRILL

Lesson 2.7
Investigate the impact of types of practice on performance

Aim

To investigate the impact of types of practice on personal performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Tape measure
- A set of markers (or goal uprights)
- 20+ AFL footballs or similar
- Pen
- Data Collection Instrument 2 (DCI 2)
- Calculator

Template: Data Collection Instrument 2 (DCI 2)



Method

Step 1

Your teacher will divide the class into three groups (A, B and C).

Within your group, work in pairs. Position yourself 30 metres from your partner with a set of markers placed halfway between you and 3 metres apart, simulating a pair of goal uprights.

Step 2

Take turns punt kicking the ball back and forth between you using your non-dominant foot. Aim to kick the ball through markers.

Each time the ball goes through the markers, you score a point.

Step 3

Record your results in the Condition 1: Pre-practice column on the DCI 2.

You should only fill out the row indicating your personal result and the result of the group you are in.

Hint: To work out the average, divide the total group score by the number of people in your group.

	Condition 1: Pre-practice	Condition 2: Post-practice	Difference post-practice (e.g. + 2, − 5)
My personal result	/20 =	/20 =	
Group A average	/20 =	/20 =	
Group B average	/20 =	/20 =	
Group C average	/20 =	/20 =	
Class average	/20 =	/20 =	

SOURCE 1 DC1 2

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Step 4

Each group now practises punt kicking with their non-dominant leg, using three different types of practices.

- **Group A** uses massed practice, repetitively kicking through the markers in unchanging conditions, for 10 minutes.
- **Group B** uses distributed practice, kicking through the markers for 2 minutes followed by handball passes for 2 minutes, repeating for 10 minutes in total.
- **Group C** practises in a modified game situation (e.g. three-on-three on a reduced field) for 10 minutes.

Step 5

Re-assess your punt kick performance by lining up for 20 kicks. Make sure that the conditions are as close as possible to what they were during step 1.

Record your personal results and the average result of your group in the Condition 2: Post-practice column of DCI 2. Analyse the difference between rounds and record it in the final column of DCI 2.

Compare the results of your group with the class. Record the class average in DCI 2.

Analysis and discussion tasks

1 To be able to find meaningful information from the primary data you have collected, it is important to **consider** the relevant motor learning concepts that underpinned this task. **Describe** the task's characteristic (for example, was it discrete or continuous? Open or closed? Fine or gross?).

2 Analysing class results will allow you to identify links between stages of learning and types of practice.

   a Prior to this Skill drill, at what stage of learning – cognitive, associative, autonomous – would you place your class in the skill of non-dominant foot punt kicking? **Justify** your answer with reference to the characteristics of each stage of learning.

   b **Consider** your personal results. Did you experience an improvement in your performance following your practice session? If so, did you increase your goal count?

   c **Compare** your results with the group you were in. Are your results consistent with the group average, or is there a significant difference? Refer to specific data from the table to enhance your response. Explain any factors that could have contributed to a difference in results between yourself and your group.

   d **Reflect on** the overall results of the class, and **determine** which group saw the greatest improvement in performance during the post-practice kicking. What type of practice did that group participate in?

   e Based solely on the data you have collected in this Skill drill, recommend the best type of practice for someone in the same stage of learning as your class.

3 Draw links between your conclusions about types of practice and your performance in your selected physical activity. Use these links to devise a personalised motor learning strategy.

   a Write down one specialised movement sequence from your current physical activity. *Hint*: Select a specialised movement where your current stage of learning is similar to the stage you were at in the Skill drill.

   b **Devise** a personalised motor learning strategy to refine your performance of the specialised movement sequence. Your motor learning strategy should detail the best type of practice for this type of skill and for someone at your stage of learning. **Justify** your response using the theories of practice and stages of learning, combined with your analysis of the primary data collected in this Skill drill.

4 How would you modify your strategy to reflect a dynamic systems approach to refining your specialised movement sequence?

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Lesson 2.8
Types of feedback

Key ideas

→ Feedback is all the information an individual receives about their performance of a skill.

→ Feedback is organised into two categories: intrinsic feedback (i.e. from inside the body) and extrinsic feedback (i.e. from outside the body).

Learning intentions and success criteria

What is feedback?

Feedback is a term used to describe all the information an individual receives about their performance of a skill. It helps learners to motivate themselves, change performance and reinforce learning. The more precise the feedback, the better the outcome for the performer. Feedback is organised into two categories:

- intrinsic feedback (i.e. from inside the body)
- extrinsic feedback (i.e. from outside the body).

We will look at each of these types of feedback in detail in this lesson.

feedback information about a person's skills or performance; can include intrinsic and extrinsic feedback

intrinsic feedback the internal or sensory information that a player receives during and after a movement

Intrinsic feedback

Intrinsic feedback is the internal (or sensory) information that a player receives during and after the performance of a skill. The main types of intrinsic feedback are:

- visual (what you see)
- tactile (what you feel)
- auditory (what you hear)
- proprioceptive (what you sense – particularly in terms of the position and movement of your body).

For example, when performing a throw in softball, a player is aware (proprioceptive) of their stance, grip and action throughout the skill. They can feel (tactile) the ball leaving their fingers, see (visual) the trajectory of the ball's flight, and can see (visual) and hear (auditory) the ball landing in their teammate's glove. In this way, individuals receive intrinsic feedback about the performance without relying on feedback from technology or other people.

You can explore your intrinsic feedback by trying to perform a skill with your eyes closed (making sure it is safe to do so) and focusing on the "feeling" of the movement. We might not think about it, but we all use intrinsic feedback constantly. Consider how rarely you need to look down at the keyboard when you type on a computer. Instead, you rely on the feeling and the sound of the keys being hit, and the visuals appearing on the screen. Another example is a guitar player who, with a degree of proficiency, changes finger positions to play different chords without stopping to look at the strings.

Learners at the cognitive stage will find intrinsic feedback more difficult to use as they are still working out what the skill should look and feel like. However, to progress to the associative stage, you need to be able to detect and correct your own errors. It is therefore important that cognitive learners learn to recognise and use intrinsic feedback and not rely solely on extrinsic feedback.

For the record!

Peyton Manning was considered one of the greatest quarterbacks to have ever played in the National Football League in the United States. Manning, who retired in 2016, acknowledged the importance of external feedback: "I love being coached. I ask a lot of questions and certainly appreciate any insight and feedback. I think if you ever stop listening to coaching or stop asking questions, you probably need to be doing something else."



SOURCE 1 NFL quarterback Peyton Manning

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Extrinsic feedback

extrinsic (augmented) feedback information from external sources that is received at the completion of a movement

Extrinsic feedback (also known as augmented feedback) is the external information that a player receives after the completion of performance of a skill. For example, after a basketball game a player might watch a replay of their performance and be given constructive criticism by their coach. Extrinsic feedback adds to the intrinsic feedback an individual has received during their performance and is particularly important for beginners (who may not yet be able to detect errors in their own performance). The main types of extrinsic feedback are:

- knowledge of results
- knowledge of performance.



SOURCE 2 A softball player receives intrinsic visual, tactile, auditory and proprioceptive feedback as they throw the ball.

Knowledge of results

knowledge of results (KR) feedback feedback based on the outcome (i.e. result) of the performance

Knowledge of results (KR) feedback is based on the outcome (i.e. result) of the performance. This type of feedback is particularly helpful when learning a skill as it allows an individual to determine their progress. Shooting a soccer ball at a goal from a certain distance and counting the number of goals is an example of how KR feedback can be used to determine a learner's skill level. Learners at the cognitive stage often find this type of feedback easy to use.

Knowledge of performance

knowledge of performance (KP) feedback feedback that is concerned with the execution or process of the movement, as opposed to the outcome

Knowledge of performance (KP) feedback is concerned with the execution or process of the movement (i.e. the technique). KP feedback is useful for cognitive learners to draw their attention to errors in their movement that they cannot detect themselves. For example, an athlete who throws a pass in touch football might initially throw the ball while facing forward, and a coach might offer them feedback to turn their hips to where they want the ball to go. KP feedback is important at all stages of learning. In the cognitive stage, the feedback will focus on the basics of technique, including timing and gross leg, arm and body movements. In the associative stage, KP feedback might cue an athlete to fine-tune their technique and to be responsive to external cues, such as the positioning of the opposition or teammates as well as court or field positioning. For autonomous learners, KP feedback might assist them to adapt specific elements of their technique to gain a tactical edge over a specific opponent.

KP feedback can be provided through the following means:

- verbal (spoken) – suited to autonomous and some associative learners who understand what the feedback means
- visual (demonstration or video) – suited to all stages of learning
- kinaesthetic (coach guides athlete's body part through the correct motion) – suited to cognitive and some associative learners who require additional guidance to ensure their body moves correctly.

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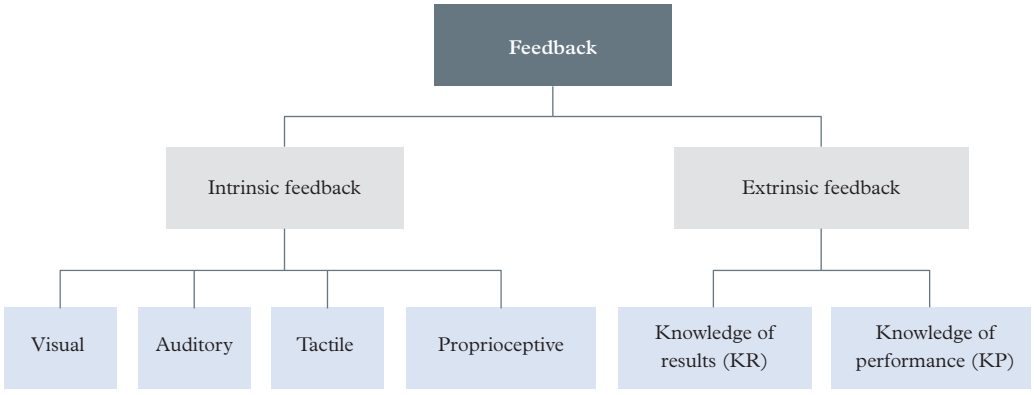
The timing of the feedback is important. Feedback can be received:

- before performance (e.g. providing instructions on how to perform a skill)
- during performance (e.g. reminding the athlete of the technical cues mid performance)
- after performance (e.g. pointing out errors in technique).

Offering feedback too quickly and too often can inhibit optimal learning. Time should be given for the learner to process intrinsic feedback before extrinsic feedback is offered. Similarly, individuals should be encouraged to perform multiple times before feedback is provided. It is recommended to wait for learners to complete at least five performances before they receive extrinsic feedback. Feedback should be both encouraging and useful. Learners are more likely to take on the feedback provided by teachers and coaches if their efforts have been positively acknowledged before corrections are offered.

Retrieve it!

Explain what blocked practice is. Check back to Lesson 2.6 Types of practice (page 61) to see if you retrieved the information correctly.



SOURCE 3 The main types of intrinsic and extrinsic feedback

Check your learning 2.8

Check your learning 2.8: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Feedback based on the outcome of the performance is known as:
   - **A** knowledge of performance.
   - **B** knowledge of results.
   - **C** extrinsic feedback.
   - **D** intrinsic feedback.

2 Choose the correct answer. Extrinsic feedback is:
   - **A** provided by senses.
   - **B** always encouraging.
   - **C** particularly important for cognitive learners.
   - **D** what you see.

3 **Describe** the four types of intrinsic feedback.

4 **Explain** the difference between intrinsic and extrinsic feedback and provide an example of each.

Analytical processes

5 **Analyse** one skill from your current physical activity. Determine the visual, tactile, auditory and proprioceptive feedback that could be received by a learner completing this skill that might help them improve future attempts.

6 **Distinguish** which type of feedback (intrinsic or extrinsic) you prefer to receive. Analyse the pros and cons of your preferred feedback method.

Knowledge utilisation

7 **Decide** whether intrinsic or extrinsic feedback is more beneficial for learners at the autonomous stage. **Justify** your response.

8 **Evaluate** a coach's decision to only use knowledge of performance feedback for cognitive learners. **Justify** your response.

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SKILL DRILL

Lesson 2.9
Evaluate the impact of different types of feedback on performance

Aim

To evaluate the effectiveness of extrinsic feedback on improving performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Blindfolds
- Tennis balls
- Tape measure
- Four bullseye targets with different scoring sections (*Hint*: You could also use tape or chalk to draw circles straight onto a wall or on a large sheet of butcher's paper.)
- Pen
- Game Performance Assessment Instrument 2 (GPAI 2)
- Calculator

Template: Game Performance Assessment Instrument 2 (GPAI 2)

Method

Step 1

In pairs, take turns being blindfolded and throwing a tennis ball at a target from 5 metres. Each student gets ten throws.

This is the control condition, so no feedback will be given. Your partner records your score in the Condition 1 column of GPAI 2 but does not reveal it to you.



SOURCE 1 Feedback is given to help improve a person's skills and confidence.

Step 2

Come together as a class to determine your class average and record the results in the Condition 1: Class average column of GPAI 2.

Step 3

Your teacher will separate the pairs into three groups – Group A, Group B and Group C. Your conditions will change depending on which group you are in. Repeat the exercise with the following differences between the groups:

- **Group A** is blindfolded and given knowledge of results (KR) feedback. This means that partner can tell them the score they receive for each throw but are not permitted to reveal anything else.
- **Group B** is blindfolded and given knowledge of performance (KP) feedback. This means that partners can provide feedback on the direction of their throw (e.g. higher, lower, left or right) but are not permitted to reveal their score.

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- **Group C** is blindfolded and given both knowledge of results and knowledge of performance (score and direction).

Record results in the Condition 2 column of GPAI 2.

Step 4

Come together as a group to determine your group average and record the results in your Condition 2: Group average column of GPAI 2.

Ball	Condition 1: Control score	Condition 1: Class average	Condition 2: Group _____	Condition 2: Group average
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTAL:				

SOURCE 2 GPAI 2

Analysis and discussion tasks

1 Graphs can help to create a visual representation of your data which can allow you to detect any trends.
   - **a** **Create** a line graph that shows your group's combined average across performance over the course of the exercise. (*Hint:* one axis of your graph should indicate points and the other axis should show the different balls.)
   - **b** **Consider** your graph. Can you spot any trends? Did accuracy improve over time?

2 Analysing the average of your entire class, rather than just your group, will help you increase the validity of your data.
   - **a** Using the data that you collected from the two other groups in the class, plot and label an additional two lines on your line graph.
   - **b** **Consider** each line in relation to the different conditions. What do you notice about the shape of the lines? Does any shape on the graph indicate improvement?

3 Detecting a trend in a graph is a good first step to start drawing conclusions about the concept that you are investigating. To **evaluate** the impact of different types of feedback on performance, **consider** the following:
   - **a** Which group had the greatest rate of improvement?
   - **b** Would you predict this result based on your understanding of KR and KP feedback? If not, what could account for the difference you discovered?
   - **c** **Justify** the use of KR and KP feedback in improving your own performance using primary data (from this Skill drill) and secondary data (from this course) to support your response. This is known as synthesising primary and secondary data.

4 **Identify** the type of feedback you find most useful for your selected physical activity. **Justify** your answer using the primary data you collected in this Skill drill.

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Lesson 2.10
Body and movement concepts

Learning intentions and success criteria

Key ideas

- → Body and movement concepts are approaches that can help individual athletes or teams to be more aware of their bodies and adapt their movements in order to achieve specific goals.
- → The four body and movement concepts are body awareness, space awareness, quality of movement and relationships.

What are body and movement concepts?

body and movement concepts four categories that describe movement based on shared characteristics; used to help athletes evaluate their performance and develop and improve specialised movement sequences and movement strategies in different sports and physical activities. The concepts are body awareness, space awareness, quality of movement and relationships (e.g. to objects and other people)

specialised movement sequence a combination of fundamental movement skills (and movement elements) that enables the body to move in response to a stimulus

movement strategies a variety of approaches (tactics or plans) that will help an individual or team achieve a determined outcome

Body and movement concepts are four categories of movement criteria that can be used to assess and evaluate performances of specialised movement sequences (motor skills) and movement strategies. Being more aware of their bodies and their movement capacity helps athletes to reflect on and adapt in order to achieve specific goals. These concepts can be applied by athletes and coaches to help support the teaching and learning of specialised movement sequences and movement strategies in different sports and physical activities.

Using body and movement concepts

Developed by Hungarian dance artist and theorist Rudolf Laban in the early 1900s, body and movement concepts provide a framework for understanding and improving:

- **specialised movement sequences**, which are the combination of movement skills and sequences relative to the position or event in a selected activity
- **movement strategies**, which are a variety of approaches that will help an individual or team achieve a determined outcome.

An understanding of the specialised movement sequences and movement strategies within a selected physical activity and for a specific position is essential for mastering skills and developing proficiency. The body and movement concepts can act as criteria for evaluating an athlete's performance of these sequences and strategies.



SOURCE 1 A gymnast needs to have an understanding of body and movement concepts to execute skills and maintain their balance.

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There are four body and movement concepts:

- quality of movement
- body awareness
- space awareness
- relationships (e.g. to objects and other people).

We will look in more detail at each of the concepts in this lesson.

quality of movement a body and movement concept; quality of movement relates to the characteristics (i.e. qualities) of a movement (e.g. speed, effort, force, accuracy, level of effort, etc.)

Quality of movement

Quality of movement relates to how the body moves. In particular, this concept helps to describe the characteristics of particular movements. Source 2 outlines the characteristics that determine an athlete's quality of movement and provides an example of how each characteristic relates to movements in a volleyball game.

Characteristic	Definition	Example: volleyball
Time and speed	The time it takes for the athlete to complete the movement (the speed in which it can occur)	A libero requires fast reaction time to defend the attack mid-rally.
Accuracy	The precision and exactness of the movement	The power of a spike is irrelevant if the ball is hit out.
Force development	The amount of force created by the movement	A jump serve generates greater power than a standing float serve due to the summation of forces in the run-up.
Effort	The effort required for the movement	An autonomous performer requires less effort to perform an accurate and powerful jump serve than a cognitive learner.
Efficiency	The ability for the movement to achieve the intended purpose with ease, power, fitness, and so on	A setter who can consistently achieve accurate sets, regardless of the set destination or their starting position, demonstrates efficiency.
Effect	The consequence of the movement	An outside hitter who forces their opponent to dive in order to defend the hit has demonstrated effectiveness.
Flow	The smoothness and ease of the movement	A setter who can set long, short, forward and back with ease and effect has the ability to fool the blockers.
Sequence	The order of the movement in relation to other movements	When a middle blocker can effectively join the outside blocker by adapting the sequence of the sub-routines of a standard middle block.
Continuity	The ability for the movement to occur in an uninterrupted sequence	When a blocker can transition from defence to attack without a break in their movement, they can achieve a fast counter-attack.
Outcome of movement	The result of the movement (e.g. on opponents, on the score, on teammates)	When a spike hits the ground inside the boundaries of the court to achieve a point for the team, this movement is said to have had a positive outcome.

SOURCE 2 The factors that determine an athlete's quality of movement

Each of these factors is relative to an athlete's ability and stage of learning. For example, a skilled performer is typically more fluent than an unskilled performer, and skilled performers are generally able to manipulate the quality and the sequencing of their movements with greater efficiency and effectiveness in relation to the movement outcome.

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Body awareness

body awareness
a body and movement concept; body awareness relates to the sense (or consciousness) we have of our own body when performing a skill

Body awareness relates to the sense (or consciousness) we have of our own body when performing a skill. The quality of a physical performance – and the difference between success and failure – can come down to knowing where your body position should be during the execution of a skill. Body awareness generally involves an understanding of the following concepts:

- balance
- stability
- weight bearing
- transfer of weight
- flight.

Balance

Balance refers to an individual's ability to keep steady, with an equal amount of weight on each side of the body, throughout a skill or a specialised movement sequence. To achieve balance, an athlete must have knowledge of:

- body parts (i.e. the parts that are used in the skill and the order in which they are used). For example, a javelin thrower needs to be aware of exactly where their feet, arms and body are positioned at the point they initiate the throw.
- body shape (i.e. a knowledge of exactly what "shape" the body needs to be in to execute the skill). For example, gymnasts need their bodies to be curled up tight to perform a somersault, but extended and symmetrical to perform a split jump.
- body action and position (i.e. a knowledge of exactly what movements the body needs to make to execute the skill – specifically, transfer of weight, balance and stability during movement). For example, surfers need to change the position of their centre of gravity to maintain balance when riding a wave.

Retrieve it!

Describe and provide an example of each of the three types of constraint in the dynamic systems approach. Check back to Lesson 2.4 The dynamic systems approach to motor learning (page 52) to see if you retrieved the information correctly.

Stability

Stability refers to the quality or state of being physically steady and not changing in any way. Some sports require higher levels of stability for successful outcomes. For example, any striking activity or making a tackle in rugby league requires a stable base. On the other hand, decreasing the body's stability can increase performance where speed and change of direction are critical, such as when performing baulks and fakes in netball.

Weight bearing

Weight bearing occurs when the legs or arms support the weight of the body. Weight-bearing activities require you to support your own weight and/or an external load. These activities include running, jumping, aerobics, weightlifting and stretching. Having an awareness of the correct technique when performing a skill (and knowing what specific parts of your body should feel like during the performance) can improve efficiency and reduce injuries.

Transfer of weight

When an athlete is required to move from supporting their entire weight on two feet to one foot or the other, this is called transfer of weight. Moving the body in this way requires care to avoid both the loss of balance and stability, or injury. For example, a skateboarder must successfully transfer weight from one side of the body to execute turns.

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Flight

When the body becomes airborne (that is, it leaps or moves through the air), this is referred to as flight. Balance and stability in the air is just as important as it is on land, as this balance allows for the athlete to land in a stable manner and avoid injury.

Space awareness

Space awareness relates to the relationship between the body and its surroundings. Specifically, space awareness is concerned with how an athlete can move their body through available space to perform a skill successfully and increase the chance of a positive outcome.

space awareness a body and movement concept; space awareness relates to the relationship between the body and its surroundings (i.e. how the athlete can move in the available space)

When examining space awareness, it is important to consider the following aspects:

- direction of movement
- levels and planes of movement
- pathways of movement
- location of movement.

Direction of movement

Direction of movement describes the way a performer might move their body to complete a specialised movement sequence for a movement strategy. Movement directions include forwards, backwards, sideways, up and down. When receiving a pass in Australian football, for example, a player could consider moving forwards, backwards, sideways, up or even down to find space for the pass (see Source 3). In confined spaces, such as netball, players may need to combine movement directions to find space.

direction of movement the direction a performer might move their body to complete a specialised movement sequence for a movement strategy



SOURCE 3 Sometimes athletes need to move up to find the space needed to execute a skill. Here, Western Bulldogs player Josh Hill finds space above his teammates and opponents.

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Levels and planes of movement

Space awareness also takes into account levels and planes of movement.

Levels of movement can be categorised as low, medium or high. Low movements are made below knee height; for example, diving below a defender for a try in touch football. Medium movements are made between knee and shoulder height (e.g. making a chest pass in netball). Movements that are made at shoulder height and above are considered high level movements. Catching a high pass or performing a lay-up are examples of high movements.

Planes of movement describe the three-dimensional ways in which a body can move. Think of a plane as an imaginary flat surface that runs through an object or thing. There are three planes of movement that describe the movement of the body (see Source 4):

- the **sagittal plane** – movements in this plane are forwards and backwards. A forward lunge is an example of movement along this plane.
- the **frontal plane** – movements in this plane are side to side. A star jump (or jumping jack) is an example of movement along this plane.
- the **horizontal (or transverse) plane** – movements in this plane are rotational. Twisting the trunk in a crossover toe touch is an example of movement along this plane.

All human movements can be described as taking place along one or more of these planes. Working through these three planes during training drills will increase body strength and reduce injuries. A badminton player, for example, may move along the frontal plane when they lunge laterally to reach a shuttlecock falling to their right.

planes of movement an approach used to describe the different movements of the body; there are three planes (i.e. imaginary flat surfaces) that run through the body and along which the body moves

sagittal plane one of the three planes of movement; movements in this plane are forwards and backwards. A forward lunge is an example of movement along this plane

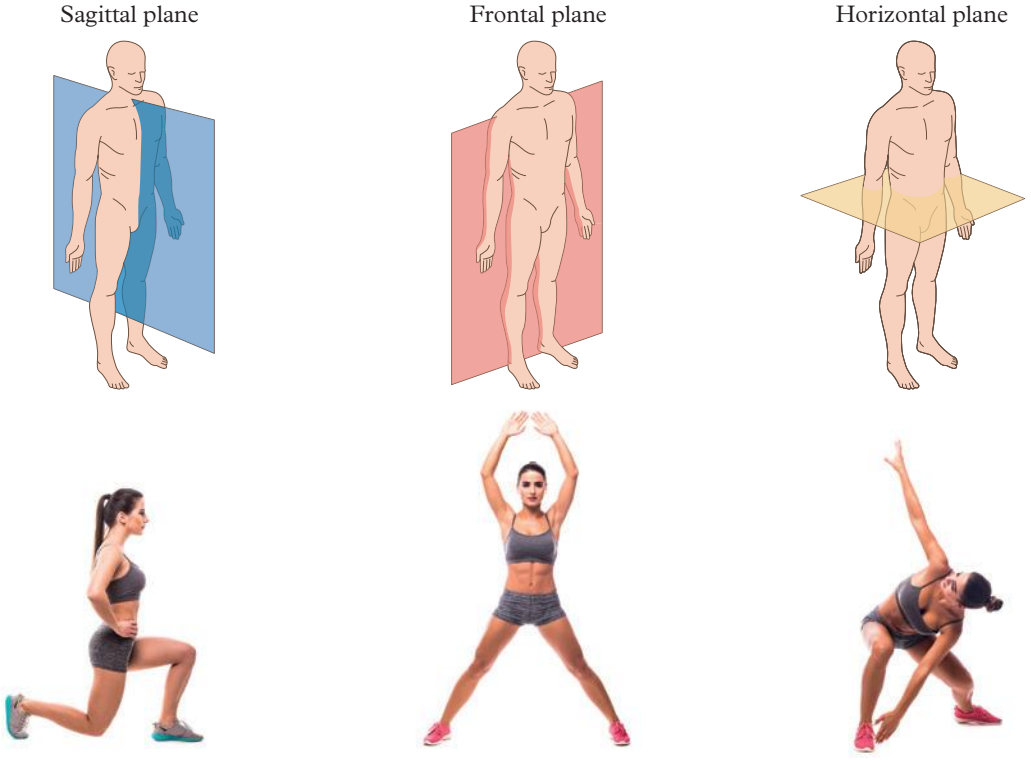
frontal plane one of the three planes of movement; movements in this plane are side to side. A star jump (or jumping jack) is an example of movement along this plane

horizontal (or transverse) plane one of the three planes of movement; movements in this plane are rotational. A golf swing is an example of movement along this plane

pathways of movement a term used to describe the pattern of direction the body is moving in (e.g. straight, curved, zigzag, angular or twisted)

Pathways of movement

Pathways of movement are described as the typical movement patterns associated with a performer finding space. Such patterns of movement include circular (e.g. the movement made by a discus thrower in their wind up), zig zag (e.g. the side-to-side movement a hockey player might make when dribbling a ball up the field), straight (e.g. the straight line movements made by a touch football player during rucking), or a combination of all three (e.g. the evasive movements made in netball or Australian football).



SOURCE 4 The three planes of movement include the sagittal plane, frontal plane and horizontal plane.

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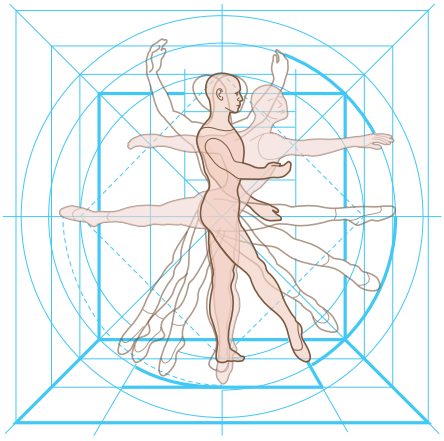
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Location of movement

Location of movement refers to the area of space in which the performance is happening. A space analysis can focus on two different areas:

- **personal space**, also known as the kinesphere – the space around an individual that they can reach with their limbs without moving
- **general space** – the space or environment in which the individual is moving.

Personal space is important in sports such as netball, where defending players often need to maintain a specific distance from the opponent to effectively contest shots or passes. Offensive players in invasion games such as basketball and touch football often try to invade an opponent's personal space to create advantages, such as gaining a better shooting angle or beating a defender in a fast break.



SOURCE 5 Personal space (also known as the kinesphere) is defined as the space around the body whose limits can be reached by easily extending the arms and legs when standing on one foot.

location of movement the area of space in which the performance of a specialised movement sequence or movement strategy is happening

Understanding the general space in which the play is being made is crucial for making informed decisions. Players must be aware of teammates' positions, opponents' movements and available passing lanes. Gaining control of general space can provide a significant advantage. For example, a basketball team that dominates the key (the general space near the basket) is often more successful. Further, effective team play relies on players understanding and utilising the general space collectively. This is evident in sports such as soccer and touch football, where intricate passing and movement patterns are essential.

The relationship between personal and general space is constantly changing in sports. Players must be able to adapt their use of space based on the situation. Successful athletes often possess high spatial intelligence, allowing them to perceive, understand and manipulate space effectively.

For the record!

In 2024, former British gymnast Lucie Colebeck set an incredible world record for the most handsprings performed in 30 seconds: 36! Colebeck set the record when performing with Cirque du Soleil. She has certainly mastered the quality of speed when it comes to handsprings!

Relationships

The concept of **relationships** relates to the interactions a player has with the people and **implements** involved in their performance of specialised movement sequences and movement strategies. In sporting contexts, the people that an athlete interacts with are generally teammates and opponents. The implements include sporting equipment, such as racquets, balls and shuttlecocks.

Successful outcomes in individual aesthetic and performance activities require a good awareness of the implements and even the external environment. For example, a sprinter is aware of their positioning on the blocks and their hands behind the painted white starting line, as they intently await the sound of the start gun.

In sports that use balls or other objects such as shuttlecocks or Frisbees, the interaction a player has with the object includes their positioning in relation to that object. For example, in badminton, the positioning of the shuttlecock at the back of the opposition court on the right-hand side can affect the other player's subsequent positioning on their side of the court as they await the return of the shuttle.

In invasion and net and court activities, this awareness must also include that of teammates and opponents. For example, a basketball player needs to know if they have enough general and personal space to shoot given the positioning of their opponent; or

relationships a body and movement concept; relationships relates to the objects (i.e. the people and equipment) that an athlete interacts with during the performance of the skill

implements equipment (e.g. bats, balls, other sporting apparatus such as a balance beam) that an athlete carries or uses when participating in a physical activity

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whether they should offload the ball to their teammates based on how well they are positioned (which also depends on the positioning of their teammates' opponents). In sports such as tennis and badminton, the positional relationship between a player and their opponent provides relevant information about where each of them may move next. For example, the movement of an opponent towards the net to attack a high shuttle could provide information to the defending playing to retreat backwards in their court, increasing the distance between them and the attacking player to optimise their chance of defending the shot.

This awareness of implements, teammates and opponents can change even within sports. Playing doubles in sports such as table tennis, badminton, tennis and squash requires a different perspective to playing singles, because you need to consider where your partner is situated on the court to ensure your spacing and positioning in relation to them is appropriate to the defence or attack required.

Retrieve it!

Why might learners at the cognitive stage find intrinsic feedback more difficult to use? Check back to Lesson 2.8 Types of feedback (page 69) to see if you retrieved the information correctly.

In the news

How do you design the perfect NRL player? Here's what Nathan Cleary thinks

Michael Chammas, Sydney Morning Herald, 29 September 2023

Penrith superstar Nathan Cleary sat down with the *Herald* in grand final week to create his perfect NRL player.

The Panthers No.7 was asked to pick which player's attribute he would most like, coming up with a combination of speed, strength, skill and courage to build the NRL's ultimate player.

Explosive speed: Reece Walsh (Brisbane Broncos)

"Acceleration is a different kind of speed to long distance. Off the mark you can't go past Reece Walsh. He's so explosive."

Long-distance speed: Tolutau Koula (Manly Sea Eagles)

"I like Koula's speed. He's got the acceleration but he can hold it, too. He's got a mad technique as well. He's under-the-radar quick."

Short-kicking game: Daly Cherry-Evans (Manly Sea Eagles)

"… I'll have to go Cherry-Evans. He can do it off both feet and has been consistently doing it for a long time. He's got a pretty deep bag of short kicks."

Long-kicking game: Matt Burton (Canterbury Bulldogs)

"I'd love to kick a ball like 'Burto'. He's unbelievable. The height and power he gets is like no one else in the game."

Vision: Cody Walker (South Sydney Rabbitohs)

"I think Cody has the best vision in the game. He picks the right option more than anyone else in the competition. He always knows which player to hit at what moment."



SOURCE 6 Nathan Cleary rates Manly Sea Eagles player Tolutau Koula (above) for his long-distance speed and technique.

Tactical nous: Adam Reynolds (Brisbane Broncos)

"Probably would have to say Adam Reynolds … He's a great game manager. Arguably the best in the competition."

Passing game: Cody Walker (South Sydney Rabbitohs)

"For the same reasons I said before about his vision. He just has this ability to continually pick the right option …"

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Catching ability: Sunia Turuva (Penrith Panthers)
"He's one of the smallest wingers in the competition and they target him by kicking to him every single game. He just rarely makes mistakes. It's impressive ..."

Heart: Mitch Kenny (Penrith Panthers)
"He's just a dawg. He's not very big but he's always leading the line speed and putting his body on the line …"

Fitness and stamina: Clint Gutherson (Parramatta Eels)
"It would be Dylan Edwards or 'Gutho'. Playing against him, he's just always there. He saves so many tries for them, just like 'Dyl' does for us. I'd love to see Dyl and Gutho have a fitness contest. That would be cool."

Tackling: Jake Trbojevic (Manly Sea Eagles)
"… I reckon I'd go with Jake Trbojevic. Jake is the best because he hits hard but he's also so efficient, too."

Strength: Latrell Mitchell (South Sydney Rabbitohs)
"Trell is so hard to tackle. He's fast, has the footwork and is strong. It's a scary sight being on the opposite side of it."

Communication: Dylan Edwards (Penrith Panthers)
"If we're saying who is the best trash talker, I'd say Romey (Luai). But if it's best communicator I'd have to go with Dyl (Edwards)."

Running power: Brian To'o (Penrith Panthers)
"It's hard to go past 'Bizza' (Brian To'o). He's just so hard to handle."

A summary of body and movement concepts

Source 7 provides a summary of the body and movement concepts that can be applied by athletes and coaches to help support the teaching and learning of specialised movement sequences and movement strategies in different sports and physical activities.

Body and movement concept	Includes an awareness of:
Body awareness	• balance • stability • weight bearing • transfer of weight • flight
Space awareness	• using general or personal space • movement directions • pathways of movement • levels and planes of movement
Quality of movement	• time and speed • accuracy • force development • effort • efficiency • effect • flow • sequence • continuity • outcome of movement
Relationships	• interactions with implements and objects • interactions with opponents • interactions with teammates

SOURCE 7 A summary of body and movement concepts

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Check your learning 2.10

Check your learning 2.10: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. A coach is assessing their players' ability to move in a zigzag pattern at speed (monitored by a stopwatch). What two body and movement concepts is this coach looking for?
   - **A** body awareness and space awareness
   - **B** space awareness and quality of movement
   - **C** quality of movement and relationships
   - **D** body awareness and quality of movement

2 Choose the correct answer to complete this sentence. Movements in the frontal plane are:
   - **A** forwards and backwards.
   - **B** rotational.
   - **C** side to side.
   - **D** curvilinear.

3 **Explain** why it is important to have body awareness when performing weight bearing exercises.

4 **Identify** the specialised movement sequence being used by the athletes in Source 3 (page 77). **Describe** the quality of movement principles they require to perform this sequence with success.

Analytical processes

5 Red Rover and Tiggy are games from primary school that develop a range of body and movement concepts. **Create** a list of your favourite games from primary school. **Analyse** the body and movement concepts used in each of your favourite games.

Knowledge utilisation

6 **Identify** an athlete who you believe is the GOAT (greatest of all time) in your favourite sport.
   - **a** **Select** five qualities of movement that this player perfects and elaborate on each one.
   - **b** Suggest a sport that this GOAT would not be successful in. **Justify** your suggestion using an example from each body and movement concept.

7 Referring to "In the news", **create** a list of all the body and movement concepts that are implicitly and explicitly featured in Nathan Cleary's "perfect player".

8 "Children learning sports should specialise in a single activity rather than learning a wide variety of movement skills." **Discuss** your thoughts on this statement in a written response of 200 words. Use your knowledge of the body awareness concepts, together with examples, to **justify** your position.

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SKILL DRILL

Lesson 2.11

Investigate how body and movement concepts can be used to assess and improve performance

Aim

To investigate the impact of body movement concepts on performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Pen
- Game Performance Assessment Instrument 3 (GPAI 3)
- Equipment specific to your selected physical activity

Template: Game Performance Assessment Instrument 3 (GPAI 3)

Method

Step 1

Select three specialised movement sequences from your selected physical activity for which you would like to assess your skill level (e.g. serving in tennis or passing the ball in touch football). Record them in the left-hand column of GPAI 3 (i.e. Skill 1, Skill 2 and Skill 3).

Step 2

Perform your three specialised movement sequences in a closed environment. Your teacher will specify whether the skill should be performed for a set time or a set number of repetitions (e.g. serve for 2 minutes or perform 20 consecutive passes with a partner).

Step 3

After each skill performance, assess your success using the criteria on GPAI 3.

Body and movement concepts																
	Quality of movement (accuracy, continuity and outcome of movement, effect, efficiency, effort, flow, force development, sequence, time and speed)				**Body awareness** (balance, flight, stability, transfer of weight and weight bearing)				**Space awareness** (direction, levels and planes of movement, pathways of movement, using general space and using personal space)				**Relationships** (interaction with opponents, interaction with other players, interaction with implements and objects)			
	E	**G**	**O**	**P**	**E**	**G**	**O**	**P**	**E**	**G**	**O**	**P**	**E**	**G**	**O**	**P**
Skill 1																
Skill 2																
Skill 3																

Note: E: Excellent; G: Good; O: Okay; P: Poor

SOURCE 1 GPAI 3

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Analysis and discussion tasks

1 In Physical Education you will often be asked to grade and evaluate your performance using different criteria, such as the ones in GPAI 3.
   - **a** **Consider** the overall effectiveness of GPAI 3 as a tool to assess your skill levels for your three selected skills. Did the four body and movement concepts help you determine your skill level?
   - **b** Quality of movement refers to how the body moves. Which sub-criteria was most relevant to your quality of movement evaluation? **Explain**.
   - **c** Body awareness refers to what movements the body can perform. Which sub-criteria was most relevant to your body awareness evaluation? **Explain**.
   - **d** Space awareness refers to awareness of where the body can move. Which sub-criteria was most relevant to your space awareness evaluation? **Explain**.
   - **e** Relationships refers to connections with objects. Which sub-criteria was most relevant to your relationships evaluation? **Explain**.

2 Reflecting on the primary data collected in this Skill drill, and specifically the sub-criteria you identified as most relevant to your specialised movement sequences, you can now **analyse** your performance.
   - **a** Referring to the four body and movement concepts, **explain** which of the three specialised movement sequences was:
     - **ii** your strongest
     - **iii** your weakest.

3 Evaluating your performance can provide you with data to inform the development of movement strategies. These strategies can act as possible solutions to any movement problems that you experienced in your performance.
   - **a** Making explicit reference to GPAI 3, **devise** a personal movement strategy to optimise your performance of one specialised movement sequence in your selected physical activity.
   - **b** **Justify** your strategy using the primary data that you collected in this Skill drill and at least two secondary sources.



SOURCE 2 A specialised movement sequence is a combination of foundational movement skills (and movement elements) that enable the body to move in response to a stimulus. A tennis serve is an example of a specialised movement sequence.

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Lesson 2.12
Assessment support: Internal assessment, Project – folio

Overview of internal assessment: Project – folio

As part of your assessment for Unit 1 of the QCE Physical Education syllabus, you will be required to complete a Project – folio. The Project – folio is a complex task with many components.

This section of the module is designed to support you as you complete your own Project – folio (see Practice assessment task, page 93). It includes practical tips and advice to ensure that what you produce meets the criteria set in the instrument-specific marking guide (ISMG). Detailed information on how to structure, create and present your Project – folio is provided in Lesson 1.3 Tips for success on the Project – folio (page 8). In addition to this, Lesson 1.4 Skill drill: Planning, creating and presenting a Project – folio provides a number of useful tips and instructions to help you.

The Project – folio is made up of two sections. We will model one possible approach to completing the task, as follows.

- **Section 1 – Presentation**: a multimodal task presented as an mp4 video up to 11 minutes
- **Section 2 – Demonstrating and applying**: supporting visual evidence presented as an mp4 video up to 3 minutes

Section 1 – Presentation

Your presentation will be the main part of your Project – folio. It is a multimodal task, and in this approach, we have chosen to produce an mp4 video up to 11 minutes in length. Do not exceed the 11-minute time limit as any content included after 11 minutes will not be counted in the awarding of your grade. Your multimodal presentation must consist of at least two modes (visual, written or spoken). One way you might meet this requirement is to make a slideshow with embedded videos, images and text. You could then use a program such as Screencastify to produce a voiceover, in which you explain the different elements on your slides and tell your story from beginning to end.

Section 1 will include the following tasks:

- analysing primary and secondary data
- devising and justifying a motor learning strategy
- evaluating the effectiveness of the strategy
- justifying the maintenance and modification of the strategy.

At each step, we will provide detail and an example of what this might look like in action for a student completing their Project – folio.

Task 1 – Analysing primary and secondary data

The first part of your presentation requires you to analyse primary and secondary data, looking for relationships between:

- the demands of the specialised movement sequences for one movement strategy

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- your identified stage of learning and applied aspects of the information processing model that impact personal performance of specialised movement sequences for one movement strategy
- application of feedback and practice strategies.

To do this, you will need to:

- analyse your personal performance of your selected specialised movement sequences for a movement strategy, looking for features of your performance relevant to your stage of motor learning and the information processing model; collecting video footage, completing skill drills and creating Game Performance Assessment Instruments (GPAIs) to collect data about your stage of learning and the information processing model will provide you with primary data you will need to use
- research the demands of your selected specialised movement sequences and movement strategy and use this secondary data to inform your analysis of your stage of learning and application of the information processing system (next step)
- experiment with different types of practice and feedback and collect data about their impact throughout the unit, which will enable you to discuss these results in relation to the first two dot points.

To assist you with this process, an example GPAI has been provided for you in Source 1. A digital version of this GPAI is also available. You can customise this GPAI to suit your individual needs.

Template: Example GPAI

SPECIALISED MOVEMENT SEQUENCE:			
MOVEMENT STRATEGY:			
Characteristic	**Cognitive stage**	**Associative stage**	**Autonomous stage**
Cue identification	stiff-looking	more relaxed	automatic
Accuracy	inaccurate	more accurate	accurate
Consistency	inconsistent	more consistent	consistent
Ease of movement	slow, halting	more fluid	fluid
Confidence	timid	more confident	confident
Decision making	indecisive	more decisive	certain
Adaptability	rigid	more adaptable	adaptable
Efficiency	inefficient	more efficient	efficient
Error rate	many errors	fewer errors	performer recognises errors

SOURCE 1 Performance analysis GPAI – analysing performance of a specialised movement sequence using characteristics associated with stages of learning

Source: Adapted from Schmidt, R.A. & Wrisberg, C.A. (2008) *Motor Learning and Performance: A Situation-based Learning Approach.*

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Example

Esther's PE class is playing Australian football during their motor learning unit and she is enjoying the position of full forward. She begins her data collection process by obtaining video footage of her performing the specialised movement sequences for a full forward for the movement strategy of "maintaining possession of the ball by providing forward, backward and lateral options to the ball carrier". Esther is drawn to this movement strategy because of her frustration in not getting the ball as often as she would like.

From the video footage, as well as from secondary data about Australian football, Esther determines that the key demands of this movement strategy include anticipation and spatial awareness. Esther needs to read the play and consider the positions of other teammates and opponents when deciding where to position herself. She should ensure there is enough distance from her teammates that a defender cannot defend both her and another attacker at the same time. She also needs quick movement into space to minimise the chance of interference from opposition should the ball be passed to her. Esther also uses the footage to conclude that she is at the associative stage of learning as she can see she performs with consistency and makes few errors. She also notes that she can detect most major cues in the stimulus detection phase of the information processing model and mostly selects an appropriate response and executes effective movement. She notes down the evidence she will use when she compiles her video.

During the next few PE lessons, Esther participates in skill drills and uses a few different GPAIs (such as Source 1) to gather more information about each specialised movement sequence and experiment with different types of feedback and practice. Analysing this data reveals that the specialised movement sequences that are having the greatest negative impact on her ability to help her maintain possession and provide more options to the ball carrier are (1) leading and (2) marking. She then analyses the GPAIs to see which types of feedback and practice are best for her stage of learning and ability to process information.

Task 2 – Devising and justifying a motor learning strategy

Once you have determined the most significant relationships between the movement strategy, motor learning concepts impacting performance and applied feedback and practice strategies, you should have enough data to devise a motor learning strategy to optimise your performance of your selected movement strategy. This strategy should consist of the types of practice and feedback you could use to elevate your performance at your stage of learning (according to your primary data). You will need to consider when, how and how often you will implement your strategy. You will also need to synthesise (put separate facts together) the primary data collected in your analysis with relevant secondary data to justify the development of your strategy.

Once you have devised your strategy, it is recommended that you implement the strategy during class time over the course of one to two weeks and collect primary data on the impact on your stage of learning and performance of the movement strategy.

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Example

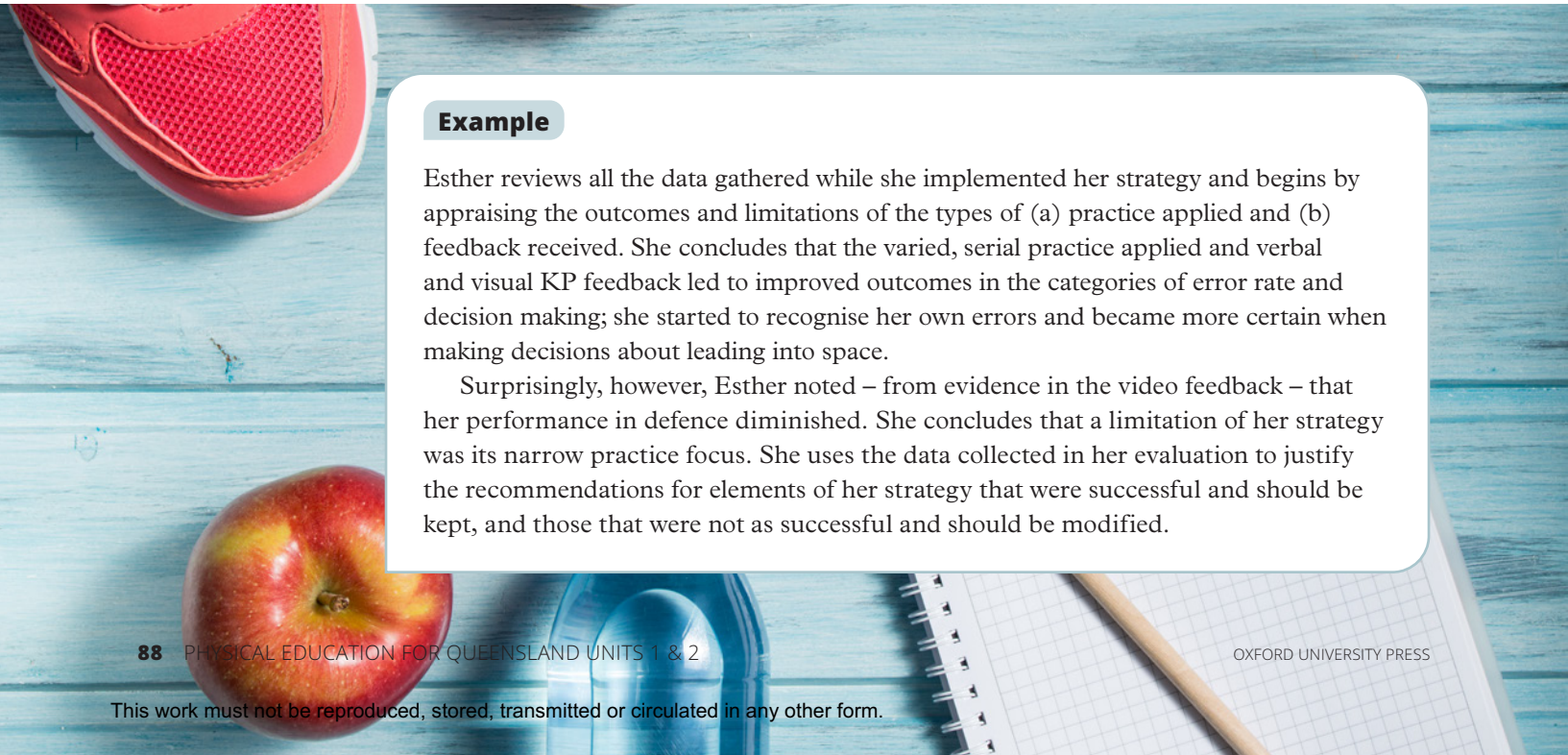
Esther understands that as an associative learner, practice in authentic environments is critical for strengthening neural pathways and increasing automatic messages transferred to her muscles. Referring to secondary data, she concludes that to become more automatic at leading and creating options for the ball carrier, she needs to gain experience in detecting and responding to cues. She devises a motor learning strategy involving several parts.

Firstly, she will use varied serial practice to work on leading and marking in closed environments before using random practice by adding in defenders to improve her ability to transfer her skills to game environments. Esther draws up a schedule for when this practice will occur, and for how long. Secondly, she will seek knowledge of performance (KP) feedback from two sources: verbally from her coach and visually by observing her video performances.

At the end of each week that the strategy is in implementation, Esther will repeat the same GPAI (Source 1) to gather data about her proficiency at leading and marking to maintain possession of the ball or create opportunities for the ball carrier. She uses her credible and reliable sources of secondary data about feedback, practice, stages of learning and the various approaches to motor learning to back up her conclusions and decisions about the outcomes and limitations of her strategy.

Task 3 – Evaluating the effectiveness of the strategy

Once you have implemented your devised strategy for one to two weeks and collected data on your performance, you are required to evaluate the effectiveness of your strategy. To do this, it is important to appraise the outcomes and limitations of the types of feedback and practice you applied in your strategy and the impact of your strategy on your identified stage of learning and performance of the movement strategy. In other words, you will need to discuss what did and did not work. Referring to primary and secondary data here will enable you to justify the parts of your strategy that you recommend keeping and those you should modify. This part will be outlined in more detail in Task 4.



Example

Esther reviews all the data gathered while she implemented her strategy and begins by appraising the outcomes and limitations of the types of (a) practice applied and (b) feedback received. She concludes that the varied, serial practice applied and verbal and visual KP feedback led to improved outcomes in the categories of error rate and decision making; she started to recognise her own errors and became more certain when making decisions about leading into space.

Surprisingly, however, Esther noted – from evidence in the video feedback – that her performance in defence diminished. She concludes that a limitation of her strategy was its narrow practice focus. She uses the data collected in her evaluation to justify the recommendations for elements of her strategy that were successful and should be kept, and those that were not as successful and should be modified.

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Task 4 – Justifying the maintenance and modification of the strategy

The final task of Section 1 of your Project – folio requires you to make recommendations for parts of your strategy you should maintain and parts you should modify or change. To do this properly, you will need to use evidence from primary and secondary data. It is also recommended that you explain your modifications by detailing what you should do differently and why.

Example

Esther concludes that her strategy was successful, with many of the components to be maintained. However, based on her evaluation she identifies some areas that would benefit from modification. In the future, she will build more random practice into her training regime to ensure that she optimises her ability to adapt fluently in gameplay. She also identifies a need to expand her focus during training to ensure all elements of her performance are being practised. She explicitly points out which primary data helped her make this decision and she finds secondary data that supports the value of random practice.

Section 2 – Demonstrating and Applying

The second section of your Project – folio requires you to collect video footage of your practical performance in your selected physical activity as evidence of your demonstrating and applying ability. Specifically, your video will be up to 3 minutes in length and will need to show evidence of your demonstration of two movement strategies from two principles of play. Do not exceed the 3-minute time limit as any content included after 3 minutes will not be counted in the awarding of your grade.



Demonstration footage must show you applying these strategies in authentic performance environments, that is, showing performance within game play. Preferably, this footage will show complete plays, rallies and so on, rather than parts of plays. While it is a highlights reel of your best performances, your footage must show the full picture of your performance rather than repeated little snippets within rallies or gameplay to be considered effective.

Finally, your video must include demonstration of quality of movement concepts (speed, accuracy, force, flow and so on) and one other body and movement concept, such as body awareness, space awareness or relationships. These body and movement concepts are discussed in detail earlier in this module (see Lesson 2.10 Body and movement concepts, page 74).

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MODULE 2

Lesson 2.13
Review: Motor learning

Summary

2.1
- Motor learning is a field of science that studies many aspects of human movement. The aim is to understand how humans learn and remember the skills required to perform specialised movements.
- Motor skills are voluntary movements that involve the use of specific muscles with the goal of achieving a specific purpose or goal.
- Motor programs are movement plans that contain all the commands from the brain to the muscles that are needed to perform complex motor skills.

2.2
- There are three categories of motor skills: fine and gross motor skills; open and closed motor skills; and discrete, continuous and serial motor skills.
- The five characteristics used to assess the development of motor skills are improvement, consistency, stability, persistence and adaptability.

2.3
- Scientists have developed two major frameworks to explain how we learn and remember motor skills and complex movement sequences.
- One of these is the cognitive systems approach to motor learning, in which the brain acts as the central command system for the body.
- Within the cognitive systems approach are two models: the information processing model and Fitts and Posner's stage model of motor learning.

2.4
- The second major framework used to explain how we learn and remember motor skills and complex movement sequences is the dynamic systems approach to motor learning.
- This dynamic systems approach views motor learning as the result of complex interactions.
- This approach suggests that motor skills are produced and learnt in response to constraints (task, environmental and individual). Rate limiters are a type of constraint that have a negative impact on learning and restrict performance.

2.6
- Practice is an essential part of learning and refining a motor skill.
- There are several different types of practice, including massed practice and distributed practice; whole practice and part practice; blocked practice, serial practice and random practice; constant practice and varied practice; drills and problem solving; specificity of practice and variability of practice.

2.8
- Feedback is all the information an individual receives about their performance of a skill.
- Feedback is organised into two categories: intrinsic feedback (i.e. from inside the body) and extrinsic feedback (i.e. from outside the body).

2.10
- Body and movement concepts are approaches that can help individual athletes or teams to be more aware of their bodies and adapt their movements in order to achieve specific goals.
- The four body and movement concepts are body awareness, space awareness, quality of movement and relationships.

Revision notes: Module 2

Module 2 summary

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Review questions 2.13 Exam-style revision questions and tasks

Section A

- Ten multiple-choice questions

Question 1

Which statement best describes motor learning?

A Motor learning is a field of science that requires a minimum practice of 300 to 500 repetitions to learn a skill.

B Motor learning is a field of science that studies the nervous system, muscular system and biomechanics in order to explain how people learn skills.

C Motor learning is a field of science that uses a range of body systems, practice and sport psychology to learn a skill.

D Motor learning is a field of science that explains how people learn skills by studying various systems of the body (such as the nervous system), and investigating practice and feedback.

Question 2

A discrete motor skill is:

A a type of motor skill that is determined by the stability of the environment.

B a type of motor skill that has a defined start and end.

C a type of motor skill that is repetitive and cyclical.

D a type of motor skill that is made up of many individual motor skills.

Question 3

Which of the following is not a characteristic of motor skill learning?

A consistency

B improvement

C stability

D variability

Question 4

At which stage of the information processing model does parallel processing take place?

A stimulus identification

B stimulus execution

C response execution

D response selection

Question 5

Which of the following practice methods reflects the dynamic systems approach to learning new skills?

A blocked practice, constant practice, random practice, varied practice

B random practice, specificity practice, problem-solving drills, variability practice

C massed practice, random practice, varied practice, problem-solving drills

D massed practice, specificity practice, varied practice, problem-solving drills

Question 6

Which of the following includes the main types of intrinsic feedback?

A auditory, proprioceptive, tactile, visual

B auditory, proprioceptive, visual, knowledge of results

C auditory, proprioceptive, visual, knowledge of performance

D auditory, tactile, visual, knowledge of performance

Question 7

Different degrees of speed, power and intensity are factors for which body and movement concept?

A body awareness

B quality of movement

C relationships

D space awareness

Question 8

According to Fitts and Posner's (1967) stage model of motor learning, a learner who cannot identify all relevant environmental cues might never progress from which stage of learning?

A the cognitive stage

B the associative stage

C the autonomous stage

D the information processing stage

Question 9

Lacking the strength required to propel the ball to the basket is an example of what type of rate limiter?

A physical

B tactical

C perceptual

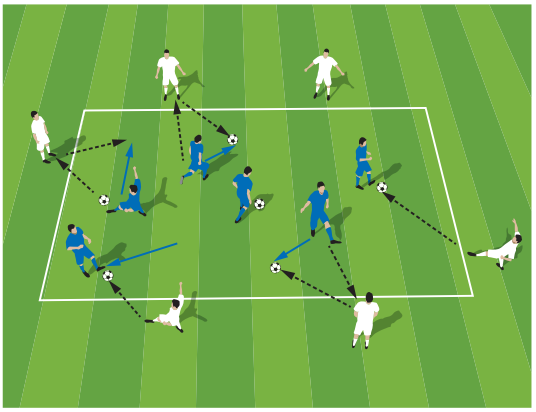
D physiological

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Question 10

The following diagram shows a soccer drill that will last for approximately five minutes before players change positions. The drill requires each player inside the square (i.e. those in blue) to pass the ball to an outside player (i.e. those in white) and move into a different position to receive the pass back. The size of the square can be changed depending upon the skill level of the players. This is an example of which type of practice?



A massed practice
B specificity practice
C part practice
D problem-solving practice

Section B

- Two short-response questions
- One extended written response question

Question 11 (10 marks)

There are five characteristics of motor skill learning – improvement, consistency, stability, persistence and adaptability. Identify a motor skill from your selected physical activity for this unit and apply the five characteristics to evaluate how well you have learnt that skill. Provide examples to justify your response.

Question 12 (6 marks)

Reflect on your current physical activity and identify two rate limiters from two different categories (perceptual, technical, tactical, physical, physiological or psychological) that might affect your performance during the game. Justify a strategy for each rate limiter that will enable you to overcome (or work with) it and thus optimise your performance during authentic gameplay.

Question 13 (12 marks)

Justify which motor learning approach has the greatest potential to optimise your performance – the cognitive systems approach or the dynamic systems approach. In your response, make reference to the following concepts:

- stages of learning
- types of practice
- feedback
- body and movement concepts.

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Practice assessment task

Subject	Physical Education
Instrument number	
Technique	Project – folio
Unit	1 Motor learning, functional anatomy and biomechanics in physical activity
Topic	1 Motor learning in physical activity

Conditions	
Duration	5 hours of class time
Mode	Multimodal (at least two modes – visual, written, spoken): up to 11 minutes
Individual / Group	Individual
Other	Examples of multimodal folios include: • a pre-recorded presentation submitted digitally • a presentation conducted in front of an audience (class or teacher) • a digital portfolio of video, images and diagrams with annotations or commentary • a multimedia movie or slideshow that may combine images, video, sound, text and a narrative voice.

Context

In this topic, you have engaged in integrated learning experiences, applying motor learning strategies including practice and feedback to improve your performance of specialised movement sequences and movement strategies from your selected physical activity. Through data collection and analysis you have identified features of athletes in different stages of learning and determined how information processing varies between learners.

Task

Analyse your performance of a movement strategy within your selected physical activity and determine which stage of learning you are currently working in and how information processing affects your performance. Devise and justify a motor learning strategy using motor learning concepts and theories. Evaluate the effectiveness of your strategy for enhancing your performance.

To complete this task, you must:

- analyse primary data and secondary data to ascertain the most significant relationships between:
  - the demands of the specialised movement sequences for one movement strategy
  - your identified stage of learning and applied aspects of the information processing model that impact personal performance of specialised movement sequences for one movement strategy
  - application of different types of practice and feedback.
- synthesise the most significant relationships to devise a motor learning strategy to optimise performance of the specialised movement sequences for one movement strategy
- justify the development of the motor learning strategy to optimise performance of specialised movement sequences for one movement strategy, using evidence from primary data and secondary data
- evaluate the effectiveness of the motor learning strategy using the selected motor learning concepts and theories to appraise the outcome and limitations
- justify the modification and maintenance of the motor learning strategy to optimise performance of specialised movement sequences for one movement strategy, using evidence from primary data and secondary data
- make decisions about and use language, conventions and mode-appropriate features to communicate information about the strategies to a technical audience.

It is recommended that this task is designed so that students can develop a response in approximately 5 hours of class time.
A detailed instrument-specific marking guide (ISMG) for this task is available for teachers to download.

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MODULE 3

Functional anatomy and biomechanics



Key terms

Download a handy list of key terms from this module to test your understanding.

Module 3 key terms

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Subject matter outcomes covered in Module 3

The following table lists all the subject matter dot points you are required to cover in **Unit 1 – Topic 2** of the Physical Education General Senior Syllabus. It also shows you exactly where that subject matter is covered in this course.

Unit 1 – Topic 2: Functional anatomy and biomechanics in physical activity

In Unit 1 – Topic 2, students engage in learning that involves the integration of functional anatomy and biomechanics subject matter and selected physical activities.

Subject matter	Lesson/s
• Recognise and explain that functional anatomy is the study of the function of muscles and bones in movement.	Lesson 3.1 Introduction to functional anatomy (page 98)
• Recognise and explain that biomechanics is the study of the laws of mechanics related to movement.	Lesson 3.6 Introduction to biomechanics (page 125)
• Recognise and explain that specialised movement sequences in physical activity are comprised of phases and sub-routines that can be investigated as part of a biomechanical analysis.	Lesson 3.6 Introduction to biomechanics (page 125)
• Analyse and synthesise primary data and secondary data about the influence of biomechanical and functional anatomy concepts and principles on specialised movement sequences and movement strategies.	Module 3
• Recognise and explain that force is any interaction (e.g. a push or pull) that, when unopposed, will change the motion of an object. Force is made up of: – internal forces, which are the structures of the body that interact to produce movement, e.g. muscles and tendons that act together to produce forces that cause movement – external forces, which result from the interaction between the body and the environment; these can include » contact forces, e.g. friction, a ball being struck by a bat » non-contact forces, e.g. gravity.	Lesson 3.7 Force (page 129)
• Recognise and explain that motion is movement that occurs when an object has changed position in space and in time, due to the application of forces. Motion can be: – linear, where movement is along a straight line, there is no rotation and all body parts move in the same direction at the same speed – curvilinear, where movement is along a curved path – angular, where all the parts of a body move through a rotational pathway, through the same angle, in the same direction and at the same time. It is the rotary movement about an axis. – a combination, which recognises that most movements in biomechanics are a combination of linear and angular motion.	Lesson 3.12 Motion in physical activity (page 153)
• Identify and explore the components of projectile motion in a suitable physical activity, including speed, angle and height of release.	Lesson 3.14 Projectile motion (page 165)
• Recognise and explain that momentum describes a quantity of motion and considers the mass of an object and its velocity.	Lesson 3.8 Force production (page 133)
• Recognise, explain and calculate biomechanical concepts such as: – summation of forces, which is the sequential combination of forces produced by different parts of the body, acting together to maximise force.	Lesson 3.8 Force production (page 133)

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Subject matter	Lesson/s
• Recognise, explain and calculate biomechanical concepts such as: – speed, which is the distance travelled per unit of time – velocity, which is the rate at which an object changes position – displacement, which is a quantity used to describe the extent of a body's motion – acceleration, which is the rate at which an object changes its velocity.	Lesson 3.12 Motion in physical activity (page 153)
• Identify and explore the concepts of Newton's three laws of motion in physical activity.	Lesson 3.12 Motion in physical activity (page 153)
• Recognise and explain the concept of balance and stability in force production and movement, including the position of the centre of gravity and base of support.	Lesson 3.16 Balance and stability (page 178)
• Identify and explore first-, second- and third-class levers in physical activity, including force multipliers and speed multipliers.	Lesson 3.10 Levers (page 143)
• Recognise and explain Bernoulli's principle in a suitable physical activity, including topspin, backspin, sidespin and lift forces.	Lesson 3.15 Bernoulli's principle (page 171)
• Identify and explore the critical anatomical and joint movements in physical activity, e.g. flexion, extension, abduction, adduction, pronation, supination, rotation, circumduction, dorsiflexion, plantar flexion, eversion and inversion.	Lesson 3.3 The structure and function of joints (page 107)
• Identify and explore isotonic muscle contractions (concentric and eccentric) and isometric muscle contractions in physical activity.	Lesson 3.5 The structure and function of muscles (page 116)
• Recognise and explain that reciprocal inhibition describes the process of muscles on one side of a joint relaxing to accommodate muscle contraction on the other side of the joint in order to produce movement. Reciprocal inhibition involves the use of agonist and antagonist muscles and stabilisers.	Lesson 3.5 The structure and function of muscles (page 116)
• Gather primary data about the influence of biomechanical and functional anatomy concepts and principles on personal performance of specialised movement sequences and movement strategies in authentic performance environments.	Lesson 3.4 Skill drill: Evaluate the impact of joint movement on optimal physical performance (page 114) Lesson 3.9 Skill drill: Evaluate the impact of summation of forces on force production (page 141) Lesson 3.11 Skill drill: Compare the effectiveness of levers in the production of speed in sport (page 151) Lesson 3.17 Skill drill: Evaluate the impact of base of support on quality of movement (page 184)
• Use secondary data to analyse how biomechanical and functional anatomy concepts and principles can influence performance in physical activity.	Module 3

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Subject matter	Lesson/s
• Analyse primary data and secondary data to ascertain relationships between the biomechanical strategies, concepts and principles, and personal performance.	Lesson 3.4 Skill drill: Evaluate the impact of joint movement on optimal physical performance (page 114) Lesson 3.9 Skill drill: Evaluate the impact of summation of forces on force production (page 141) Lesson 3.11 Skill drill: Compare the effectiveness of levers in the production of speed in sport (page 151) Lesson 3.17 Skill drill: Evaluate the impact of base of support on quality of movement (page 184) Lesson 3.20 Review: Functional anatomy and biomechanics Practice assessment task (page 201)
• Devise personal biomechanical strategies to optimise performance in physical activity that considers the: – relevant biomechanical and functional anatomy requirements of the specialised movement sequences and movement strategies – individual's biomechanical strengths and limitations.	
• Justify the development of biomechanical and movement strategies using evidence from primary data and secondary data.	
• Implement the biomechanical strategies to gather primary data about the outcomes and limitations of the decisions.	
• Reflect on primary data and secondary data to evaluate the effectiveness of the biomechanical strategies to achieve a determined outcome that: – meets the biomechanical requirements of the individual and the specialised movement sequences and movement strategies – optimises performance of specialised movement sequences and movement strategies.	
• Make decisions to maintain or modify the biomechanical and movement strategies.	
• Justify maintenance or modification of the biomechanical and movement strategies using evidence from primary data and secondary data.	

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Lesson 3.1
Introduction to functional anatomy

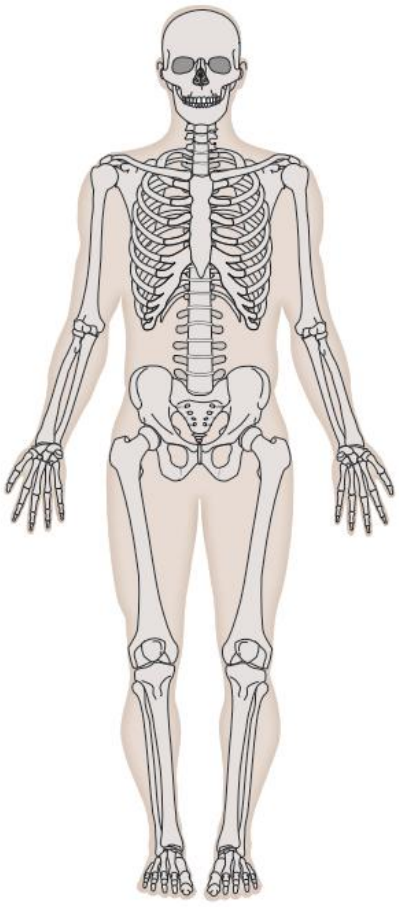
Learning intentions and success criteria

Key ideas

→ Functional anatomy is the study of how muscles and bones in the body work together to produce movement.

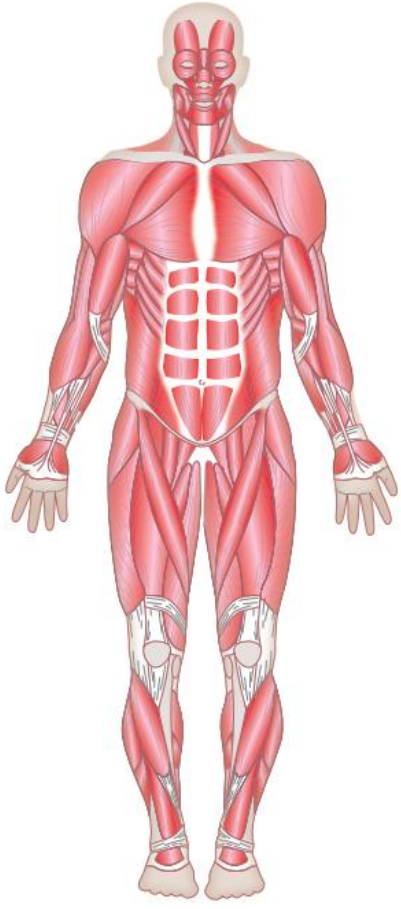
→ An understanding of functional anatomy can assist in the analysis of specialised movement sequences.

Musculoskeletal system



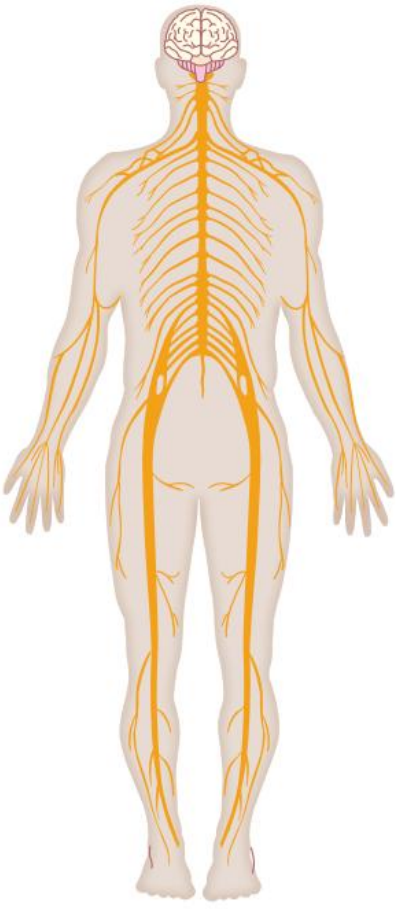
Skeletal system

- Includes all bones, including spine, skull, pelvis and ribs
- Gives the body its structure and supports and protects internal organs; provides attachment for muscles



Muscular system

- Includes all muscles and tendons
- Enables movement through connection to the skeleton
- Helps maintain temperature in the body



Nervous system

- Includes the brain, spinal cord, nerve cells and fibres
- Collects information from different parts of the body (via nerves) and processes that information (via the brain) to activate responses in the muscles

SOURCE 1 Functional anatomy is the study of how the muscles and bones in our bodies interact to produce movement. An understanding of the skeletal system and the muscular system are key to the study of functional anatomy. These two body systems are studied as a single system – known as the musculoskeletal system.

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Defining functional anatomy

Functional anatomy is a field of science that studies how muscles and bones in the body work together to produce movement. It is a specialised branch of **anatomy**, and it teaches us that the human body is a complex organism with many interconnected systems working together to produce movement. In the field of sport science, we are particularly interested in how the body's network of muscles, bones, tendons and joint structures allow a wide range of intricate movements that facilitate physical performances in sport and physical activity.

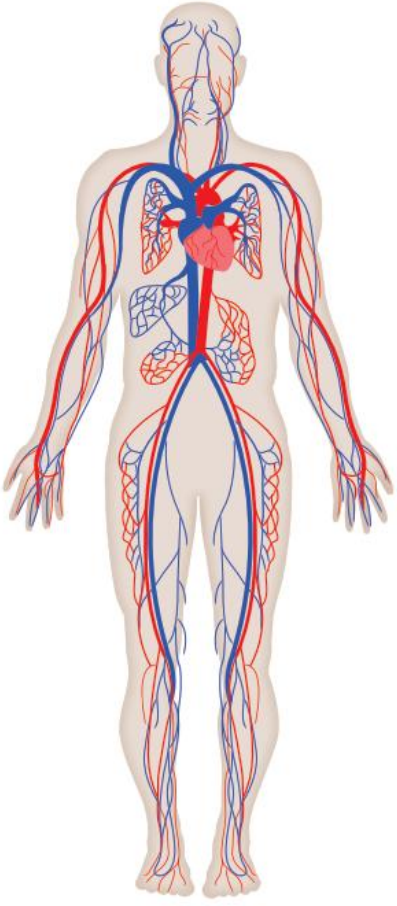
When devising strategies to enhance performance through technique refinement and strength and conditioning training, it is important to understand:

- the single anatomical components that make up a **specialised movement sequence**
- how these components function in an integrated way to produce complex movement across multiple joints and structures.

functional anatomy a specialised branch of anatomy that studies how muscles and bones in the human body produce and affect movement

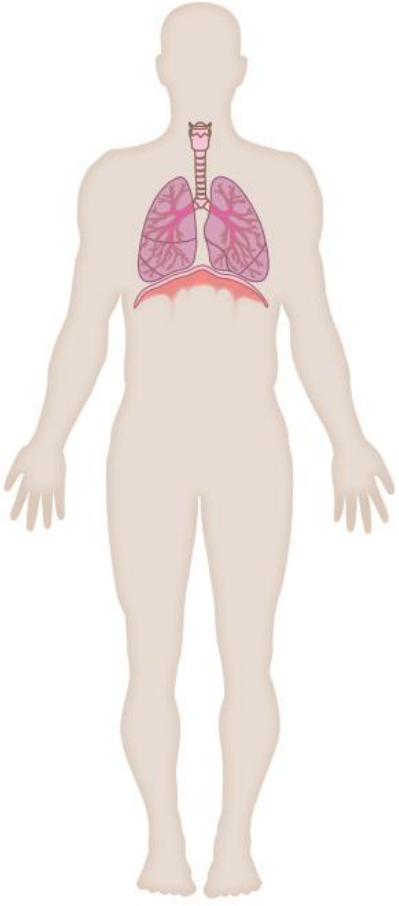
anatomy a field of science that investigates the bodily structures of humans, animals and other living organisms often by dissecting and examining the muscles, bone and internal organs of the organisms being studied

specialised movement sequence a combination of fundamental movement skills (and movement elements) that enables the body to move in response to a stimulus



Circulatory system

- Includes the heart, veins and arteries
- Carries oxygen and nutrients to cells (via blood)
- Carries waste materials away from cells (via blood)

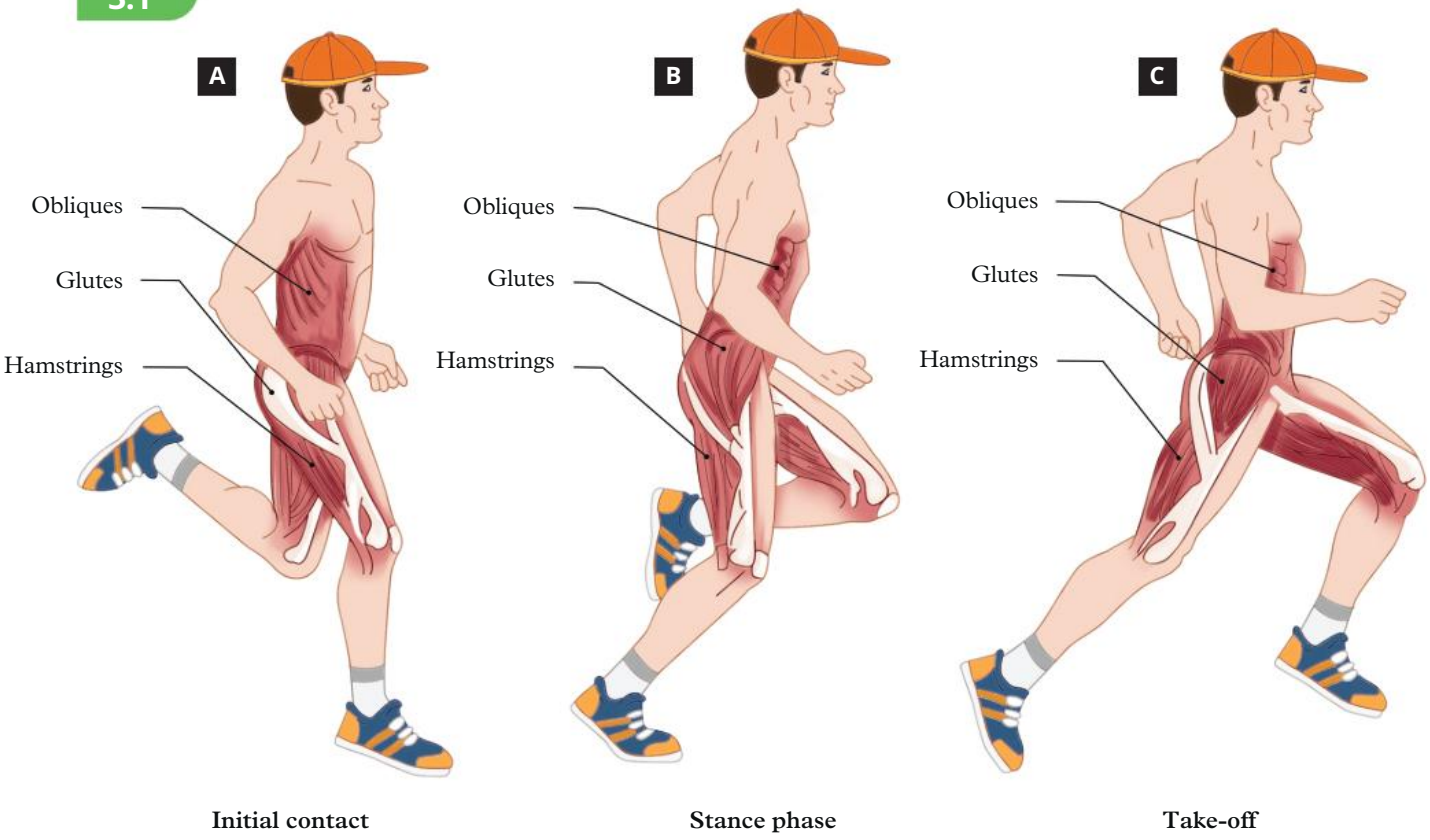


Respiratory system

- Includes the lungs, windpipe and diaphragm
- Filters oxygen from the air and transfers it to the blood so that it can be transported to muscles and organs throughout the body
- Removes carbon dioxide from cells (via blood) and transports it back to the lungs to be exhaled

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SOURCE 2 The hamstring muscle group plays a varied role through the phases of a run cycle – (a) initial contact, (b) stance phase, (c) take-off, (d) forward swing phase.

skeletal system a body system consisting of bones that gives the body its structure and supports and protects internal organs; provides attachment for muscles

muscular system a body system consisting of muscles and tendons that enables movement through connection to the skeleton; helps maintain temperature in the body

musculoskeletal system a body system that is a combination of both the muscular system and the skeletal system; the musculoskeletal system provides support, stability, structure and movement in the body through the bones and muscles

For example, examine the leg movements of a runner. In simple terms, the hamstring muscles are considered to be knee flexors, but as the hamstring muscles cross over two joints, their contributions to the running action are much more varied and complex. As Source 2 illustrates, the hamstrings play different roles in each phase.

- Phase A (initial contact); eccentrically contract to control movement and absorb impact
- Phase B (stance): activate
- Phase C (take-off): act as hip extensors
- Phase D (forward swing): continue to act as hip extensors and knee stabilisers during concentric contractions. They also act as decelerators of knee extension during the forward swing.

The primary focus of functional anatomy is understanding how the **skeletal system** and the **muscular system** interact to produce movement. As such, these two body systems (see Source 1) are integral to functional anatomy. Because functional anatomy seeks to understand the interaction between these systems, they are often thought about and studied as a single system – the **musculoskeletal system**. You will learn more about each of these systems over the course of this module.

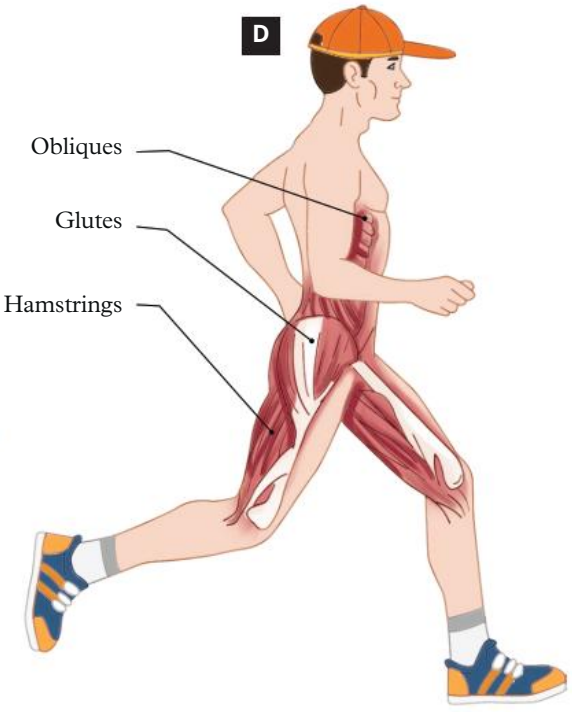
Why study functional anatomy?

A basic understanding of functional anatomy can have many benefits – both for athletes and health professionals. Doctors, physiotherapists and other health professionals (such as osteopaths, exercise physiologists and occupational therapists) use their extensive knowledge of functional anatomy to help athletes:

- recover from injuries during rehabilitation
- reduce the risk of being injured in the first place.

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Forward swing phase



SOURCE 3 Athletes with a thorough understanding of functional anatomy can reduce their risk of injury and speed up the rehabilitation process.

For the record!

While minor sporting injuries, such as sprains or strains, often result in an athlete being out of action for 1–2 weeks, more serious injuries – such as Achilles tendonitis (an injury of the Achilles tendon, which connects the calf muscle to the heel bone), fracture dislocations of the ankle joint, patella tendonitis or anterior cruciate ligament (ACL) tears – often result in longer recovery times of around 6 months. A basic understanding of functional anatomy can help prevent injuries like this!

An understanding of functional anatomy can also benefit people outside the medical profession. For example, when athletes understand how their bones, muscles and joints function, they can:

- more easily understand and follow advice given by health professionals
- engage in movement sequences that are more effective and efficient
- increase the chance of a quick recovery
- reduce the risk of injury
- reduce the likelihood of relapse after injury.

"Theory in action: A structured warm-up to prevent injury" further explores how functional anatomy principles aided in the prevention of injuries in soccer.

Retrieve it!

What are the five characteristics of motor skills learning? Check back to Lesson 2.2 Motor skills (page 35) to see if you retrieved the information correctly.

Theory in action A structured warm-up to prevent injury

In 2008, FIFA (the international governing body of football) funded a research study to investigate whether lower limb injuries could be reduced through the implementation of a warm-up program. The program was designed with many of the central principles of functional anatomy in mind. It became known as FIFA 11+.

The research study was carried out with a group of approximately 2500 participants who were members of the Norwegian amateur female football league. All participants were between the ages of 13 and 17 years. Participants in the study were divided into two groups:

- around 1900 players became part of an intervention group; these players performed the FIFA 11+ program
- around 600 players became part of the control group; these players followed their normal warm-up program.

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The intervention group followed a comprehensive warm-up program to improve strength, awareness and neuromuscular control during static and dynamic movements. The warm-up activities included:

- **part 1**: running exercises
- **part 2**: plyometric, strength and balance exercises (using many movements typically experienced in gameplay)
- **part 3**: further running exercises.

The program was performed during one season and injuries were tracked throughout.

When performed twice a week, the intervention group reported 37 per cent fewer injuries during training and 29 per cent fewer injuries during matches than the control group.

Severe injuries (i.e. those that required at least 28 days of recovery before athletes returned to play) reduced by almost 50 per cent, and the incidence of acute, overuse, ankle and knee injuries also reduced significantly.



SOURCE 4 The FIFA 11+ warm-up program results in fewer injuries during training and matches.

Check your learning 3.1

Check your learning 3.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Functional anatomy is:
   - **A** the study of human body structures.
   - **B** a field of science investigating how muscles utilise energy to produce movement.
   - **C** concerned with the interconnected nature of muscles and bones in the production of movement.
   - **D** used to eliminate the possibility of injury.

2 **Identify** two benefits of a basic understanding of functional anatomy.

Analytical processes

3 **Analyse** "Theory in action: A structured warm-up to prevent injury" and **critique** the effectiveness of the FIFA 11+ warm-up procedure in reducing injuries in football players.

4 **Compare** and **contrast** the FIFA 11+ warm-up with a traditional warm-up, such as running a few laps of an oval and stretching. **Explain** how the functional anatomy has been considered in the warm-up protocol.

Knowledge utilisation

5 **Conduct** some additional research to learn about the term "neuromuscular control". **Justify** its importance in the prevention of musculoskeletal injuries.

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Lesson 3.2
The structure and function of bones

Key ideas

- → The skeletal system provides a framework for movement. It consists of bones, tendons, ligaments and cartilage.
- → Bones contain two types of bone tissue: compact bone and spongy bone.
- → Bones are classified according to their shape: long bones, short bones, flat bones and irregular bones.
- → Bones are also classified according to their location in the body: sesamoid bones and sutural bones.

Learning intentions and success criteria

skeleton the internal framework of the body, which is made up of around 206 bones in adults

tendon a flexible but inelastic cord of strong, fibrous collagen tissue attaching a muscle to a bone

ligament a short band of tough, flexible fibrous connective tissue which connects two bones or cartilages or holds together a joint

cartilage firm, flexible connective tissue found in many parts of the body, particularly on the articulating surfaces of joints

axial skeleton the part of the skeleton consisting of the skull, vertebral column, ribs, sternum and coccyx; the axial skeleton is so named because it forms the long axis of the body

appendicular skeleton the part of the skeleton consisting of the pectoral (shoulder) girdle and the upper extremities, the bones of the pelvic (hip) girdle and the lower extremities; the appendicular skeleton is so named because it supports the body's appendages (i.e. arms and legs)

The skeletal system

The **skeleton** is the internal framework of the body. There are 206 bones in the skeleton of an adult human (see Source 1, page 104). The bones of the skeleton, together with the anatomical structures that hold them together (such as **tendons**, **ligaments** and **cartilage**), are referred to as the skeletal system. The skeletal system performs a number of important functions, including:

- **support** – it provides a framework (like a scaffold) for the soft connective tissue of the body (e.g. muscles and organs)
- **protection** – it protects internal soft organs (e.g. the ribs protect the heart and lungs and the skull protects the brain)
- **movement** – when muscles in the body contract, they pull on bones in the skeleton to produce movement
- **storage** – bones in the skeleton store important minerals such as calcium and phosphorus, which are released when needed
- **blood cell production** – the creation of most new blood cells happens in the red marrow of the bones in the skeleton.

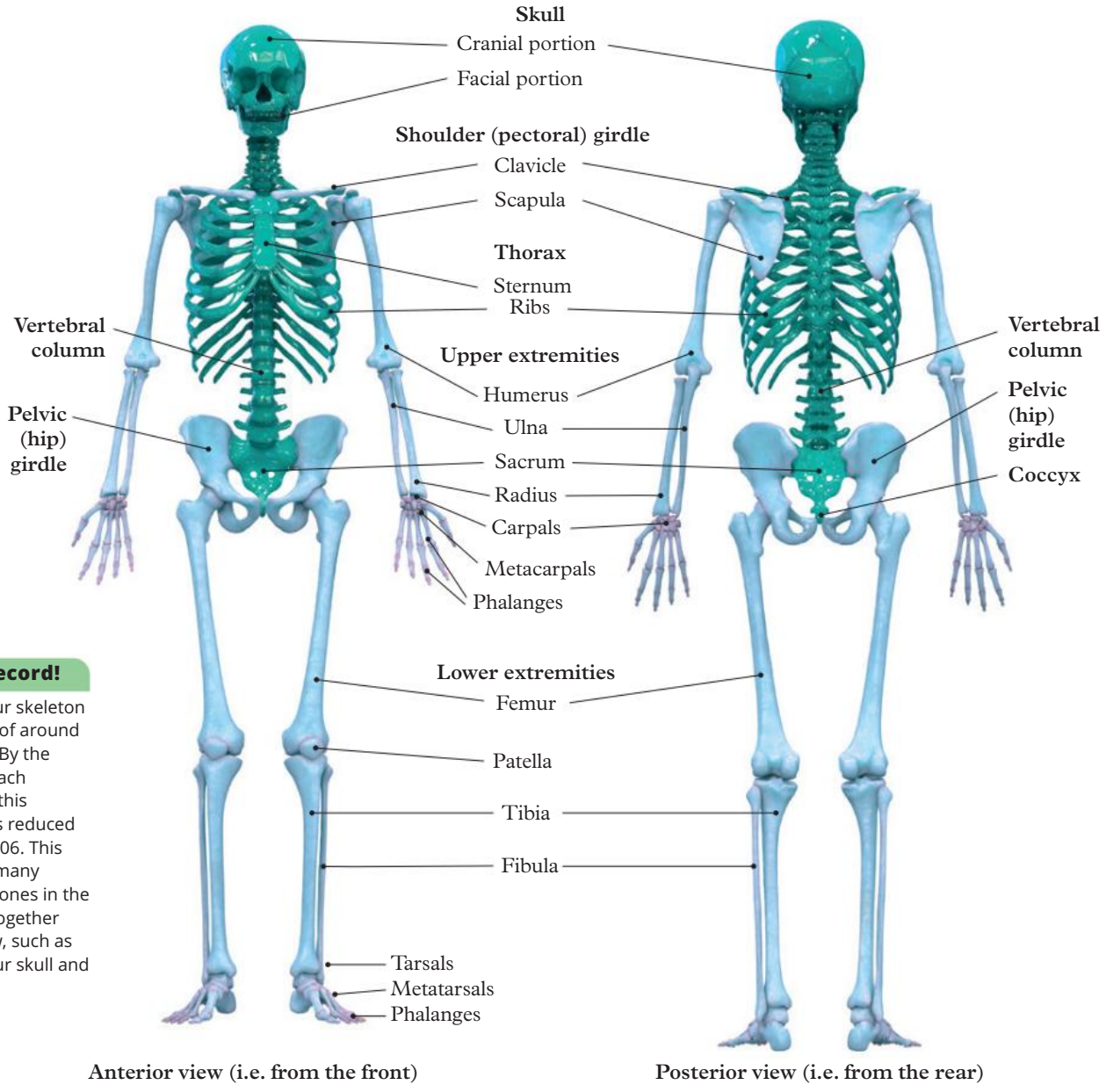
Parts of the human skeleton

There are two main parts to the human skeleton. They are the:

- **axial skeleton** – which forms the long axis of the body, hence the name "axial". It includes the skull, vertebral column, ribs, sternum and coccyx. The axial skeleton is shaded green in Source 1.
- **appendicular skeleton** – which is attached to the axial skeleton and forms the support for the body's appendages (i.e. arms and legs), hence the name "appendicular". It includes the bones of the pectoral (shoulder) girdle and the upper extremities, as well as the bones of the pelvic (hip) girdle and the lower extremities. The appendicular skeleton is shaded blue in Source 1.

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For the record!

At birth, your skeleton is made up of around 270 bones. By the time you reach adulthood, this number has reduced to around 206. This is because many individual bones in the body fuse together as you grow, such as those in your skull and spine.

SOURCE 1 The human skeleton is made up of 206 bones. It has two main parts – the axial skeleton (shaded green) and the appendicular skeleton (shaded blue).

The structure of bones

compact bone a solid mass of bony tissue that has a smooth appearance; this forms the solid outer shell of most bones

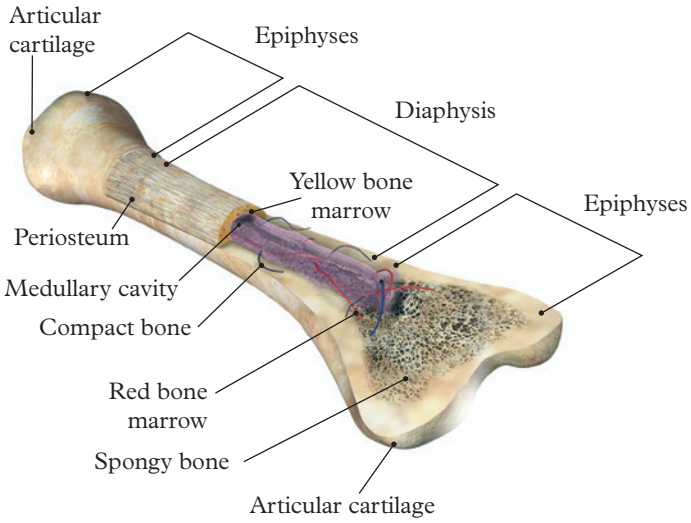
spongy bone a lightweight mass filled with marrow, nerves and blood vessels; this forms the soft spongy centre of most bones

All bones contain two forms of bone tissue:

- **compact bone** – a solid mass of bone tissue that has a smooth appearance; compact bone forms the hard outer shell of most bones
- **spongy bone** – a lightweight mass of bone tissue that has a spongy, honeycomb appearance and is filled with marrow, nerves and blood vessels. Spongy bone is located inside bones, where it takes on the least stress, and allows nutrients to be carried in and out of the bone.

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SOURCE 2 The structure of a long bone

For the record!

The long and short of it

- The shortest bone in the human body is the stapes (or stirrup), which is located inside the ear. It is about 3 millimetres long.
- The longest bone in the human body is the femur (or thigh bone). It is generally one-quarter of the height of an adult.

We will now look at the structure and function of bones, using long bones as an example (see Source 2). The most common long bones are in the arms and legs. They typically have the following features:

- diaphysis (i.e. a long shaft), which is covered by a membrane called the periosteum
- epiphyses (i.e. two end sections), which are covered by an articular cartilage (a smooth white tissue) to reduce friction and absorb shock at the joint
- the medullary cavity, which is the space within the diaphysis that contains red bone marrow in childhood and yellow bone marrow in adulthood.

The function of bones

Most bones in the human body can be classified into four main categories according to their shape (see Source 3, page 106).

The unique shape of each bone in the human body allows it to perform a specific function. The four main categories of bones are:

- **long bones** – these bones are most commonly found in the arms and legs, and have a long shaft and a curved shape to absorb force and distribute it; their length helps facilitate leverage to enable increased force production in physical activities requiring propulsion, such as running
- **short bones** – these bones are often shaped for strength; short bones can be found in the wrists and ankles
- **flat bones** – these bones are often wide and flat to offer protection to internal organs or area for muscles to attach to; flat bones can be found in the skull, sternum and pelvis
- **irregular bones** – these bones do not fit easily into any of the other categories. They are unusually shaped bones that fit into a variety of positions and perform a wide range of functions. Irregular bones can be found in the vertebral column (i.e. vertebrae), the facial portion of the skull and in the shoulders.

There are two additional types of bones that are classified according to their location in the body rather than their shape (see Source 3). These are:

- **sesamoid bones** – these bones are embedded in tendons where pressure develops; the patella (kneecap) is an example of a sesamoid bone
- **sutural bones** – these bones (also known as Wormian bones) are located between the joints of some cranial bones in the skull.

long bones bones that have a long shaft and a curved ends to absorb and distribute force

short bones bones that are often cube shaped for strength

flat bones bones that are often wide and flat to offer protection to internal organs or areas for muscles to attach

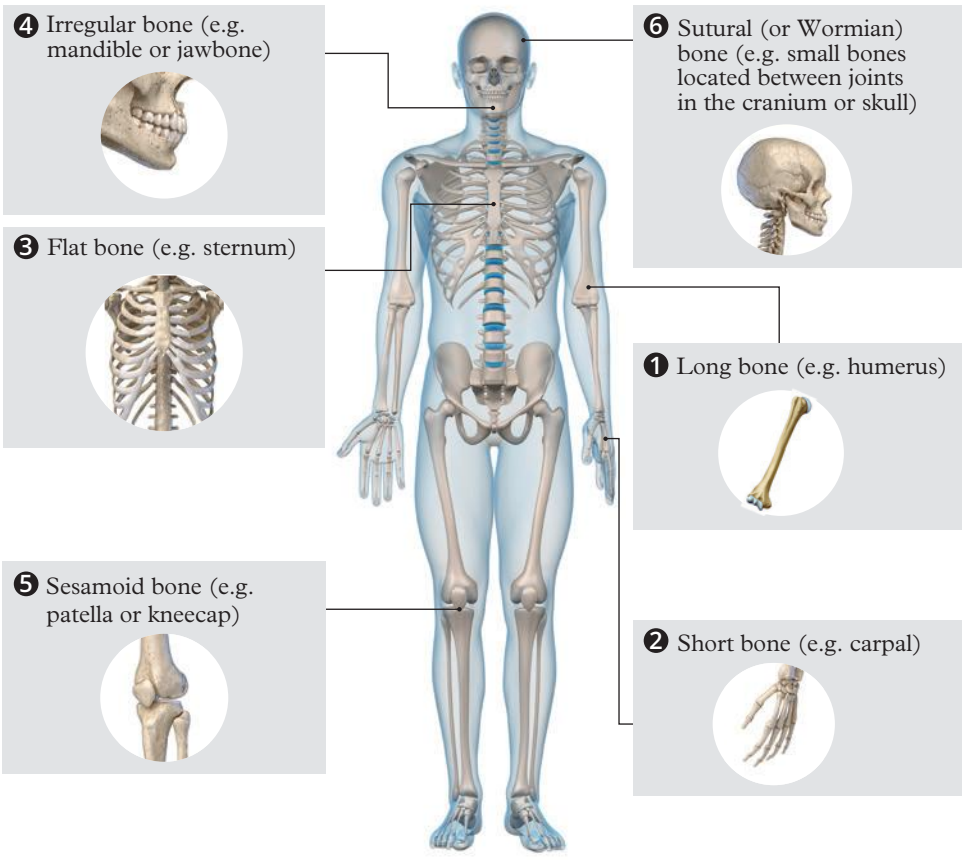
irregular bones bones that are unusually-shaped and designed to fit into different positions and perform different functions

sesamoid bones bones that are small and develop in tendons where pressure develops

sutural bones small bones that are located between the joints of cranial bones in the skull; also known as Wormian bones

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SOURCE 3 Most bones in the human body can be classified into four main categories according to their shape and function. They include: (1) long bones; (2) short bones; (3) flat bones; (4) irregular bones. There are two other categories of bones that are classified according to their location in the body rather than their shape: (5) sesamoid bones; and (6) sutural (or Wormian) bones.

Check your learning 3.2

Check your learning 3.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. The main function of the skeletal system is to:
- **A** provide structure and shape to the human body.
- **B** protect skeletal muscles from injury.
- **C** allow humans to run and jump.
- **D** help athletes control their movements in sport.

2 Refer to Source 1 and **identify** whether the following bones are part of the axial or appendicular skeleton.
- **a** Fibula
- **b** Clavicle
- **c** Coccyx
- **d** Sternum

Analytical processes

3 **Categorise** the following bones into long, short, flat or irregular.
- **a** Femur
- **b** Tarsals
- **c** Pelvis
- **d** Rib
- **e** Humerus
- **f** Mandible
- **g** Carpals
- **h** Vertebra
- **i** Scapula

Knowledge utilisation

4 **Investigate** which bones face a higher risk of injury or stress during physical activity. In one paragraph, **justify** the need for shock absorbent protective gear or footwear.

5 **Assess** the impact that things such as gender, nutrition, physical activity and lifestyle can have on bone health. In a 150-word written response, **discuss** a range of potential changes you could make to your life (e.g. diet, lifestyle) to improve the health of your bones.

6 **Select** a long bone from your arms or legs and **determine** how it contributes to optimal performance in your selected sport.

7 **Hypothesise** why the hand (including the wrist) is made up of 27 bones. **Use** a physical example in your response.

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Lesson 3.3
The structure and function of joints

Key ideas

→ Joints are formed where two or more bones meet, and they allow the body to move.
→ There are three types of joints: fibrous, cartilaginous and synovial.
→ Synovial joints are the most important for movement.

Learning intentions and success criteria

Joints in the human body

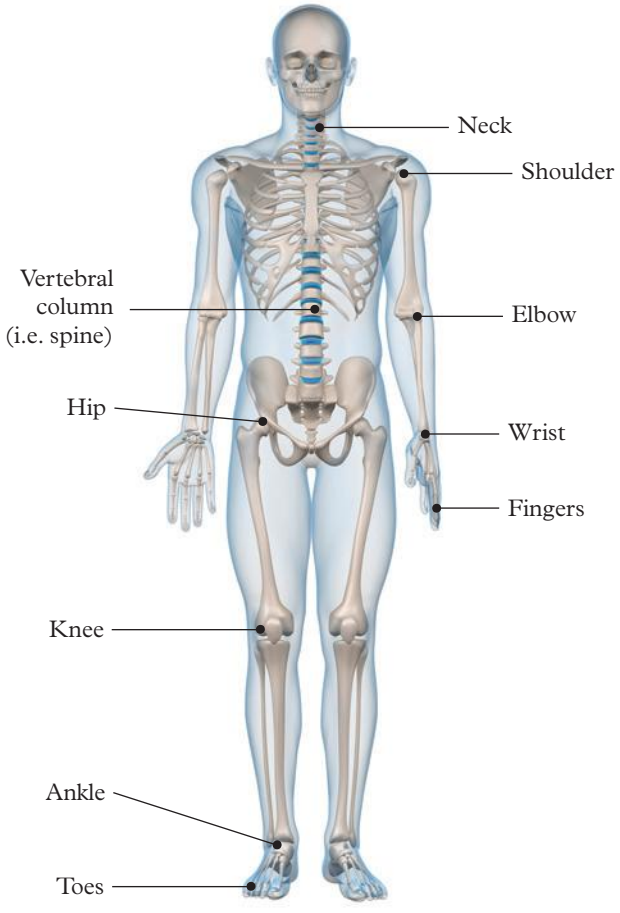
Joints are formed where two or more bones meet. To be more precise, joints – also called articulations – are formed where the surfaces of two or more bones meet and "articulate" with each other (i.e. connect in joined segments), allowing movement. The fact that most bones in the human body are very rigid and cannot bend without breaking means that we depend on our joints to help us move. Joints can allow movement and flexibility and provide support.

joints the points at which bones meet and articulate with each other

Major joints involved in movement

In total, there are around 360 joints in the human body. The majority of these joints are involved in movement, but some are not. The major joints that support movement (see Source 1) include the:

- neck – where the cervical vertebrae meet the skull
- shoulder – made up of two parts; where the clavicle meets the scapula and where the humerus meets the scapula
- elbow – where the humerus meets the radius and ulna
- wrist – where the ulna and radius meet the carpal bones
- fingers – comprised of many joints where the carpals meet the metacarpals, the metacarpals meet the phalanges and between phalanges
- vertebral column – made up of 33 interlocking vertebrae
- hip – where the pelvis meets the femur and vertebral column
- knee – where the femur meets the tibia
- ankle – where the tibia and fibula meet the talus
- toes – where the metatarsals meet the phalanges and between phalanges.



SOURCE 1 There are around 360 joints in the human body. The major joints that allow movement are shown here.

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Retrieve it!

What are the body and movement concepts? Check back to Lesson 2.10 Body and movement concepts (page 74) to see if you retrieved the information correctly.

The structure and function of joints

Joints are categorised according to how much movement they allow (their function) and what they are made of (their structure). The function and structure of a joint is determined by:

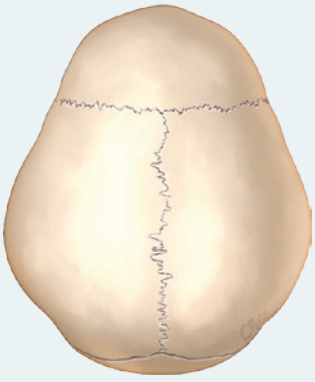
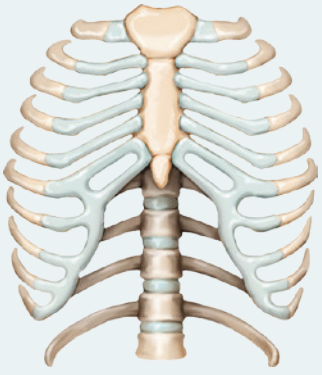
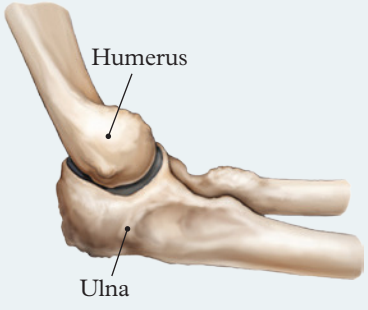
- the way in which the articulating bones fit together
- the flexibility of the connective tissue that holds the joint in place
- the position of the muscles, tendons and ligaments around the joint.

Types of joint movements

On the basis of joint movements, joints can be classified into three categories according to their structure or function (as shown in Source 2).

For the record!

While most of the joints in the human body help us to move, some do not! These include some joints that connect bones in the skull and other joints that connect our teeth to sockets in the jaw.

Type of joint	Description	Range of movement
Fibrous joints 	The bones have no joint cavity and are held together by strong connective tissue.	Fixed (i.e. no movement)
Cartilaginous joints 	The bones have no joint cavity and are held together by cartilage. Fibrous and cartilaginous joints are more prominent in infancy and childhood; they fuse and are replaced by bone growth during adulthood.	Slight (i.e. limited movement)
Synovial joints 	The bones have a joint cavity, and they are held together by ligaments and separated by synovial fluid in the joint cavity.	Free (i.e. full range of movement)

SOURCE 2 Categories of joints in the human body

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Synovial joints

As synovial joints are the most important in terms of movement, we will now look more closely at their structure and function.

Successful performance in most sporting activities relies heavily on the structure and function of synovial joints. Stability is provided by a number of important physical structures. They are shown in Source 3 and Source 4 (page 110) and include:

- the articular capsule – a capsule that encloses the joint cavity
- articular cartilage – a smooth connective tissue covering the surface of articulating bones
- synovial fluid – a secretion that lubricates and nourishes the articular cartilage
- the synovial membrane – a connective tissue that lines the inner surface of the articular capsule
- the synovial cavity – the space created within the enclosed articular capsule, filled with synovial fluid
- the fat pad – fatty tissue that provides cushioning for the articular capsule
- the bursa – a small sac containing synovial fluid, located at friction sites between bones and tendons.

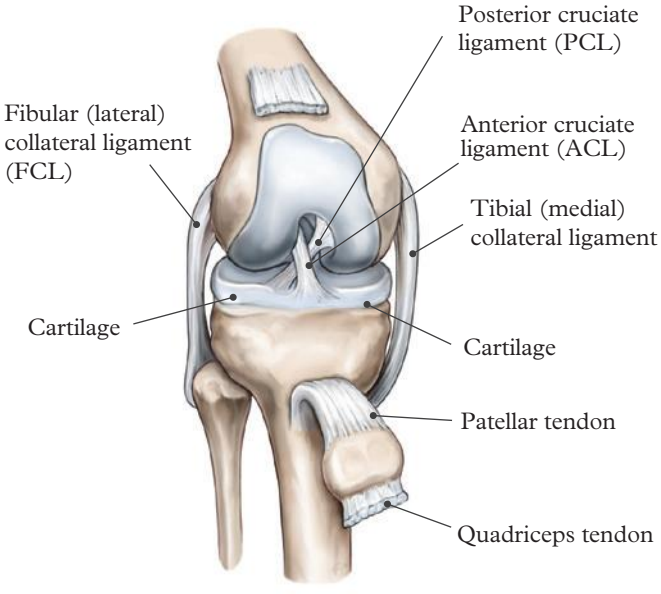
The structures that provide support and function around the joint are:

- tendons – fibrous cords of dense connective tissue that attaches muscle to bone
- ligaments – dense connective tissue that attaches bone to bone.

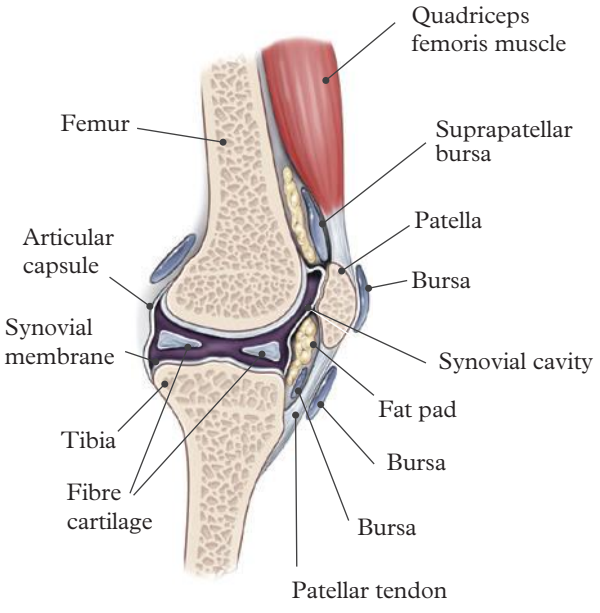
These structures inside and around joints determine the types of movements that are possible. Synovial joints are the only joints that allow true mobility. This level of mobility can vary depending on the joint's function, position, the state of the ligaments, tendons and muscles, or the presence of diseases (such as arthritis).

For the record!

Australia holds the record for the highest rate of anterior cruciate ligament (ACL) injuries in the world! Each year, more than 10 000 surgical knee reconstructions are carried out in Australia to address these injuries, and this rate is rising by 5–6 per cent per annum. The majority of these operations are performed on 15- to 25-year-olds. Sport injuries have become so common that they now result in more hospital admissions than road trauma.



Structural view of the knee joint, showing ligaments

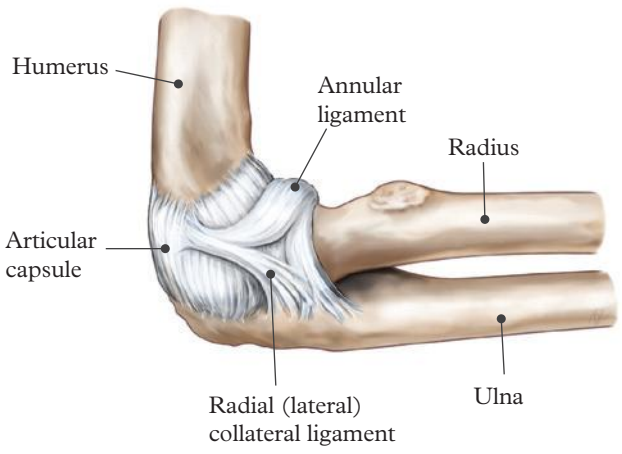


Cross-section view of the knee joint

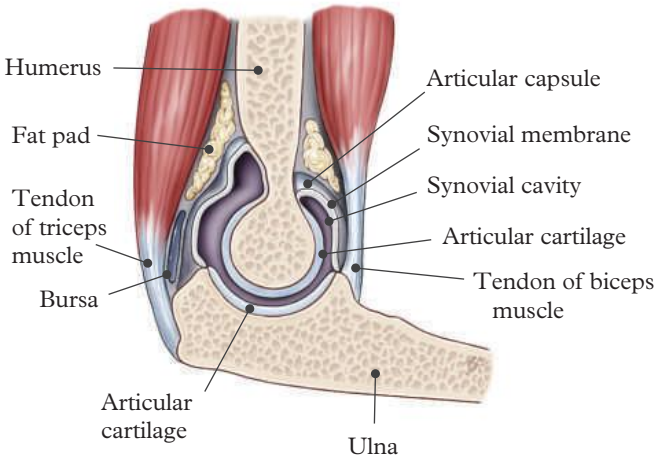
SOURCE 3 The internal structural view of a knee joint

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Structural view of the elbow joint, showing ligaments



Cross-section view of the elbow joint

SOURCE 4 The internal structural view of an elbow joint

Study tip

Being able to recall and apply the terminology used to describe joint movements quickly and correctly will improve your ability to describe various specialised movement sequences efficiently and accurately. It is also likely to improve your performance on assessment tasks!

For example, instead of saying "My tennis volley technique is pretty good", the correct terminology will enable you to say "I am generating accuracy and power in my forehand volley by focusing on elbow extension during the punching phase."

In the news

Sam Kerr: Chelsea and Australia striker out for the season after ACL injury

Suzanne Wrack, *The Guardian*, 8 January 2024

The Australia and Chelsea forward Sam Kerr has become the latest Women's Super League player to suffer an anterior cruciate ligament (ACL) injury and will miss the remainder of the domestic season, her club announced on Sunday.

Kerr suffered the knee injury at Chelsea's warm-weather training camp in Morocco before next weekend's FA Cup game against West Ham.

The forward joined Chelsea midway through the 2019–20 season and has scored 99 goals in 128 games for the Blues. "Sam will be assessed by a specialist in the coming days and then begin her rehabilitation with the club's medical team," the club said in a statement.

Kerr will sit out the rest of the season with the injury, which means her last game played under the influential manager, Emma Hayes, will prove to be the London side's 3–1 away win against the Swedish side Häcken in the Champions League on 20 December. She will also miss the Olympics this summer if Australia qualify.

Hayes is leaving Chelsea at the end of the season to become the head coach of the US women's national team. Kerr's own contract is up at the end of this season, meaning she may even have played her last game for the Blues altogether.

Since recruiting Australia's talismanic forward, who missed the majority of her home World Cup in 2023 with a calf injury, Chelsea have added nine trophies to their cabinet, winning the league four times, the FA Cup three times and the League Cup twice.

The 30-year-old has also won the Golden Boot twice, was runner-up to Spain's Aitana Bonmatí at the Ballon d'Or awards last year and finished third on the Guardian's list of the top 100 female footballers in 2021 and 2022.

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The global players union, Fifpro, has reported that an increased workload, travel and insufficient rest have all contributed to an increase in injuries, including ACL injuries.

In December European football's governing body, UEFA, announced the introduction of an expert panel on women's health to seek a deeper understanding of ACL injuries and their frequency among women players.



SOURCE 5 Sam Kerr tore her ACL while playing soccer.

Types of synovial joints

There are six different types of synovial joints. They permit particular types of movement, according to the shape of the bones and the structures around them. They are shown in Source 6 and Source 7.

Type of synovial joint	Description	Example
Pivot joints	Form when the rounded (or pointed) surface of one bone articulates with the depression (or opening) of another. These joints support rotational movement (as the rounded bone moves around its own axis).	Joint of the first and second vertebrae of the neck
Hinge joints	Form when the slightly rounded bump (i.e. convex) of one bone fits into the slightly rounded hollow (i.e. concave) of another. These joints support movement back and forth in the same direction.	Elbow joints and knee joints
Saddle joints	Form when the ends of each bone resemble a saddle (i.e. with concave and convex sections) that fit together. These joints support angular movements (similar to ellipsoid joints) but with a greater range of motion.	Thumb joint
Ball and socket joints	Form when the rounded surface of one bone (the ball) fits into a rounded cup-like hollow of another (the socket). These joints support a large range of motion with movement possible in all directions.	Shoulder joints and hip joints
Gliding joints	Form when the flat (or slightly curved) surfaces of two bones meet. These joints support a limited range of motion (i.e. side to side and back and forth movements) that do not include rotation.	Intercarpal joints (in the hand)
Ellipsoid joints (also known as condyloid joints)	Form when an elliptical condyle (i.e. oval-shaped bump) of one bone fits into the elliptical depression (i.e. oval-shaped hollow) of another. These joints support angular movements along two axes (i.e. both side to side and up and down).	Wrist joints and finger joints

SOURCE 6 There are six types of synovial joints.

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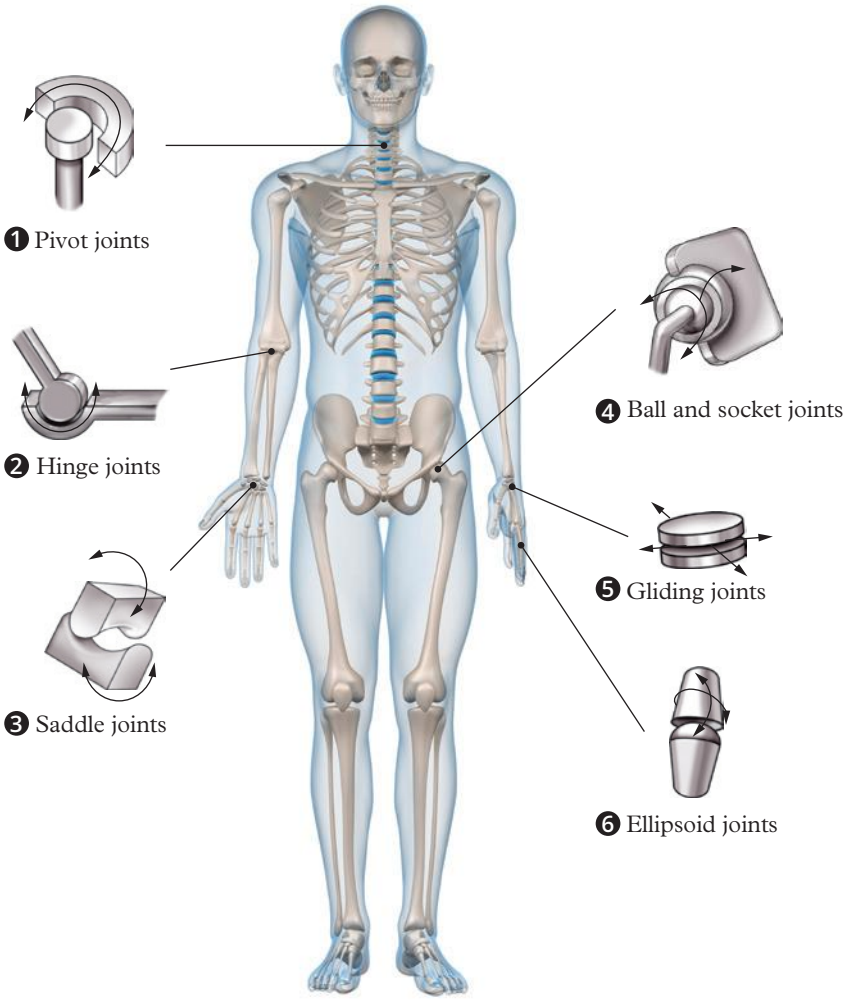
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Retrieve it!

In reference to feedback, what is the difference between knowledge of performance versus knowledge of results? Check back to Lesson 2.8 Types of feedback (page 69) to see if you retrieved the information correctly.

Study tip

Anatomical position
Joint movements are always described assuming the body is in the anatomical position. The anatomical position for humans assumes the body is in an upright standing position with the face looking forward, the feet facing forward, the arms at the side and the palms of the hands facing forward.



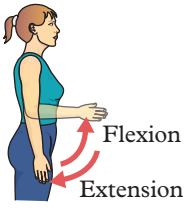
SOURCE 7 Synovial joints are the only joints that allow true movement.



Types of joint movements

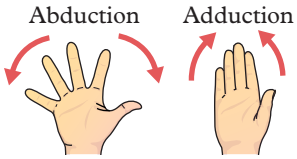
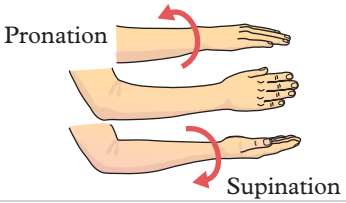
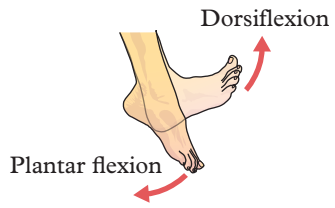
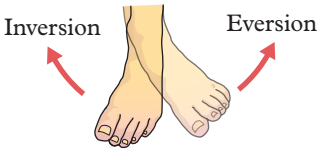
As we have learnt, joints help to support movement by acting as the meeting point between bones and muscles. Most of the joints in our bodies are synovial joints, and there are six types of synovial joints. The types of movements that can occur at joints depend on the type of joint (as shown in Source 7). Not all joints have the same possible movements and for this reason, experts developed a specialised vocabulary to accurately describe every type of movement that can be produced by synovial joints.

As shown in Source 8, most movement types are paired (meaning one is the opposite of the other), but some are unpaired (meaning they have no opposite), as shown in Source 9.

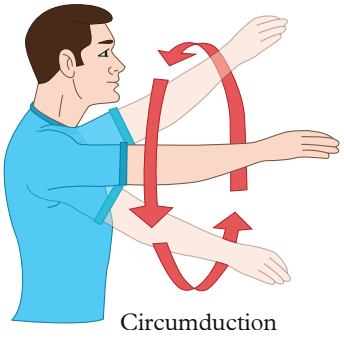
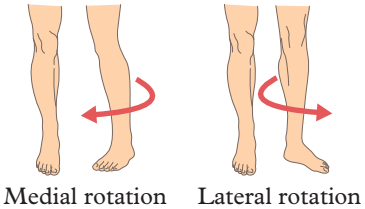
Joint movement	Paired joint movement	Example
Flexion Decreasing the angle between two bones	**Extension** Increasing the angle between two bones	

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Joint movement	Paired joint movement	Example
Abduction Moving a body part (e.g. arm) away from the midline of the body	**Adduction** Moving a body part (e.g. arm) towards the midline of the body	
Pronation Rotating a body part (e.g. the forearm) so that palm is posterior (i.e. facing backwards) or inferior (i.e. facing downwards)	**Supination** Rotation of forearm so that palm is anterior (facing forwards) or superior (facing upwards)	
Plantar flexion Bending of foot away from the shin	**Dorsiflexion** Bending of foot towards shin	
Inversion Rotation of the sole of the foot inwards towards the midline of the body	**Eversion** Movement of the sole of the foot away from the midline of the body	

SOURCE 8 Paired joint movements

Joint movement	Example
Circumduction Movement in a circular motion where one end of a limb remains relatively stationary while the other moves in circles.	
Rotation Movement of a bone around its longitudinal axis. This movement can be medial (i.e. movement that brings the anterior surface of the limb toward the midline of the body) or lateral (i.e. movement that brings the anterior surface of the limb away from the midline of the body).	

SOURCE 9 Unpaired joint movements

When analysing the performance of specialised movement sequences by a learner, it can be helpful to describe the joint movements used. In many cases, arms and legs will need to perform joint movements simultaneously. For example, when throwing a shoulder pass in netball, the wrist, elbow and shoulder joints are all engaging in movements such as flexion, extension, abduction and rotation simultaneously as well as sequentially to ensure a coordinated and effective pass is made.

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Check your learning 3.3

Check your learning 3.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. The types of joints in the human body that allow free movement are called:

A fibrous joints.
B synovial joints.
C cartilaginous joints.
D shoulder joints.

2 Choose the correct answer. Pivot joints form when:

A the rounded surface of one bone joins to the depression of another.
B the ends of each bone resemble a saddle that fit together.
C the oval-shaped bump of one bone fits into the oval-shaped depression of another.
D the flat surfaces of two bones meet.

Analytical processes

3 **Select** an important skill or movement sequence from your selected physical activity this term. **Determine** each of the discrete movements required to complete the skill successfully (i.e. by breaking it down into phases and sub-routines). Record each of these in a table and:

– **identify** the type of synovial joints involved
– **describe** the type of joint movements involved.

SKILL DRILL

Lesson 3.4
Evaluate the impact of joint movement on optimal physical performance

Aim

To identify the anatomical structures and correct movements involved in a bicep curl to determine the impact of incorrect joint actions on physical performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- 3- to 5-kilogram hand weights (enough to share for one between a small group)
- Pen
- Data Collection Instrument 3 (DCI 3)

Template: Data Collection Instrument 3 (DCI 3)

Method

Step 1

Form small groups of approximately three to four students.

Step 2

Have one group member perform a minimum of ten bicep curls, as per the following instructions for

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Position A. Sit on a bench (or the edge of a seat), with upright posture (sit still and do not sway). Hold hand weight in non-dominant hand, down by your side. Lock your elbow in against your torso. Slowly perform a bicep curl, bending the elbow to raise the weight up towards the shoulder before lowering it back down (with control) so that the arm is straight. At the same time have other group members ask questions 1 to 5 and record the answers in the "Position A" column of DCI 3. Discuss the degree of awareness that you have for the muscle groups mentioned in questions 1 to 5 of DCI 3.

Step 3

Repeat Step 2, this time performing the bicep curl as per the following instructions for Position B. Repeat all elements of Position A; however, rather than pinning your elbow against your torso, position your elbow approximately 20 centimetres away from your torso (i.e. abduct your elbow). Record the answers to questions 1 to 5 in the "Position B" column of DCI 3.

Step 4

Rotate through the group so that each group member completes Steps 2 and 3.

Step 5

Complete questions 6 to 9, identifying the joint actions involved in your performance of the two different bicep curls.

	Position A:	Position B:
1. Do you have an awareness of muscles being engaged in the hand?	☐ Yes ☐ No	☐ Yes ☐ No
2. Do you have an awareness of muscles being engaged throughout the lower arm?	☐ Yes ☐ No	☐ Yes ☐ No
3. Do you have an awareness of muscles being engaged throughout the upper arm?	☐ Yes ☐ No	☐ Yes ☐ No
4. Do you have an awareness of muscles being engaged throughout the shoulder region?	☐ Yes ☐ No	☐ Yes ☐ No
5. Do you have an awareness of muscles being engaged throughout the back including trapezius and latissimus dorsi (lats)?	☐ Yes ☐ No	☐ Yes ☐ No
6. What are the joint actions occurring at the fingers?	☐ Flexion ☐ Extension ☐ Abduction ☐ Adduction ☐ None	☐ Flexion ☐ Extension ☐ Abduction ☐ Adduction ☐ None
7. What are the joint actions occurring at the wrist?	☐ Flexion ☐ Extension ☐ Abduction ☐ Adduction ☐ None	☐ Flexion ☐ Extension ☐ Abduction ☐ Adduction ☐ None
8. What are the joint actions occurring at the elbow?	☐ Flexion ☐ Extension ☐ Abduction ☐ Adduction ☐ None	☐ Flexion ☐ Extension ☐ Abduction ☐ Adduction ☐ None
9. What are the joint actions occurring at the shoulder?	☐ Flexion ☐ Extension ☐ Abduction ☐ Adduction ☐ None	☐ Flexion ☐ Extension ☐ Abduction ☐ Adduction ☐ None

SOURCE 1 DCI 3

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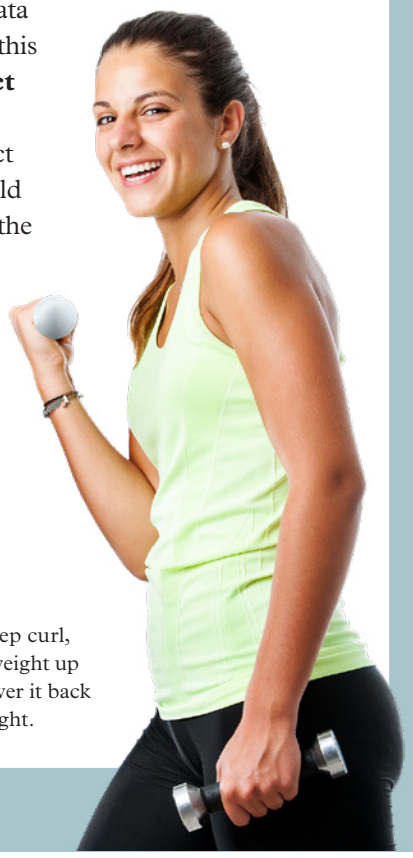
Analysis and discussion tasks

1 **Reflect on** your performance and data to determine which bicep curl technique felt the most efficient and effective.

2 **Analyse** secondary data about the joints and muscles involved in a bicep curl by doing some further research. Gather data from two secondary sources. A good place to start is the Livestrong website.
   - **a** **Explain** where the secondary data correlates (relates or connects) with your findings and where there is a discrepancy (a mismatch) between the secondary data and your findings.
   - **b** Considering your findings, draw a conclusion about which position (A or B from the task above) most closely resembles the optimal technique for a bicep curl.

3 **Select** one sub-routine within a key movement sequence in the physical activity you are currently studying (e.g. the arm action during the flight phase of a volleyball spike).
   - **a** Research the joint actions and muscle contractions necessary for optimal performance of this sub-routine. For example, (1) flex elbow, contract biceps; (2) adduct shoulder, contract deltoid; (3) circumduct shoulder, contract rotator cuff muscles; (4) adduct and rotate shoulder, contract rotator cuff; (5) extend elbow, rotate rotator cuff.
   - **b** Based on the primary and secondary data collected during this Skill drill, **predict** the various ways in which incorrect joint actions would negatively affect the performance of this sub-routine.

Weblink: Livestrong



SOURCE 2 To perform a bicep curl, bend the elbow to raise the weight up towards the shoulder and lower it back down so that the arm is straight.

Lesson 3.5
The structure and function of muscles

Learning intentions and success criteria

Key ideas

- → There are three types of muscles: skeletal, cardiac and smooth.
- → Skeletal muscles are responsible for moving the skeleton. They produce movement by contracting and relaxing.
- → There are two main types of contractions: istonic and isometric.
- → Reciprocal inhibition is when the central nervous system sends a message for a muscle on one side of a joint to contract and the muscle on the other side to relax.

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The muscular system

The muscular system is made up of all the muscles in our body that are directly responsible for movement. These muscles are referred to as skeletal muscles. There are more than 600 named skeletal muscles in the human body. Skeletal muscles are attached to the bones of the skeletal system and usually make up about half a person's total weight. Each of the muscles in the human muscular system is a discrete (i.e. separate) organ made up of muscle fibres, blood vessels and nerves.

skeletal muscle a type of muscle that is usually attached to bones and is responsible for moving the skeleton; it is a striated (i.e. striped), voluntary muscle (i.e. one that we have control over)

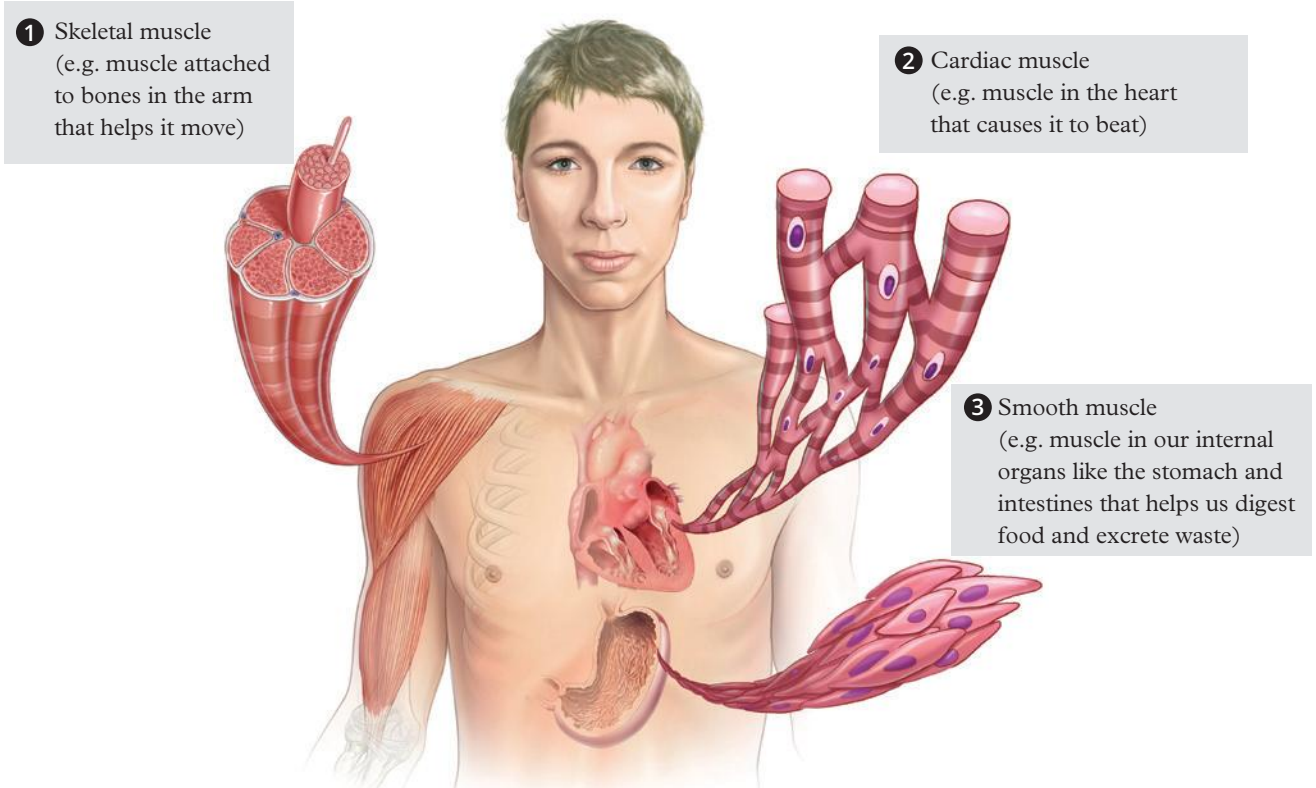
cardiac muscle a type of muscle that is found in the walls of the heart; it is a striated (i.e. striped), involuntary muscle (i.e. one that we have no control over)

smooth muscle a type of muscle that is found in the walls of our internal structures (such as the stomach, blood vessels and intestines); it is non-striated (i.e. not striped), involuntary muscle (i.e. one that we have no control over)

Types of muscles in the body

Before we learn more about the muscular system, it is useful to understand that there are three main types of muscles in the human body (as shown in Source 1). These muscles vary in size, shape and appearance depending on their purpose and where they are located in the body. The three types of muscle include:

- **skeletal muscle**: This type of muscle is usually attached to bones and is responsible for moving the skeleton. Skeletal muscle is said to be **striated** (i.e. streaked) because of its striped appearance. We have direct control over how and when we move skeletal muscles. For this reason, the movement of skeletal muscle is said to be **voluntary**.
- **cardiac muscle**: This type of muscle is found in the walls of the heart. Cardiac muscle is said to be **striated** (i.e. streaked) because of its striped appearance. We have no direct control over how and when we move cardiac muscles. For this reason, the movement of cardiac muscle is said to be **involuntary**.
- **smooth muscle**: This type of muscle is found in the walls of our internal structures (such as the stomach, blood vessels and intestines). Smooth muscle is said to be **non-striated** (i.e. not streaked) because – unlike skeletal and cardiac muscle – it does not have a stripy appearance. We have no direct control over how and when we move smooth muscles. For this reason, the movement of smooth muscle is said to be **involuntary**.



SOURCE 1 Most muscles in the human body can be classified into three main categories: (1) skeletal muscle; (2) cardiac muscle; and (3) smooth muscle.

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For the record!

The long and short of it

- The sartorius muscle is the longest muscle in the human body. It runs from the outside of the upper thigh down and across the leg to the inside of the knee and can be up to 60 centimetres long.
- The stapedius is shortest muscle in the human body. It is located in the middle ear and is around 2 millimetres in length.

Study tip

It is important to remember that the term "human muscular system" refers only to skeletal muscles. It does not include the many other muscles in our body that are not responsible for movement (e.g. muscles in the heart, stomach and lungs).

Retrieve it!

Under the cognitive systems approach to learning there are two main models. One is the information processing model. What is the other? Check back to Lesson 2.3 The cognitive systems approach to motor learning (page 43) to see if you retrieved the information correctly.

The structure of skeletal muscles

As the goal of functional anatomy is understanding how muscles and bones work together to produce movement, we will be learning exclusively about **skeletal muscles** for the remainder of this module. The skeletal muscles of the human body can be categorised into five groups, depending on where they are located in the body. These include:

- **muscles of the head** – this includes the face muscles (those that control facial expressions), jaw muscles, tongue and eye muscles
- **muscles of the neck** – this includes all the muscles responsible for the movement of the head and neck (i.e. sternocleidomastoid and the trapezius)
- **muscles of the torso** – this includes the deep muscles of the back and the muscles of the thorax, abdomen, pelvis and perineum (an area near the rectum)
- **muscles of the upper extremities** – this includes the muscles connecting the upper limbs with the vertebral column, the muscles connecting the upper limbs with the anterior and lateral thoracic walls (the upper rib cage area) and the muscles of the shoulder, upper arm, forearm and hand
- **muscles of the lower extremities** – this includes the muscles of the iliac region (the hips and lower abdomen), thigh, leg and foot.

Names of the major skeletal muscles

The names of skeletal muscles can be difficult to remember and understand to begin with, so it is helpful to know that muscles are named according to:

- **their size** – muscles come in a variety of different sizes. They can be large or small, short or long, narrow or wide. As a result, the names of some muscles reflect this. For example, larger muscles are called major (e.g. pectoralis major) and smaller muscles are called minor (e.g. pectoralis minor). Likewise, the largest muscle in a group is called maximus (e.g. gluteus maximus) and the smallest muscle in a group is called minimus (e.g. gluteus minimus).
- **their shape** – muscles come in a range of different shapes. There are four main shapes of muscles in the body: trapezoids, triangles, sawtooth and flat. For example, a trapezoid is like a rectangle but with only two sides that are parallel, as opposed to all four. The trapezius is the large muscle that sits on the upper portion of the back.
- **their location** – muscles are located in specific parts of the body. They can be located on the sides of the body or more towards the midline. They can also be towards the front or back of the body, or above or below other muscles, so the names of some muscles reflect this. For example, the latissimus dorsi muscle is a large, flat muscle on the back that stretches to the sides. *Dorsum* is a Latin word meaning "back".
- **the action they perform** – muscles are designed to perform a variety of different actions (or functions) in the body. They flex, extend, rotate around a joint, or move body parts up and down, and are often named accordingly. For example, the flexor carpi radialis is a muscle in the forearm that acts to flex the hand.



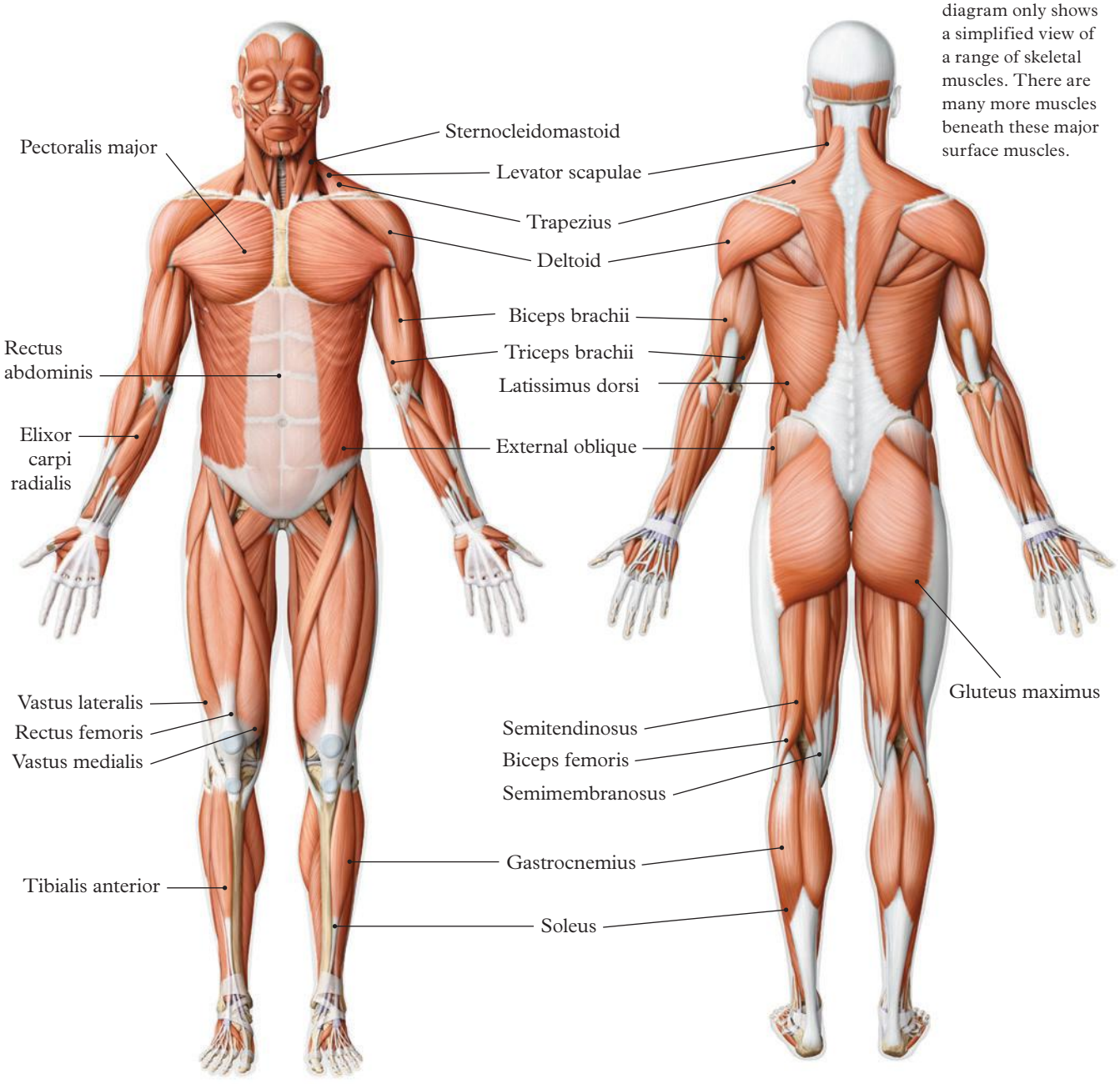
SOURCE 2 Knowledge of the structure and function of muscles can prevent injuries.

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- **the direction of their fibres** – muscles are designed to run in different directions (relative to the midline of the body). Some run up and down the body (i.e. parallel with the midline) and are called rectus, others run perpendicular (i.e. at 90° to the midline) and are called transverse, and some run diagonally (i.e. at 45° to the midline) and are called oblique. For example, the external oblique runs diagonally across the abdomen.
- **the fact that they have multiple points of origin** – some muscles in the body have more than one point of attachment at their origin, so some names of these muscles reflect that. For example, the biceps brachii has two attachment points at its origin. *Brachii* is a Latin word meaning "branches".
- **their origin and/or insertion points** – some muscles in the body have more than one point of attachment at their origin. For example, the sternocleidomastoid muscle in the neck takes its name from *sterno* and *cleido* (at its origin point at the sternum and clavicle) and *mastoid* (at its insertion point at the mastoid process).

SOURCE 3 The muscles in the human body that are responsible for movement are referred to as skeletal muscles. There are more than 600 named skeletal muscles in the human body. This diagram only shows a simplified view of a range of skeletal muscles. There are many more muscles beneath these major surface muscles.



Anterior view (i.e. from the front) **Posterior view (i.e. from the rear)**

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For the record!

It's all Greek (and a bit of Latin) to me
When early anatomists in the 1600s were naming many of the organs, bones and muscles in the human body, they assigned words from Latin and Greek. As a result, it is possible to find clues to the size, location, shape and function of many muscles from their names. Take the levator scapulae muscle: "levator" sounds like the English word "elevate". That is because they both come from the Latin word *levare* meaning "to raise".

Combine this knowledge with the fact that the scapula is a bone, and you would be right to conclude that the primary function of the levator scapulae muscle is used to lift the scapula bone.

The function of skeletal muscles

There are three basic functions that skeletal muscles carry out in the body. They:

- produce the movement required to walk, run, jump, breathe, digest food and excrete waste
- stabilise the position of the body and internal organs (i.e. maintain posture)
- generate heat to maintain body temperature.

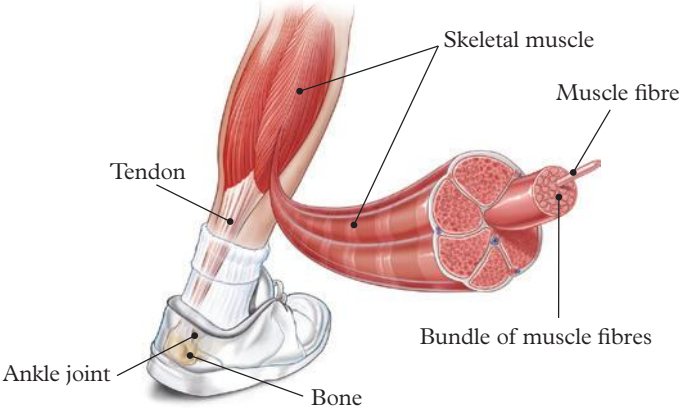
Once again, as the goal of functional anatomy is understanding how muscles and bones work together to produce movement, we will now learn in more detail about the first point listed above.

How muscles produce movement

To produce movement, muscles must convert chemical energy to mechanical energy to produce forces. It is this force that ultimately creates movement. The movement that a muscle produces is called its action. Each muscle in the body is only capable of two actions:

- **contraction** – a state in which tension in the muscle fibres increases, making them shorter and tighter
- **relaxation** – a state in which tension in the muscle fibres decreases, making them longer and looser.

As shown in Source 4, skeletal muscles are attached to bones by tendons. When a muscle exerts force on a tendon, the tendon pulls on the bone to create a movement. Because most bones in the human body are very rigid (and cannot bend without breaking), we also depend on our joints to help us move.



SOURCE 4 A skeletal muscle is constructed of many smaller bundles of muscle fibres. Muscles attach to tendons, which attach to bone. Movements (such as raising your heel off the ground) are produced when muscles (made up of bundles of muscle fibres) contract and exert force on tendons. Tendons pull on articulating bones (such as those in the ankle joint), resulting in a movement.

Muscle relationships

When it comes to moving our bodies or performing complex motor skills, there are often hundreds of muscles moving in unison (i.e. in harmony and agreement) with one another. In fact, it is almost always the action of muscles working in groups that causes us to move. Muscles are arranged to work with each other – or against each other – to produce movement.

Agonists, antagonists and stabilisers

agonist a muscle that provides the main force to cause a particular movement

antagonist a muscle whose action opposes (or reverses) that of the agonist muscle

Skeletal muscles can be classified into three groups depending on the relationships they have with each other. These are:

- **agonists** (also known as prime movers) – these muscles provide the main force that causes a particular movement
- **antagonists** – these muscles oppose (or reverse) the main force that causes a particular movement

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- **stabilisers** – these muscles support the movement by promoting the same movement or reducing unnecessary movement. There are two types of stabiliser muscles:
  - synergists – these muscles stabilise the joint where movement is occurring
  - fixators – these muscles stabilise the area where the agonist originates.

stabiliser a muscle that supports movement by promoting the same movement as the agonist or by reducing unnecessary movement (or undesired action)

Muscle origin, insertion and action

We have already learnt that skeletal muscles are attached to bones on each end by tendons, but to understand and explain how precise movements are produced, we need to look at this in more detail.

To create a movement, most muscles cross over at least one joint and the tendons at each end of the muscle attach to different bones. Movements are produced when a muscle exerts force (i.e. pulls) on a tendon, which in turn pulls on an articulating bone. During a muscle contraction, one bone (to which one end of the muscle is attached) moves, while the other bone (to which the other end is attached) does not.

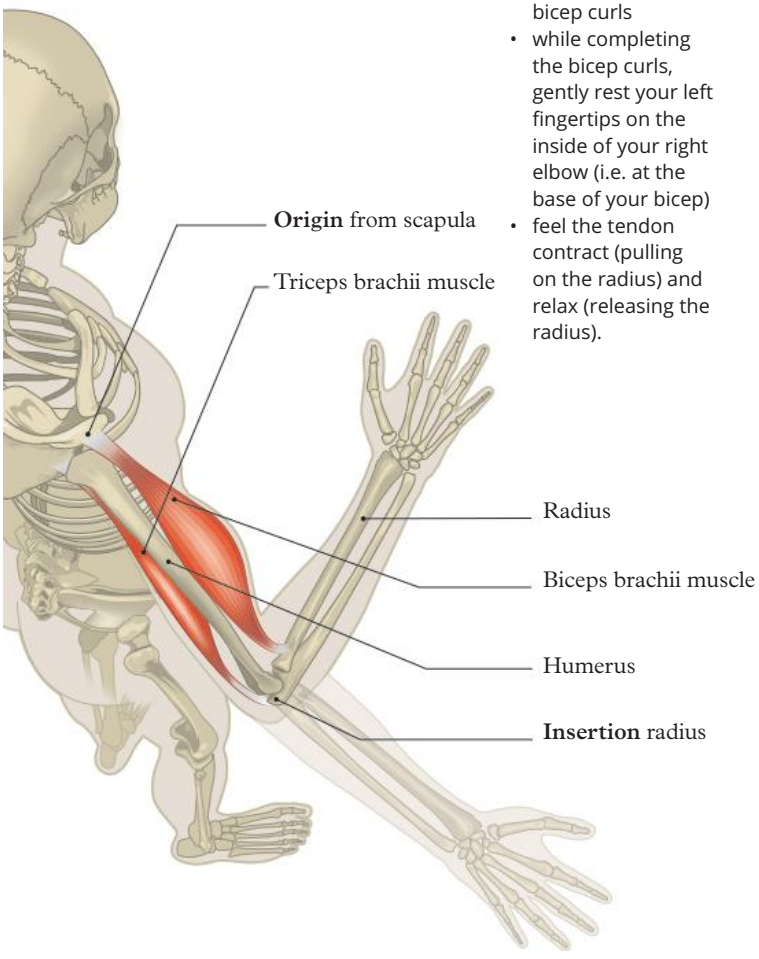
The different ends of the muscle where the tendon attaches to a bone are known as the:

- origin – the origin of the tendon is on the most stationary bone
- insertion – the insertion of the tendon is on the most moveable bone.

During a simple movement, when the muscle contracts, it creates the action – the movement that a muscle produces in the fleshy portion between the origin and insertion of the tendons (known as the muscle belly).

Consider an example of these concepts at work. As shown in Source 5, flexion of the forearm at the elbow involves a group of muscles working together to achieve a movement. These include:

- the **agonist** – in this case, the biceps brachii muscle acts as the agonist, carrying out the primary movement (pulling the forearm upwards)
- the **antagonist** – in this case, the triceps brachii muscle acts as antagonist, carrying out the opposing movement (a downward pull on the forearm)
- the **stabilisers** – in this case, muscles around the elbow joint act as synergists (i.e. stabilising the elbow joint) and the muscles of the shoulder act as fixators (i.e. preventing any unnecessary movement in the arm). These are further explored in "Theory in action: The importance of stabiliser muscles".
- the **origin** of the agonist at the scapula and the **insertion** at the ulna – when the biceps brachii contracts, it exerts force on the tendons, which pull on the scapula and ulna. The scapula remains stationary as it is anchored to the axial skeleton, but the ulna is movable and therefore the force exerted pulls the forearm upwards.



SOURCE 5 Muscles are arranged to work in groups to produce movement. Often they work with each other – or against each other – in order to do this. For example, flexion of the forearm at the elbow occurs when the agonist (the biceps brachii) contracts and the antagonist (the triceps brachii) opposes the movement

Study tip

Putting theory into action can help consolidate your understanding. For example, this section explains how the biceps brachii pulls on the ulna to create movement. Try this exercise now.

Hold out your right forearm at a right angle:

- complete a series of slow, controlled bicep curls
- while completing the bicep curls, gently rest your left fingertips on the inside of your right elbow (i.e. at the base of your bicep)
- feel the tendon contract (pulling on the radius) and relax (releasing the radius).

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Theory in action The importance of stabiliser muscles

Your performance at the gym is often more focused on the volume and the load you intend on lifting and less on the way you perform weight exercises. You may have heard your gym peers talk about having "proper form" when weight training. Incorrect weight training techniques can hinder your weight training efforts and result in fractures, sprains and strains.

An important part of doing weightlifting exercises the right way – using proper form – is being able to stabilise your body to maximise the available strength and energy of the movement. The muscles you use to stabilise your body are called stabiliser muscles. They spread the work of training and movement throughout your body instead of putting all the stress onto one or two primary movers.

For example, when performing a barbell back squat, your hamstrings and gluteus maximus are doing the majority of the work (i.e. they act as the primary movers). The abductor muscles then work to keep the hips and thighs stable (i.e. they act as the stabiliser muscles). Underdeveloped and inactive stabiliser muscles can result in the knees collapsing inwards.

Stabiliser muscles make movements safer and more efficient while preventing primary movers from getting overworked. They allow you to become a more powerful, efficient athlete both inside and outside the weight room.



SOURCE 6 Your stabiliser muscles work to stabilise your body as you work your larger muscle groups. A lack of strength in your stabiliser muscles can result in improper form and injury.

isotonic contraction a process in which the muscle fibres produce tension (i.e. force) as they shorten or lengthen, and there is a range of movement across the joint (i.e. the joint moves)

isometric contraction a process in which the muscle fibres produce tension (i.e. force), but they neither shorten nor lengthen and there is no movement across the joint (i.e. the joint does not move)

concentric isotonic contraction a process in which the muscle shortens to pull on bones and bring them closer together

eccentric isotonic contraction a process in which the muscle lengthens to release the bones and move them further apart

Types of muscle contractions

When muscles are in a relaxed state, they are soft and loose. When they contract to produce a force, they become hard and tense.

Muscle tension is the force that is produced when a muscle contracts; the load is the force exerted on a muscle by a weight. In the case of a bicep curl with a dumbbell, the load is the weight of the dumbbell (see Source 8).

Two main types of contractions are possible within muscles:

- **isotonic contractions**
- **isometric contractions**

Isotonic contraction

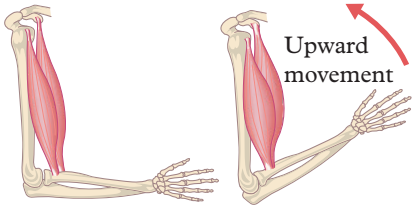
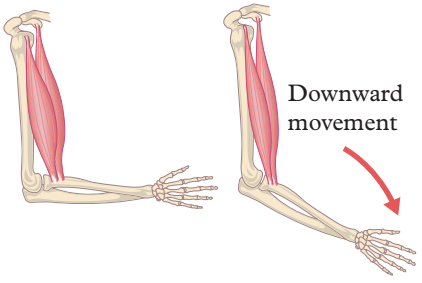
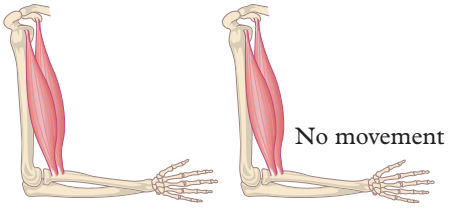
During an isotonic contraction, the muscle fibres produce a tension, or force, as they lift the load through the range of movement. The muscle length changes (either shortens or lengthens) as tension develops; therefore, two possible types of isotonic contractions exist. When the muscle shortens it is known as a **concentric isotonic contraction**, and when it lengthens, it is known as an **eccentric isotonic contraction**. For example, a squat uses both types of isotonic contractions.

Isometric contraction

During an isometric contraction, tension develops in the muscle, but it neither shortens nor lengthens. There is also no movement across the joint. Isometric contractions produce energy but no movement.

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Type of contraction	Muscle movement	Example	Diagram
Concentric isotonic contraction	Muscle contracts		
Eccentric isotonic contraction	Muscle elongates		
Isometric contraction	Muscle contracts		

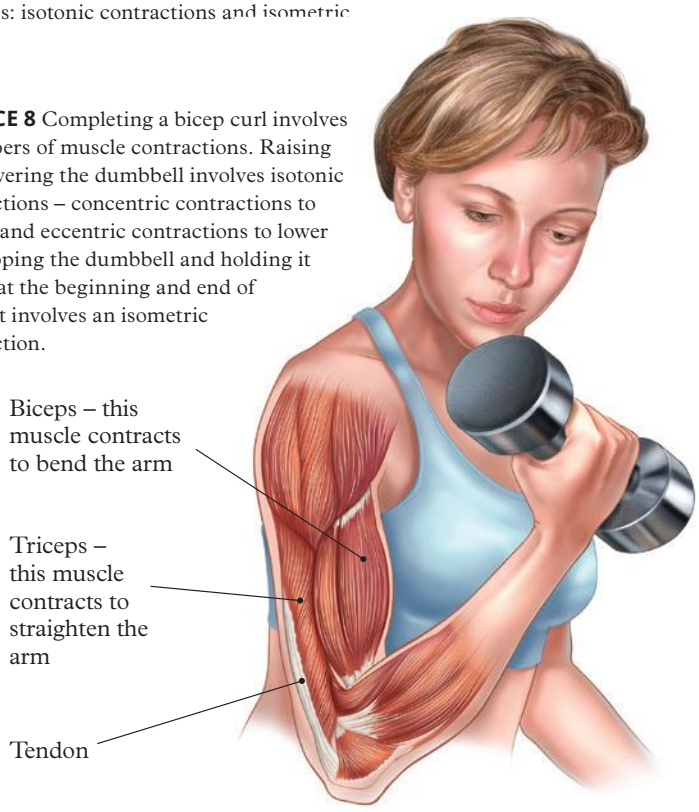
SOURCE 7 Two main types of contractions are possible within muscles: isotonic contractions and isometric contractions.

Combining muscle contractions

Most sporting skills involve a combination of both isotonic and isometric contractions. Consider the tennis backhand topspin shot. The isometric contraction required of the muscles gripping the racquet in the eastern orientation (which allows for greater generation of spin) is of equal importance to the concentric and eccentric isotonic contractions occurring through the biceps and triceps muscles.

The same applies to the softball batting action. The batter must withstand the force of the oncoming ball impacting the bat by using isometrically contracted muscles in the forearm; otherwise, the isotonic contractions required to swing the bat are irrelevant.

SOURCE 8 Completing a bicep curl involves a numbers of muscle contractions. Raising and lowering the dumbbell involves isotonic contractions – concentric contractions to raise it and eccentric contractions to lower it. Gripping the dumbbell and holding it steady at the beginning and end of each set involves an isometric contraction.

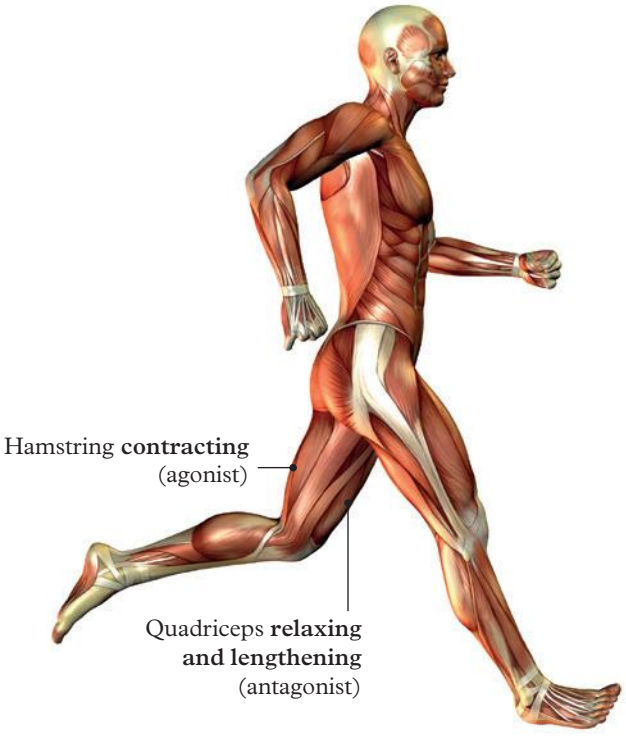


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Study tip

As you complete the movement sequences of your chosen physical activity, keep in mind the major muscles involved. For instance, you may wish to explain to a friend the key agonists, antagonists and stabilisers involved. Alternatively, you could do a sketch in your workbook and label the muscles. Use specific and accurate terminology to enhance your communication.



SOURCE 9 In this example of reciprocal inhibition, the quadriceps (antagonist) relaxes to accommodate the contraction of the hamstring (agonist) in order to produce movement.

Reciprocal inhibition

It is important to know that muscles play multiple roles. A certain muscle may act as an agonist in one movement, an antagonist in another movement and a stabiliser in another movement.

When the **central nervous system** sends a message for a muscle on one side of a joint to contract (i.e. the agonist), it sends a message for the muscle on the other side of the joint to relax (i.e. the antagonist). This process is called **reciprocal inhibition**.

central nervous system part of the larger body system known as the nervous system, the central nervous system consists only of the brain and spinal cord (i.e. the central part of the system). It does not include the network of nerves that run throughout our bodies (referred to as the peripheral nervous system)

reciprocal inhibition a process during which the muscle (or muscles) on one side of a joint relax in order to accommodate the muscle (or muscles) on the other side of that joint that are contracting

Reciprocal inhibition is crucial because it allows movement at the joint and prevents injury. If agonists and antagonists contracted at the same time, movement would be negatively affected and injuries (such as muscle tears) would occur. The combined functions of agonists, antagonists and stabilisers are important in creating coordinated, smooth, precise and injury-free movements.

The paired muscles of the shoulder girdle can be used to further explain these concepts. The shoulder girdle is the anatomical structure that allows for all movements of the upper arm and shoulder.

- When the shoulder girdle is in action, the pectorals and latissimus dorsi work to create flexion and extension at the shoulder joint.
- When the pectorals (agonist) contract, flexion of the arm occurs and the latissimus dorsi (antagonist) is relaxed. In this movement, the deltoid, biceps brachii and trapezius act as stabilisers.
- During extension, the latissimus dorsi (agonist) contracts and pectorals (antagonist) relax. The triceps and trapezius act as stabilisers.

Examples of sporting actions that require the use of the muscles of the shoulder girdle include the baseball pitch, discus throw, volleyball spike, tennis serve, freestyle stroke and static strength hold on the rings (in artistic gymnastics).

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Check your learning 3.5

Check your learning 3.5: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Skeletal muscle is:
   A involuntary.
   B non-striated.
   C voluntary.
   D smooth.

2 Choose the correct answer. Muscles work together using:
   A agonists, contractions and relaxations.
   B agonists, antagonists and stabilisers.
   C stabilisers, synergists and fixators.
   D agonists, insertions and origins.

3 **Identify** the seven characteristics used to name muscles.

4 **Explain** the two types of isotonic muscle contractions. Provide an example of each using a skill from your selected physical activity this term.

5 **Describe** what is meant by the term "reciprocal inhibition". **Explain** why it is crucial, using examples from your selected physical activity.

6 **Identify** a sub-routine within a movement sequence in your selected physical activity.
   a **Sketch** a simple diagram to illustrate the movement of the major muscles and bones during the completion of the skill (or part of it).
   b Label the major muscles and bones you have drawn.
   c Now **identify** each one as agonist, antagonist, stabiliser, origin, insertion.

Analytical processes

7 **Compare** and **contrast** the three main types of muscle tissue in the body by completing the following table.

	Purpose	Appearance	Degree of control over movement
Skeletal			
Cardiac			
Smooth			

8 **Differentiate** between isotonic and isometric contractions. Provide an example of each using a skill from your selected physical activity this term.

Knowledge utilisation

9 Read "Theory in action: The importance of stabiliser muscles". **Select** a weight-bearing movement sequence (other than a barbell squat or military press) and **investigate** the agonists, antagonists and stabilisers that are important for the safe completion of that activity.

Lesson 3.6
Introduction to biomechanics

Learning intentions and success criteria

Key ideas

→ Biomechanics is a field of science that studies how the laws of mechanics relate to movement.
→ Biomechanics can be used to improve performance and prevent injury in sports.
→ An understanding of biomechanics can assist in the analysis of specialised movement sequences.

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Defining biomechanics

biomechanics a field of science that studies the body systems responsible for movement (i.e. the musculoskeletal system) using concepts from a specialised branch of mathematics known as mechanics

Biomechanics is a field of science that studies how the laws of **mechanics** relate to movement. In other words, biomechanics is the study of the body systems responsible for movement (i.e. the musculoskeletal system) using concepts from a specialised branch of mathematics known as mechanics.

Biomechanics takes into account a range of different forces (such as the internal and external forces) that act on the human body (and other objects) and measures the effects of these forces. By applying some basic concepts from biomechanics, athletes and coaches can develop a better understanding of how the human body operates as a machine. This kind of insight can help athletes think about their training and technique in new ways.



SOURCE 1 By applying some basic concepts from biomechanics, we can develop a better appreciation of how our bodies function mechanically.

Why study biomechanics?

mechanics a branch of applied mathematics that deals with motion (and the forces that produce motion)

The study of biomechanics can be a very useful tool in achieving sporting success as it enables athletes to:

- identify better, more effective techniques (see Source 2)
- break specialised movement sequences down into specific phases and sub-routines so that they can be investigated and analysed
- correct technical errors
- reduce injury
- understand the importance of equipment design.

Retrieve it!

What type of muscle is found in the walls of our internal structures? Check back to Lesson 3.5 The structure and function of muscles (page 116) to see if you retrieved the information correctly.

Biomechanical analysis

Biomechanical analysis can benefit all athletes by helping to improve their techniques. Every sport has techniques, based on the physics of movement, which are considered ideal for optimal performance. By applying some basic concepts from the field of biomechanics to their training:

- a recreational runner may be able to run longer distances with less risk of repetitive strain-type injuries
- a high-performance track star may be able to shave milliseconds off their personal best time
- a cricket bowler may be able to make small adjustments to the rotation of their arm to reduce the stress loads on their shoulder joints and potentially increase the length of their playing career
- a soccer player may be able to improve the accuracy and effectiveness of their kicks.

In fact, biomechanics can assist almost every athlete by analysing motor skills or movement sequences to identify more effective and efficient outcomes.

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SOURCE 2 The application of biomechanics led to the evolution of high jump over the past 200 years. The original scissor jump (A) was popular in the mid-1800s. A new technique was developed in the early 1900s and used by some athletes, called the Western roll (B). The Fosbury Flop (C) was popularised in 1968 and remains the dominant style used today.

For the record!

Some of the first people to benefit from the application of biomechanics to human movement were US war veterans. After World War I, thousands of soldiers were missing limbs. They needed more effective aids than the traditional wooden "peg leg". Mechanical engineers began to study the functional movement of limbs to design prosthetics that more closely matched the natural motion of an arm or a leg.

Applying biomechanics to different sports and physical activities

For the remainder of this module, we will be discussing some of the general principles of biomechanics and demonstrating how these apply to different sports and physical activities. These general principles of biomechanics include the study of:

- force (including summation of force, momentum and levers)
- motion (including Newton's laws of motion, projectile motion and Bernoulli's principle)
- balance and stability.

To make sure you get the most out of the biomechanical concepts you will be studying in this module, we will be providing relevant examples from a variety of sports and physical activities. As you work through the remainder of the module, think about how the concepts apply to your selected physical activity. Try to identify specialised movement sequences and think about the desired outcome or goal of each one.

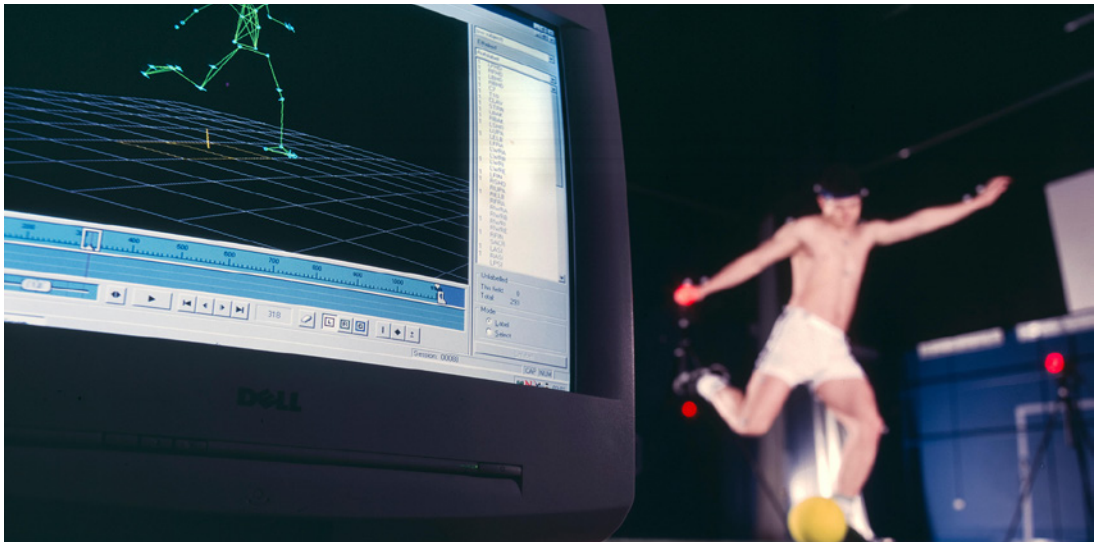
Once you have identified a specialised movement sequence, you can begin to break it down into its **phases** and **sub-routines** and apply biomechanical concepts to improve your technique and performance. Lesson 3.18 Analysing specialised movement sequences (page 186) will provide a step-by-step example of how to conduct a biomechanical analysis of a movement sequence of your choice.

phase a distinct, observable period within the execution of a motor program or specialised movement sequence; for example, a tennis serve or volleyball spike could be organised into preparation, action and follow-through phases or, similarly, into pre-impact, impact and post-impact phases

sub-routine a simple motor skill that – when combined with a number of other simple motor skills and sequenced in a specific order – is part of a motor program

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SOURCE 3 Biomechanics applies the laws of mechanics to human movement.

Check your learning 3.6

Check your learning 3.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Biomechanics is:
   - **A** a field of science that studies the human body in sport.
   - **B** a field of science that studies mechanics of human movement.
   - **C** used to make athletes achieve greater fitness.
   - **D** the only way to ensure technique is optimal in sport.

2 **Identify** three ways in which the study of biomechanical principles can be useful to athletes.

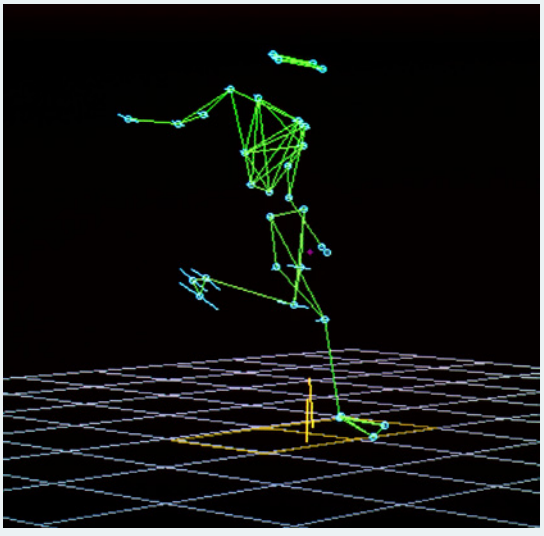
Analytical processes

3 "Biomechanical analysis has benefits for all athletes." **Consider** this statement and prepare a 150-word written response outlining whether you agree or disagree. Include examples from your selected physical activity to support your opinion.

Knowledge utilisation

4 **Conduct** some additional research into the application of biomechanical principles in your selected physical activity.
   - **a** **Identify** and **explain** at least one example or case in which the application of biomechanical principles has led to a change (either positive or negative) in the way your chosen sport is played or performed (e.g. the evolution of high jump techniques).
   - **b** **Design** a poster or presentation to communicate your findings to your class.

5 **Examine** a sub-routine within a movement sequence in your selected physical activity (e.g. drawing the lower leg back in the kicking action in football). **Predict** what would happen if the stabiliser muscles needed for this movement sequence were underdeveloped.



SOURCE 4 Biomechanical analysis studies allow techniques in sport to be analysed to improve performance and reduce injuries.

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Lesson 3.7
Force

Key ideas

- → Force is a push or pull that happens when two objects interact.
- → Force is made up internal forces (i.e. inside the body) and external forces (i.e. contact and non-contact forces between the body and the environment).
- → Force can affect performance in a physical activity.

Learning intentions and success criteria

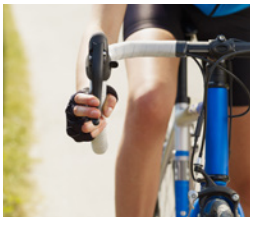
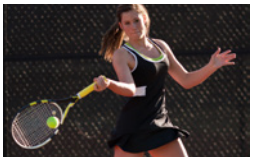
Defining force

In the simplest terms, a **force** is a push or pull that happens when two objects interact. In slightly more complex terms, a force is defined as an interaction that (when unopposed) causes (or has the potential to cause) a change in the motion of an object.

force a push or pull that happens when two objects interact; an interaction that (when unopposed) causes (or has the potential to cause) a change in the motion of an object

Regardless of how you define the term, forces are at work on everything around us all the time. Forces cannot be seen, but their *effects* can be seen and felt. Whether an object or body is at rest or in motion, forces are acting on it. Whether you are sitting at your desk, running around a track, sleeping in your bed or jumping out of an aeroplane, forces are acting on your body.

Forces can affect objects in different ways, as shown in Source 1.

Action	Example	Image
Begin to move	Force from the golf club is transferred to the golf ball, causing it to move.	
Speed up	Force from the muscles is transferred to the ground, causing the sprinter to accelerate.	
Slow down or stop	Force from the brakes of the bicycle are transferred onto the rim of the wheel, slowing it down or bringing it to a stop.	
Change direction	Force from the tennis racquet is transferred to the ball, causing it to change direction.	
Change shape	Force from the leg of the soccer player is transferred to the ball, causing it to change shape momentarily (as it absorbs the force) and begin to move.	
Stay still	Forces from gravity and the weight of the air pulling down on the athlete are in balance with the force of the ground pushing up against her.	

SOURCE 1 Whether an object or body is at rest or in motion, forces are acting on it. The many effects that forces can have on objects are explained here.

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Internal and external forces

internal force a type of force that is generated inside the body (e.g. muscles inside the body contracting and relaxing to pull on tendons and joints to generate movement)

external force a type of force that is generated outside the body or through an interaction with the body and the external environment (e.g. gravity, resistance from the air or water, contact with other objects or people)

Forces can be separated into two broad categories based on where and how they are generated. These are:

- **internal forces** – generated inside the body, and include movements and reactions that are the result of muscles inside the body contracting and relaxing to pull on tendons and joints. They also include the movements of other internal organs and systems, such as the beating of the heart or the movement of blood through the circulatory system.
- **external forces** – generated outside the body (or are the result of an interaction between the body and the external environment). They include things like gravity, resistance (from the air or water), or contact with other objects or people.

Source 2 shows a player taking a mark in a game of Australian football, exemplifying internal and external forces at work. Internal forces generated by the player's muscles propel him into the air and help him move into position, while external forces such as gravity, air resistance and other players are all interacting with his body.



SOURCE 2 Taking a mark in Australian football demonstrates a number of internal and external forces at work

Types of external forces

There are two main types of external forces:

- **contact forces** act on objects that come into direct contact with each other
- **non-contact forces** act on objects without coming into contact with them.

We will now learn about these types of forces in more detail.

contact force a type of force that acts on objects that come into direct contact with each other (e.g. friction force, drag force)

non-contact force a type of force that acts on objects without coming into contact with them (e.g. gravitational force)

Contact forces

Most of the forces encountered during sport and physical activity are contact forces. This is because every sport involves some kind of contact between objects and bodies.

There are many different contact forces. Six of the most common forces are introduced in Source 3.

Type of contact force	Description	Example	Image
Ground reaction force	A force exerted by the ground on a body or object that is in contact with it	A person standing still on the ground is exerting a contact force on it that is equal to the person's weight. At the same time, an equal and opposite ground reaction force is exerted by the ground on the person.	
Joint reaction force	A force that is generated by two bones acting on each other across a joint	A volleyball player jumping to spike the ball places pressure on their knee joints during take-off. The upper and lower leg bones push against each other through the cartilage in the knee and generate a joint reaction force.	

Retrieve it!

What are the two structures that provide support and function around synovial joints? Check back to Lesson 3.3 The structure and function of joints (page 107) to see if you retrieved the information correctly.

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Type of contact force	Description	Example	Image
Friction force	A force that is generated by the surface of an object rubbing against the surface of another object	A lawn bowl travelling across a bowling green slows down as it approaches the jack. This is because the surface of the bowl is rubbing against the surface of the green. This slowing is due to friction force.	
Drag force	A force that is generated by a fluid (e.g. air or water) opposing the movement of an object	As a freestyle swimmer moves their body through the water, they are being slowed down by the contact between their body and the water. As their arms move through the air to complete each stroke, they are also being slowed down by the air. This slowing effect is due to drag force.	
Inertial force	A force that is generated by the resistance to change in the velocity of an object	A rugby league player who is tackled while running at full speed drops the ball on impact. The ball continues to move forward due to inertial force.	
Elastic force	A force that is generated by the resistance of an object to change shape	A tennis ball that is hit hard during a serve is instantly deformed as it absorbs the impact from the racquet. The ball returns to its original shape due to elastic force.	

SOURCE 3 The six most common contact forces are ground reaction force, joint reaction force, friction force, drag force, inertial force and elastic force.

An example of how force can be used to increase the effectiveness of training and proper technique is discussed in "Theory in action: How swimmers use drag force for training" (page 132).

Non-contact forces

Although the majority of the forces experienced by athletes during sport and physical activity are contact forces, there are also a small number of non-contact forces acting on athletes. The most important of these is introduced in Source 4.

Type of non-contact force	Description	Example
Gravitational force	A force that attracts a body or object towards the centre of the Earth (or towards any other body that has mass)	Gravitational force gives every person on Earth their weight and pulls them back to the ground when they are airborne. Athletes use their weight to generate force against the ground, which enables them to run and jump. When a gymnast executes an aerial skill, gravitational force pulls their body back to the ground.

SOURCE 4 The most common non-contact force in sport and physical activity is gravitational force.

For the record!

Weight and mass are not the same thing!

Weight is a measure of how much gravitational force is pulling on an object.

Mass is a measure of how much matter (i.e. particles and atoms) there is in an object.

On the Moon, a human body would have the same mass (in kilograms) as it has on Earth, but a much lighter weight (in newtons). That's because weight is a measure of force and the gravitational force of Earth is much higher than the gravitational force of the Moon.



On Earth
Gravitational force = 9.8 m/s²
Mass: 100 kg
Weight: 980 N



On the Moon
Gravitational force = 1.6 m/s²
Mass: 100 kg
Weight: 160 N

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Theory in action How swimmers use drag force for training

While minimising drag force is critical when competing, some swimmers prefer to train with equipment and/or conditions that create small amounts of drag. For example, a swimmer might practise without a swimming cap or without shaving to create resistance and increase the difficulty of the workout.

Other more extreme examples include training while towing a parachute-like object (see Source 5), wearing a drag suit or simply swimming in boardshorts. When competition time approaches, swimmers switch back to a minimal drag routine and move faster in the water.

The research suggests that drag suits, while a valuable training tool, are best used for shorter, higher intensity sets, and that ample rest time is important to allow swimmers to maintain proper technique and form. Any drag equipment should be used sparingly and as just one part of a training regime to increase speed and improve technique.



SOURCE 5 Swimmers can use drag force during training to improve their strength and technique. Increasing drag force can be achieved in a number of ways, including wearing a special drag suit or using equipment such as a swim parachute.

Forces in action

For any movement to occur in a sport or physical activity, the internal force applied by an athlete needs to be greater than the sum of the external forces acting on their body. For example, to change direction quickly to avoid an opponent, a footballer needs to generate enough internal force to overcome the external forces acting against them. These include contact forces (such as ground reaction force and friction force), as well as non-contact forces (such as gravitational force).

Using the same logic, a long jumper will jump further by generating enough internal force to accelerate to the board faster and apply a greater force on take-off, than if they were to run slowly to the board and apply less force on take-off.

Gravity is a constant external force acting on the human body. As a result, the body adapts to it in every action it completes. While gravity can restrict our movement in some circumstances, there are many occasions where the force of gravity acting upon us enhances our performance.

For example, in the case of friction force between a foot and the ground, the downwards force of gravity gives athletes their weight. The body applies this weight force to the ground and the ground responds by exerting a ground reaction force up on the body. Friction force is directly proportional to the ground reaction force, and this provides the grip that enables athletes, such as sprinters, to propel themselves forward when running.



SOURCE 6 Internal and external forces are acting on a sprinter's body to enable movement.

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Check your learning 3.7

Check your learning 3.7: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which of the following forces acts against the movement of an athlete trying to run faster?
   A Isometric force
   B Friction force
   C Muscle force
   D Drag force

2 Choose the correct answer. Drag force is:
   A a type of contact force that is generated by a fluid (e.g. air or water) opposing the movement of an object.
   B a type of contact force that is generated by air opposing the movement of an object.
   C a type of contact force that is generated by water opposing the movement of an object.
   D a type of force generated by an object or implement being dragged along the ground.

3 In your own words, **define** the term "force".

4 **Explain** the key features of internal and external forces. Provide an example of each at work in your selected physical activity.

Analytical processes

5 Source 7 shows a basketball player preparing to perform a jump shot. **Analyse** the image and **explain** where the following contact forces are occurring:
   a ground reaction force
   b joint reaction force
   c elastic force.

6 "Theory in action: How swimmers use drag force for training" provides an example of how drag force can be used in the pool to enhance training. **Determine** how contact and non-contact forces could be used in your selected physical activity to enhance training and optimise performance. Provide three examples and include simple diagrams if required.

Knowledge utilisation

7 **Assess** how force has an impact on your performance in your current sport.



SOURCE 7 A basketballer about to perform a jump shot.

Lesson 3.8
Force production

Key ideas

→ Force production is the ability of the body to generate internal force (movement) against an external force (resistance).

→ Momentum, summation of forces and impulse are biomechanical concepts that combine to produce force.

→ We can apply formulas to calculate biomechanical concepts such as momentum, summation of forces and impulse.

Learning intentions and success criteria

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Defining force production

force production a general term used to describe the ability of the body to produce internal force (i.e. movement) in order to overcome one or more external forces (e.g. gravitational force, drag force, friction force)

momentum a term used to describe the tendency of a moving object to continue moving (in a straight line); the mass (e.g. in kilograms) of an object multiplied by its velocity (e.g. metres per second)

summation of forces a term used to describe the sequential combination of forces produced by different parts of the human body acting together to maximise force production

impulse a term used to describe the change in momentum that occurs over time when force is applied to an object

Force production is a general term used to describe the ability of the body to generate internal force (i.e. movement) against an external force (i.e. resistance). The ability of the body to produce force is one of the most defining aspects of being alive. It is also an essential part of every type of sport and physical activity.

It is important to note, however, that most sports require athletes to not only produce force but also to control it. For example, in sports where success is measured in terms of achieving the greatest distance or speed (e.g. shot put, weightlifting, swimming), it can be beneficial for athletes to produce as much force as possible. However, in sports where success is measured in terms of achieving the greatest accuracy (e.g. lawn bowls, archery, darts), it can be beneficial for athletes to carefully control the production of force.Internal force production also needs to be balanced with a number of other external factors. In fact, force production is often the combined result of several different biomechanical concepts. These include:

- **momentum**
- **summation of forces**
- **impulse**.

We will now look at each of these concepts in more detail.

Momentum

Momentum is a term used to describe the tendency of any object in motion to continue moving. In other words, it is a measure of the quantity (amount) of motion that an object possesses.

If an object has zero velocity (i.e. it is not moving), then it has zero momentum. The higher the mass of the object (measured in kilograms) and the higher the velocity, the greater the momentum.

There are many sports in which momentum can have a significant impact on the result. For example, in sports such as rugby league, ruby union and Australian football, where impact and collision situations (e.g. in the form of tackles) are part of the game, momentum plays an important role in the performance of individual athletes and the overall result.



SOURCE 1 Momentum is a measure of the quantity (i.e. amount) of motion that an object possesses. For example, the momentum of this gym sled being moved can be measured by multiplying mass by velocity.



SOURCE 2 In sports such as rugby union, collision situations (in the form of tackles) are a big part of the game. As a result, momentum plays an important role in the performance of individual athletes and often influences the overall result

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Worked example 3.8A Calculate it!

Momentum

The momentum of any object (measured in kilogram metres per second) is equal to the mass (measured in kilograms) of an object multiplied by its velocity (measured in metres per second). It can be expressed as:

momentum(p) = mass(m) × velocity(v)

or

$p = mv$

Example

A gym sled weighing 50 kilograms is moving at a velocity of 4 metres per second across synthetic turf. Calculate its momentum.

Answer

momentum(p) = mass(m) × velocity(v)

p = 50 kg × 4 m/s

p = 200 kg m/s

Rearranging the formula

If you are missing velocity but know momentum and mass, you can rearrange the formula as follows to calculate the velocity:

velocity(v) = momentum(p) ÷ mass(m)

Alternatively, if you are missing mass but know the momentum and velocity, you can calculate mass as follows:

mass(m) = momentum(p) ÷ velocity(v)

Important: Make sure you use the correct units when conducting your calculation.

Retrieve it!

In the dynamic systems approach, an individual's strength is what type of constraint? Check back to Lesson 2.4 The dynamic systems approach to motor learning (page 52) to see if you retrieved the information correctly.

conservation of momentum a biomechanical principle (i.e. law) that states that momentum cannot be lost. Instead, whenever two objects collide, their combined momentum will be the same after the collision as it was before

Conservation of momentum

Energy cannot be created or lost – it can only be transferred or changed from one form to another. **Conservation of momentum** is a similar principle (or law) that states that momentum cannot be lost. Instead, whenever two objects collide, their combined momentum will be the same after the collision as it was before (i.e. it will be conserved).

For example, in ten-pin bowling, when a bowling ball travels down the lane towards the pins it does so with a certain momentum (i.e. the product of its mass and velocity). By contrast, the pins at the end of the lane have zero momentum because they are not moving (i.e. they have zero velocity).

According to the principle of conservation of momentum, the quantity of momentum possessed by the bowling ball before the collision will be the same as the total momentum after the collision. Instead of being lost, some of the momentum will simply be transferred to the pins at the point of collision. As a result of the collision, the pins move – increasing their velocity and gaining momentum. At the same time, the bowling ball slows down – decreasing velocity and losing the exact same amount of momentum. Overall, the momentum remains the same (i.e. is conserved).



SOURCE 3 Conservation of momentum is a biomechanical principle (i.e. law) that states that momentum cannot be lost – instead, it is just transferred from one object to another. Here, momentum is transferred from the bowling ball to the pins.

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Summation of forces

Summation of forces is a term used to describe the sequential combination of forces produced by different parts of the human body acting together to maximise force production. In other words, when a person is moving their body or an object, several different parts of the body all act together (in a particular order) to maximise the force that is being produced and/or being transferred to the object.

Elite athletes in all sporting disciplines spend years practising the relevant range of movements required to perform specialised movement sequences in their chosen sports. This practice helps to ensure their timing and the order of the various sub-routines is efficiently transferring appropriate force to perform the movement sequence.



SOURCE 4 The summation of forces generated by all parts of the body allows long jumpers to propel themselves further through the air.

For the record!

The terms **force** and **momentum** are sometimes used interchangeably, but they are not the same!

- **Force** = the **mass** of an object multiplied by its **acceleration**
- **Momentum** = the **mass** of an object multiplied by its **velocity**

Simultaneous summation of force

In some sports and physical activities, producing the greatest amount of force possible is the goal. For example, athletes competing in events such as long jump or high jump aim to produce maximal force and use it to propel themselves as far or as high as possible. They do this by harnessing the power of almost every part of their body at the same time to maximise force production. This is referred to as simultaneous summation of force.

Sequential summation of force

In other sports and physical activities, producing smaller, more controlled amounts of force is the goal. For example, a netball or basketball player shooting to score will aim to produce a carefully controlled amount of force to propel the ball with high accuracy. They do this by primarily using their arms, with their wrists and fingers used to make fine accuracy adjustments to shoot the ball. This is referred to as sequential summation of force.

In reality, summation of forces occurs when all body parts act together sequentially rather than simultaneously (see Source 6). Generally, the strongest and lowest body parts around

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the **centre of gravity** (such as the torso and thighs) move first, followed by the weaker, lighter and faster extremities (such as arms, hands and fingers). This process helps to maximise force by transferring momentum and energy from one body part to another.

Summation of force is influenced by a number of factors. These include:

- **the number of body parts used in the movement** – e.g. using as many body parts as possible enables force to be generated over a greater time
- **the order and timing of the body parts involved in the movement** – e.g. activating the stronger and larger muscles first and weaker, lighter muscles last
- **the force and velocity generated** – e.g. transferring momentum from one body part to another when it is at its maximum velocity
- **the way in which the body and each body part is stabilised and balanced** – e.g. ensuring that a stable base for maximal **acceleration** of body parts is present so that momentum can be transferred successfully from one body part to another.

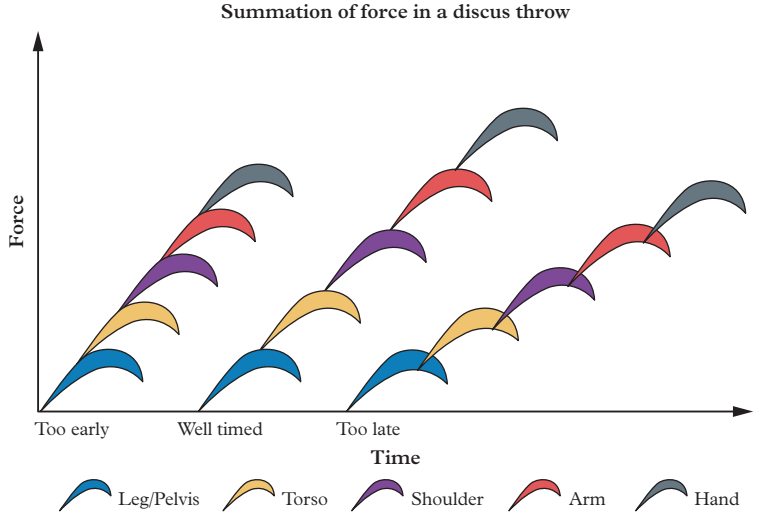


SOURCE 5 A discus thrower combines the force generated in their legs, torso and arms to maximise the force they can apply to propel the discus as far as possible. This is referred to as sequential summation of force.

centre of gravity the central point of an object, around which all of its weight is evenly distributed and balanced

acceleration a measure of how quickly or slowly the velocity of an object changes over time

A discus thrower, for example, will use the larger muscles in their legs, followed by their torso muscles, upper arm muscles and finally their forearm and hand muscles to release the discus. The successful generation of maximum force requires that each of these body parts transfers its force to the next body part through the use of stabilisation. The order and timing of each body part's force production is crucial for the successful summation of force. For best results, movement begins with the larger, slower body parts and finishes with the smaller, faster body parts.



SOURCE 6 Force production is maximised when body parts generate and produce force sequentially, from the legs through to the hand. This is known as summation of forces and relies on the order and timing to be correct in order to maximise force.

Retrieve it!

What is the difference between a motor skill and a motor reflex? Check back to Lesson 2.1 Introduction to motor learning (page 32) to see if you retrieved the information correctly.

For the record!

In rugby union, the average male lock weighs more than 100 kilograms. It would take more than a total of 950 newtons to lift him to full height during a lineout!

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Worked example 3.8B Calculate it!

Summation of forces

As you have learned, summation of forces involves the sequential combination of forces produced by different parts of the body. It is extremely difficult to measure the individual forces (of the parts of the body) and is certainly not a case of combining the separate forces. This is because forces are dynamic and hard to isolate, and they change in direction and magnitude as the athlete moves.

At a Senior PE level, we use a simple calculation for determining the total force that can be imparted on an object when we summate force. Force (measured in newtons, expressed as N) is equal to the mass of the object (measured in kilograms) multiplied by its acceleration (measured in metres per second squared).

It can be expressed as:

Force(F) = mass(m) × acceleration(a)

or

$F = ma$

Example

Charlie, a 16-year-old athlete, is training for a shot put competition. The shot put he uses has a mass of 4 kilograms. During the throw, Charlie engages his muscles through the wind-up phase and causes the shot put to accelerate from rest to 8.8 m/s^2. Calculate the total force applied to the shot put at the point of release.

Answer

Force(F) = mass(m) × acceleration(a)

$F = 4$ kg × 8.8 m/s^2

$F = 35.2$ N

Rearranging the formula

If you are missing mass but know acceleration and force, you can rearrange the formula as follows to calculate the mass:

mass(m) = force(F) ÷ acceleration(a)

Alternatively, if you are missing acceleration but know the mass and force you can calculate acceleration as follows:

acceleration(a) = force(F) ÷ mass(m)

Important: Make sure you use the correct units when conducting your calculation.



SOURCE 7 Impulse is a term used to describe the amount of force needed to change the momentum of an object. A hockey player can use an understanding of impulse when performing a push pass to generate more momentum by keeping the ball in contact with their stick for longer.

Impulse

Impulse is a term used to describe the change in momentum that occurs over time when force is applied to an object. To change the momentum of an object, a force needs to be applied over a certain period of time. In other words, the impulse of an object is the measurable change in the quantity of momentum over time.

An understanding of impulse in sport and physical activity can be useful because, by considering both force and time, an athlete can either minimise or maximise the transfer of momentum.

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It is important to understand that the amount of force needed to change the momentum of an object varies depending on the amount of time that the force is applied to it. A small force applied over a long period of time can be just as effective as a large force applied over a short period of time. For example, in a game of hockey, a player performing a push pass generates more velocity and momentum on the ball the longer the ball stays in contact with their stick.

Shot putters and discus throwers also increase the time over which they apply force to their implements by using techniques (e.g. rotational technique or glide technique) that result in greater impulse being applied and a greater velocity on release.

In some striking and fielding sports, such as baseball and cricket, the time the bat is in contact with the ball is very brief. In these situations, to increase the amount of force transferred from the bat to the ball (i.e. to make it travel as far or as fast as possible), the batter can follow through to increase the contact time between bat and ball.

Alternatively, some sporting techniques use impulse to reduce the amount of force on a ball by increasing the time over which the force is working. Soccer players often move their bodies in the same direction as the ball when receiving chest passes. This reduces the force on the ball by increasing the time that the force is applied. This process results in the ball dropping to ground rather than bouncing off them.



SOURCE 8 Some sporting techniques use impulse to reduce the amount on force of an object by increasing the time over which the force is working. Soccer players often use this technique when receiving chest passes.

Study tip

Data is key!
As you analyse and develop your specialised movement sequences using biomechanical principles, be sure to record and document your progress.

- Record the changes you are making to the phases and sub-routines within the sequences.
- Make notes of all the techniques you have tried and compare them to your optimised technique.
- Write a brief description of how one or more biomechanical principles have helped to optimise your specialised movement sequence.
- Include specific examples, images and/or video recordings from your performances to demonstrate how your overall movement strategies have been optimised as a result of this process.

Worked example 3.8C Calculate it!

Impulse

Impulse (measured in newton seconds) is equal to the force applied to an object (measured in newtons) multiplied by the length of time that it was applied (measured in seconds).

This calculation can be expressed as:

$\text{Impulse}(J) = \text{force}(F) \times \text{time}(t)$

or

$J = Ft$

Example

Yifan, a wing on the football team, kicks a long ball. Her foot applies a force of 190 newtons to the ball for 0.23 seconds. What is the impulse applied to the ball?

$\text{Impulse}(J) = \text{force}(F) \times \text{time}(t)$

$J = 190\ \text{N} \times 0.23\ \text{s}$

$J = 43.7\ \text{N s}$

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Rearranging the formula

If you are missing time but know force and impulse, you can rearrange the formula as follows to calculate time:

time(t) = impulse(J) ÷ force(F)

Alternatively, if you are missing force but know the impulse and time you can calculate force as follows:

Force(F) = impulse(J) ÷ time(t)

Important: Make sure you are using the correct units when conducting your calculation.

Check your learning 3.8

Check your learning 3.8: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. A basketballer weighing 75 kilograms jumps for a slam dunk. They reach their peak jump height in 0.5 seconds, accelerating upwards at 8 m/s². In summating their forces, what force is exerted by the player on the ground during the jump?

A 300 N
B 600 N
C 900 N
D 1200 N

2 Choose the correct answer. Which of the following statements best describes the relationship between momentum, summation of forces and impulse?

A More force applied (higher summation of forces) and greater momentum will always lead to increased impulse.
B More momentum and increased impulse will result in greater summation of forces.
C More force applied (higher summation of forces) or a shorter application time (reduced impulse) results in a greater change in momentum.
D More force applied (higher summation of forces) or a longer application time (increased impulse) results in a greater change in momentum.

3 **Identify** the missing words to complete this paragraph:

When forces are created sequentially by body parts it is known as _____. Force and _____ are closely related. Momentum is the product of _____ and _____. In order for the momentum generated by a body part to be transferred to another body part or to an external object, _____ must occur. _____ is the application of force over time. The greater the _____ and _____, the greater the change in momentum.

4 In relation to question 2, give three examples from your selected physical activity to illustrate the relationship between momentum, summation of forces and impulse.

Analytical processes

5 **Identify** one specialised movement sequence from your selected physical activity.

a **Determine** the body parts used (and the order in which they are used) to produce the desired level of force to complete the skill (i.e. from start to finish).
b **Construct** a simple graph (similar to Source 6, page 137) to show the order, timing and relative contribution of each body part to the total quantity of force produced.

Knowledge utilisation

6 Cricket bats come in different weights to suit the needs of different players. Assuming Player A and Player B below are the same mass and hit the ball with the same force, **identify** which player has the potential to gain maximum momentum on the cricket ball. **Justify** your position in a 150-word response.

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- Player A uses a bat weighing 1.27 kilograms.
- Player B uses a bat weighing 1.04 kilograms.

7 **Critique** the body position of the discus thrower shown in Source 9. **Assess** how effectively they appear to be applying the principle of summation of forces. Make reference to the engagement and sequencing of body parts in your response.

8 Imagine you are observing a novice volleyball player perform a spike with a fist, hitting the ball with a short swinging action (i.e. their hand is in line with their head during the back swing). **Evaluate** this player's technique. **Justify** changes to their technique, referring to the principle of impulse.



SOURCE 9 A discus throw requires the summation of forces to propel the discus forward.

SKILL DRILL

Lesson 3.9

Evaluate the impact of summation of forces on force production

Aim

To evaluate the impact of summation of forces on force production

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Netball
- Measuring tape
- Data Collection Instrument 4 (DCI 4)

Template: Data Collection Instrument 4 (DCI 4)

Method

Step 1

Form groups of three (one thrower and two measurers).

Step 2

The thrower in the group throws a netball multiple times under the conditions listed below.

a Sitting with your back against a wall, legs straight out in front, using only your throwing arm (ensure your back stays against the wall throughout the throw).

b Sitting with your buttocks on a line, legs straight out in front, using only your torso and arms.

c Standing with feet shoulder-width apart, toes to a line.

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d Standing side-on with feet shoulder-width apart, front foot to a line.

e No restrictions (may run or take a "crow hop") but must release the ball before a line.

Step 3

The measurers measure the distance the ball travels from the point it is thrown to the first contact it makes with the ground and then record it in the Distance column of DCI 4.

Step 4

Repeat steps 2 and 3 until all members of the group have had a turn at throwing.

Step 5

Record your results in DCI 4.

Throwing condition	Measure from	Distance (m)	Muscle groups activated
a. Sitting against a wall	The wall		
b. Sitting on a line	The line		
c. Standing with feet apart, toes to a line	The line		
d. Standing side-on to a line	The line		
e. No restrictions (can move)	The line		

SOURCE 1 DCI 4

Analysis and discussion tasks

1 Before considering the data from your experiment, it is useful to apply some prior knowledge to help start the process of understanding your findings. What do you notice about the number of muscles that are activated as you move through the conditions?

2 Gathering primary data can allow you to identify patterns, trends and relationships in your physical performance. **Identify** patterns, trends and relationships in the primary data that you gathered in DCI 4.

- **a** Which of the throwing conditions (a–e) produced the most force?
- **b** Convert your results to a line graph with Distance (m) on the *y*-axis and Conditions a–e listed along the *x*-axis.
- **c** What pattern do you notice when looking at the distance thrown and the conditions in this experiment?
- **d** **Explain** the relationship between muscle activation and distance achieved when throwing a ball. **Use** the format: "As muscle activation _____, the distance the ball can be thrown _____".

3 After investigating secondary sources of data on force summation, you can consider additional information to form valid conclusions about the impact of increased muscle activation on producing force. **Analyse** the secondary data in Source 2.

- **a** **Identify** the role of sequencing and timing of muscle activation in effective force summation.
- **b** How did the conditions set up from a to e in this experiment replicate the ideal sequencing for force summation? Was there a way to control for timing in each condition?

4 Once an initial analysis of data has been conducted, it is important to use the information to develop strategies to optimise performance.

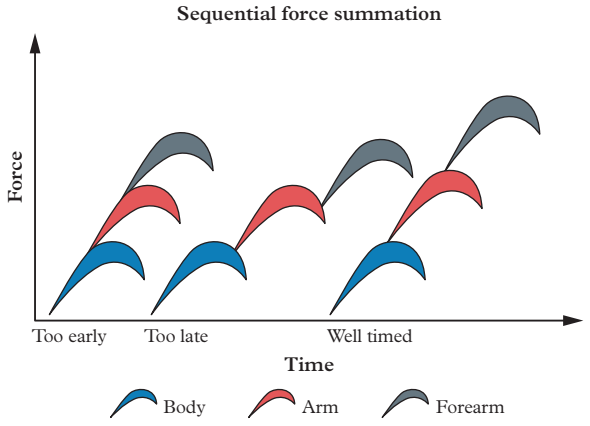
- **a** **Consider** your selected physical activity and select a specialised movement sequence that requires considerable force production (if any).
- **b** List the phases within the specialised movement sequence that combine to produce optimal force summation.
- **c** **Explain** how the timing and sequencing of the sub-routines within each phase contributed to optimal force production.
- **d** **Consider** a movement sequence in your selected physical activity that favours accuracy

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over force. **Compare** the phases within this movement sequence to the ones you listed in part b.

e Based on your understanding of force summation, make recommendations to either maintain or modify your performance of the specialised movement sequence you identified in part a. **Justify** your recommendations using primary data collected in this Skill drill and at least one other piece of secondary data..



SOURCE 2 Force summation is maximised when body parts generate and produce force sequentially

Lesson 3.10
Levers

Key ideas

- → Levers are simple machines designed to help move a heavy load.
- → There are three types of levers: first-class, second-class and third-class.
- → Levers play a role in the performance of physical activities.
- → Athletes may combine anatomical levers (i.e. from the body) with external levers (sporting equipment) to increase force (force multipliers) and speed (speed multipliers).

Learning intentions and success criteria

Defining levers

A **lever** is a simple machine consisting of a solid bar (or rod) supported by a pivot point. A lever is designed to help move a heavy load on one end of the bar when pressure is applied on the other end of the bar. In sport, a lever can increase the efficiency of movement, increase the speed of an object and help athletes produce force.

lever a simple machine consisting of a solid bar supported by a pivot point (fulcrum) designed to help move a load (resistance) on one end by applying effort (force) on the other end

How do levers work?

Levers have three main parts:

- the load – the object that is to be moved; also referred to as the **resistance** or **output force**
- the effort – the energy that is used to move the lever; also referred to as **force** or **input force**
- the pivot point – the point at which the lever pivots; also referred to as the **fulcrum**.

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Levers can make it easier to move heavy loads with less effort. Levers can also be used to increase the speed of an object. Levers are frequently used in sport and physical activity for this purpose.

The human body contains many levers made up of bones and muscles. In fact, our arms, legs and fingers are all types of levers. These levers allow the body to move and generate force. Many types of sporting equipment are also levers that allow us to hit objects faster and further (e.g. bats and racquets).

A solid understanding of how levers work can help athletes to modify their technique to move more efficiently and with greater effect.

first-class lever a type of lever in which the pivot point (fulcrum) is positioned between the effort (force) and the load (resistance)

second-class lever a type of lever in which the load (resistance) is positioned between the effort (force) and the pivot point (fulcrum)

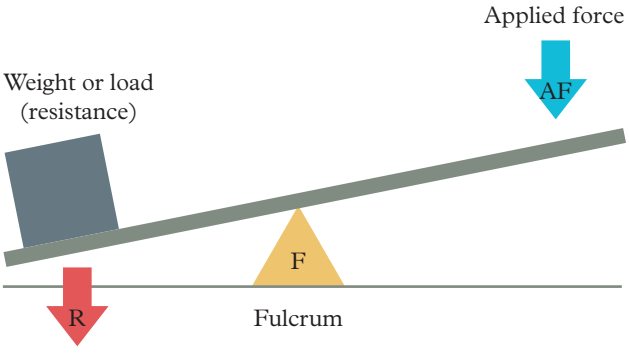
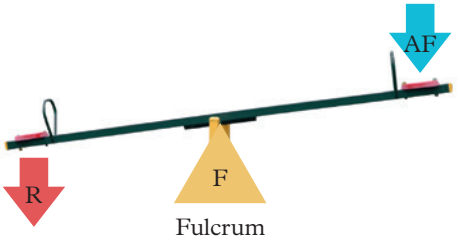
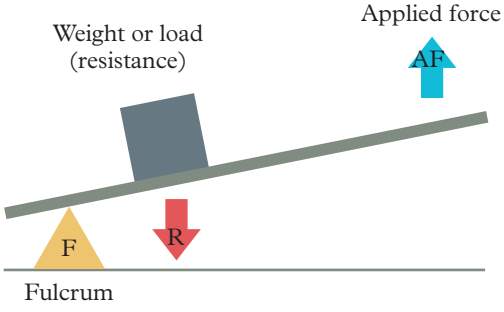
third-class lever a type of lever in which the effort (force) is positioned between the load (resistance) and the pivot point (fulcrum)

Types of levers

There are three different types of levers, all of which play a role in the performance of different sports and physical activities. They include:

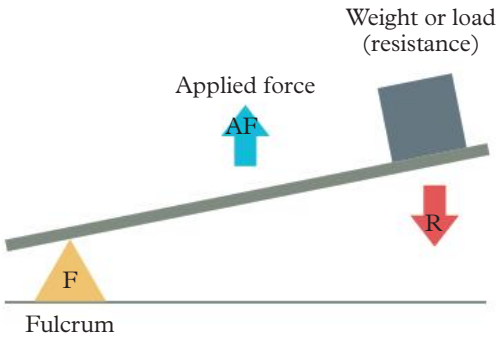
- **first-class levers** (where the fulcrum is positioned between force and resistance)
- **second-class levers** (where the resistance is positioned between the effort and the fulcrum)
- **third-class levers** (where the effort is positioned between the resistance and the fulcrum).

Each lever works slightly differently, as shown in Source 1. We will now look more closely at how each one functions.

Type of lever	Diagram	Example
First-class levers • In a first-class lever, the fulcrum is placed between the resistance and the force. That is, the pivot point is in the middle, with the load and effort at each end. • Resistance and force are applied in the same direction. • The most basic example of a first-class lever is a see-saw.		
Second-class levers • In a second-class lever, the resistance is placed between the fulcrum and the force. That is, the load is in the middle, with pivot point and effort at each end. • Resistance and force are applied in opposite directions. • The most basic example of a second-class lever is a wheelbarrow.		

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Type of lever	Diagram	Example
Third-class levers • In a third-class lever, the force is placed between the fulcrum and the resistance. • That is, the effort is in the middle, with pivot point and load at each end. • The most basic example of a third-class lever is a hammer being used to extract a nail.		

SOURCE 1 There are three types of levers. Every lever has a pivot point (fulcrum), a point at which a load is present (resistance) and a point at which force is applied (applied force).

Levers in the body

The bones, joints and muscles in our bodies function as levers. The long bones of our arms and legs are used as levers to help reduce effort in moving a load, and our knees and elbows are used as fulcrums.

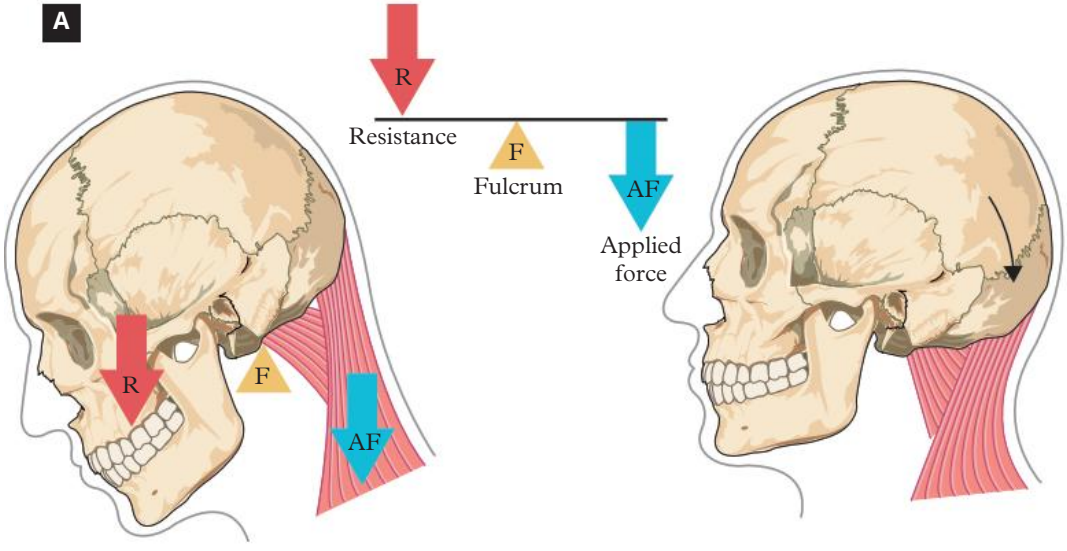
We will now look at some examples of the three different types of levers at work in the body and learn how these can be applied in sporting situations.

Study tip

A good way to remember the **middle position** of each type of lever is to use the mnemonic (i.e. memory trick) "**FLEE**":
- **F**ulcrum – first-class lever
- **L**oad – second-class lever
- **E**ffort – third-class lever
- **E**asy to remember!

First-class levers

While it is easy to find examples of first-class levers in the world around you, there are not many examples of first-class levers in the human body. One of the few examples of a first-class lever is nodding your head up and down (see Source 2).



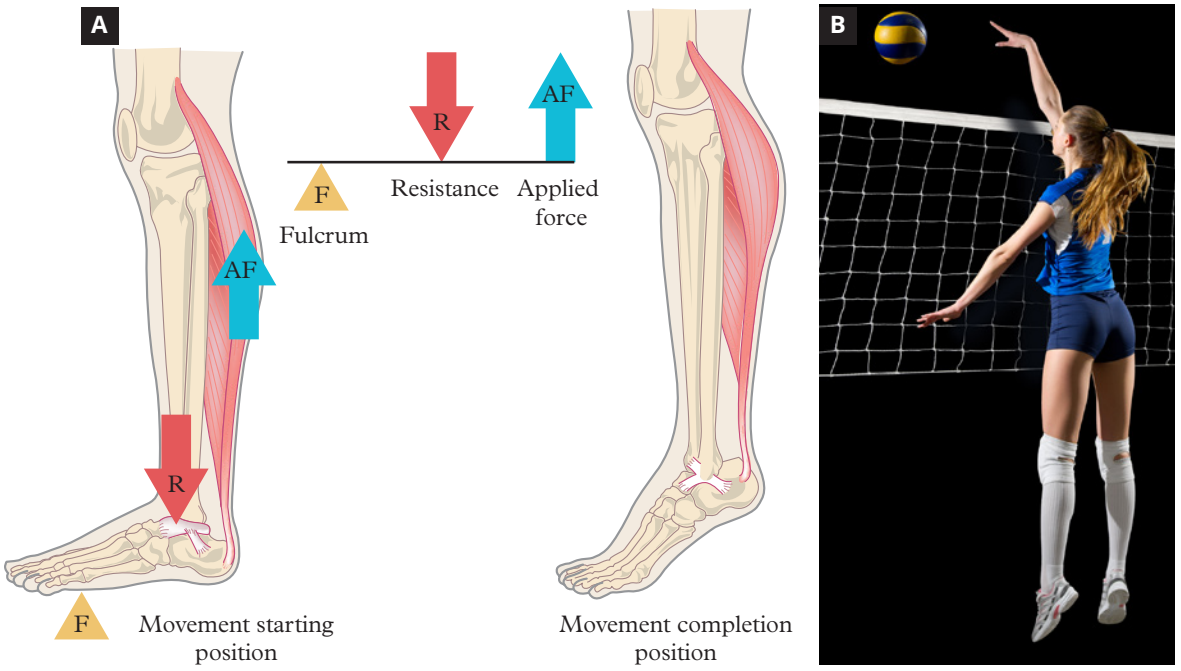
SOURCE 2 (A) Nodding your head up and down is an example of a first-class lever. This lever is commonly used in sport for heading a ball in soccer and packing into a scrum in rugby (B).

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Second-class levers

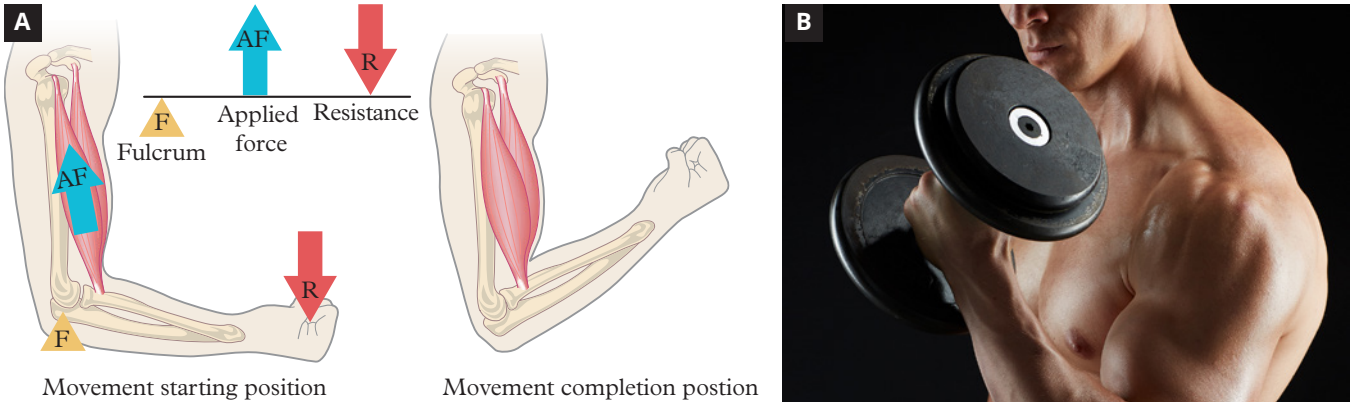
There are also few examples of second-class levers in the human body. One example of a second-class lever is standing on the ball of your foot (see Source 3).



SOURCE 3 (A) Standing on the ball of your foot is an example of a second-class lever. This lever is commonly used in sport (B) when jumping for height to complete a block in volleyball or to complete a jump shot in basketball.

Third-class levers

Third-class levers are the most common type of lever found in the human body. They are also the most widely used in sports and physical activities. This is because our bones are the resistance, joints become the fulcrum, and muscles, which provide the force, are inserted close to the joint for increased efficiency. One example of a third-class lever in the human body is performing a bicep curl (see Source 4).



SOURCE 4 (A) A bicep curl is an example of a third-class lever. This lever is commonly used in sport (B) when performing a bicep curl or hitting a ball in cricket, tennis or softball.

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Levers in sport and physical activity

Levers are used in all types of sports and physical activities to improve performance in different ways. Depending on the type of sport and the specific skill being performed, different types of levers can be more useful than others. For example, in certain sports we use bats and racquets to extend the levers in our arms and deliver a greater force and speed. The action or advantage gained from using a lever is known as **leverage**.

leverage the advantage gained from using a lever

Understanding the different effects levers can have in these situations is key to using them to your advantage.

Anatomical levers in sport

When it comes to performance in sport and physical activity, it is important to consider the effects of individual anatomy. "Natural" levers in the body (i.e. those created by our bones, joints and muscles) are commonly referred to as **anatomical levers**.

Retrieve it!

What are the six most common types of contact forces? Check back to Lesson 3.7 Force (page 129) to see if you retrieved the information correctly.

Taller people naturally have longer anatomical levers than shorter people. This creates the potential for more speed at the end of their levers. A longer muscle also has greater potential to exert more force, and this can contribute to generating greater speed. Athletes in striking and throwing events can have an advantage based on the length of their anatomical levers. Shorter athletes in these sports need to rely on excellent technique (e.g. using the summation of forces and the ability to transfer momentum) to optimise the result of their "natural" levers when performing in the same events. However, shorter athletes have natural advantages over taller athletes in other sports, such as weightlifting, gymnastics and diving.

As discussed earlier in this lesson, force is required to cause a lever to rotate around the fulcrum. Getting a lever moving from a stationary position can sometimes require additional force to overcome inertia (i.e. a reluctance to begin rotation). Longer levers require more strength to overcome this initial resistance. To make it easier to move and swing through with speed, athletes will often shorten the length of their body levers by bending their arms or legs. An example of this can be seen when running. As shown in Source 5, the leg remains bent in the back recovery phase to shorten the lever. This helps overcome inertia and increases the speed of the leg as it moves into the forward recovery phase. During the propulsion phase the leg is extended to lengthen the lever and deliver the maximum force and speed.

Retrieve it!

What is the formula for calculating force? Check back to Lesson 3.8 Force production (page 133) to see if you retrieved the information correctly.



SOURCE 5 Athletes can create short and long anatomical levers by moving their body parts to different positions, as shown here by this sprinter.

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SOURCE 6 Similar to the changes in a sprinter's legs shown in Source 5, in a tennis serve, the arm starts in the bent position before opening out to a straight position just before contact.

For the record!

The woomera is a wooden spear thrower that has been used by First Nations peoples on the continent we now call Australia for around 5000 years. Woomeras vary between 60 and 90 centimetres in length and are used as an extension of the human arm. This additional leverage allows the spear to travel around three times further than it would with the arm alone.



The process of kicking a ball in soccer is very similar. The kicking leg starts in the bent position before opening out to a straight position just before contact.

A similar approach is adopted with the arms in other sports, such as tennis (see Source 6), cricket, volleyball and javelin. In all these examples, the arm lever is shortened to overcome the arm's inertia, which generates more speed as the weight of the lever moves closer to the fulcrum (i.e. the shoulder). This action increases the rotational momentum generated from the torso and is a technical aspect that can significantly increase the speed of a lever. For accuracy, it is important that the lever is straightened at the point of contact to ensure the maximum speed and force is transferred to the ball or object. If a performance lacks speed or force, it is possible that an athlete is not taking full advantage of levers.

Force multipliers and speed multipliers in sport

In many types of sport and physical activities, athletes combine the use of anatomical levers (i.e. internal levers) with sporting equipment such as bats and racquets (i.e. external levers). Some of this equipment helps athletes to multiply (increase) force, while others help them multiply (increase) speed. To understand which types of external levers are best suited to different sports and physical activities, it helps to divide them into two categories: force multipliers and speed multipliers.

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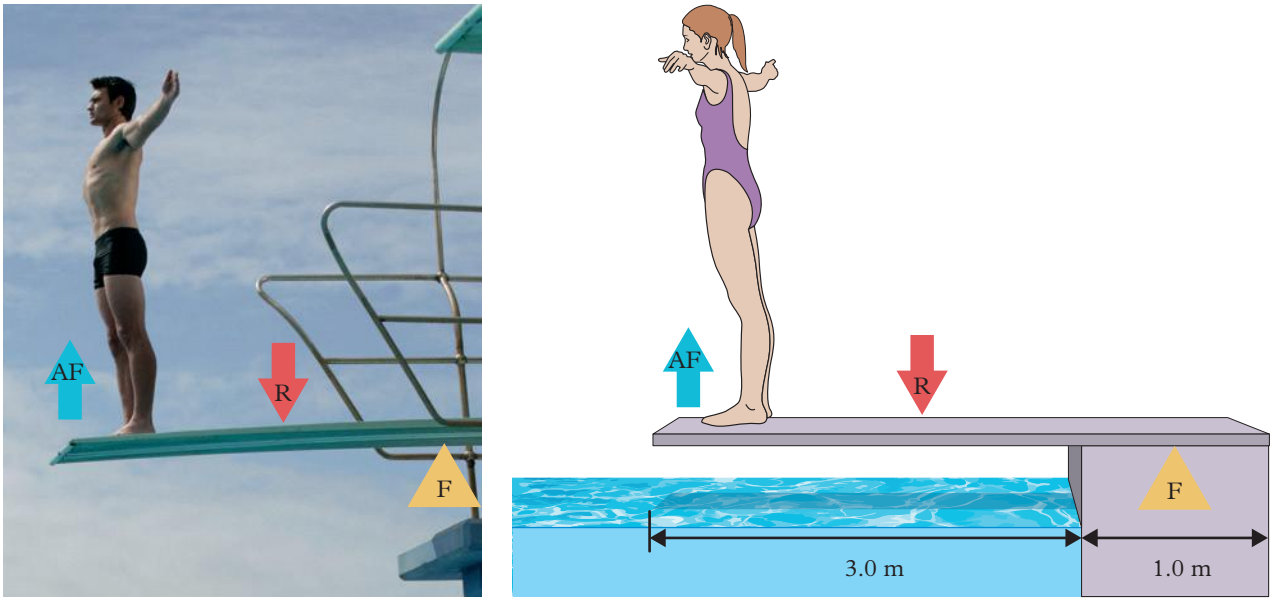
Force multipliers

Force multipliers **have a long force arm** that requires **less effort** (force) to move a heavier load (resistance). These kinds of levers are used to move heavy loads (objects). An example of a force multiplier being used in sport is a diver jumping off a springboard (see Source 7).

force multipliers levers that make it easier to move a heavy object with less force by increasing the distance over which the force is acting

During the dive, the force generated by second-class anatomical levers (i.e. in the feet and legs across the ankle joints) is combined with an external piece of equipment (i.e. a diving board). The board is an external second-class lever and a force multiplier because it increases mechanical advantage. By using the board, the diver is able to generate more force to produce a higher jump.

As shown in Source 7, the force is applied by the athlete to the end of the board. The resistance is supplied by the weight of the board. The fulcrum is located where the board is secured to the side of the pool (or ground). The result of these two force multipliers is greater height to perform the required skills.



SOURCE 7 A diving board is an example of a force multiplier. It helps a diver to multiply the force of a jump because it increases mechanical advantage. By using the board, the diver is able to generate more force to produce a higher jump.

Speed multipliers

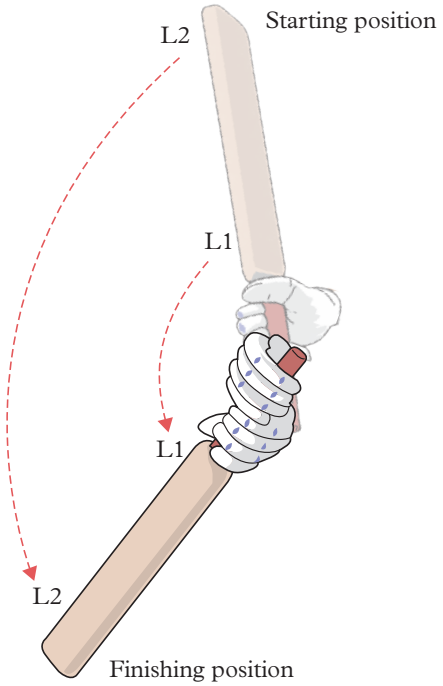
Speed multipliers **have a long resistance arm** that requires **greater effort** (force) to move a load (resistance). These kinds of levers are used to increase the speed of or distance travelled by an object. Any object or implement (i.e. piece of sporting equipment) that can increase the length of a resistance arm is classed as a speed multiplier. The increased movement offered by a longer lever means that the velocity at the end of a long lever is faster than the velocity at the end of a short lever. This means the end of a lever will move more quickly than any other point on the lever.

speed multipliers levers that can increase the speed of or distance travelled by an object

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SOURCE 8 A cricket bat is an example of a speed multiplier. It extends the lever of the arm to produce greater force and increase the speed of the object being hit (i.e. the ball).

An example of a speed multiplier being used in sport is a ball being hit by a cricket bat (see Source 8). Here, the end of the bat (the longer lever labelled L2) travels a longer distance than the middle of the bat (the shorter lever labelled L1) in the same amount of time. This means it is moving at a greater speed.

Athletes do not always need to use speed multipliers such as bats and racquets to increase speed. For example, in cricket, bowlers will generate more speed on the ball if they use a straight arm, because a straight arm lengthens the lever of their arm.

When it comes to speed multipliers, it is necessary to balance speed with accuracy. In other words, there is a limit to the optimum lever length. Increasing the length of a lever too much will create handling errors and reduce the accuracy with which an object can be hit. For example, the cricket player in Source 8 would not want to use a bat that is 4 metres long – even if it would technically allow them to hit the ball faster and over a longer distance – because the size of the bat would reduce control and accuracy.

For this reason, most bats and racquets available today come in a range of different lengths to suit athletes of different heights. Softball bats, tennis racquets, golf clubs and cricket bats are examples of implements that come in different lengths so that all athletes can maximise the advantages of using a third-class lever, based on their particular size and height. In addition to this, players may choose to "give up" a little bit of power and speed in exchange for accuracy by shortening their grip on their bat, racquet or club.

Check your learning 3.10

Check your learning 3.10: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Performing a chest pass in netball is an example which class of lever?
   - **A** First class
   - **B** Second class
   - **C** Third class
   - **D** Fourth class

2 Choose the correct answer. In a tennis serve such as the one pictured in Source 9, the racquet acts as a:
   - **A** force multiplier.
   - **B** resistance multiplier.
   - **C** velocity multiplier.
   - **D** speed multiplier.

3 Referring to Question 1, **explain** why you classified the netball chest pass this way. Draw a diagram to support your response.

4 **Explain** the difference between force multipliers and speed multipliers.

5 **Explain** the advantage a tall sprinter has over a short sprinter in terms of levers.

Analytical processes

6 **Consider** the average length of a softball bat. Draw a picture to explain why a bat that is too short and a bat that is too long can restrict performance.

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7 **Identify** two discrete skills from your selected physical activity this term. **Classify** each one using the table below (i.e. by providing a lever type, description and illustration).

Type of lever	Name and description of skill	Diagram (including labels: force, fulcrum, resistance)
First class		
Second class		
Third class		

8 Refer to Source 9. In this image, the tennis player uses the racquet as a lever to maximise force and velocity.

a At the point of impact with the ball, **determine** where the axis, resistance and force are.

b Use this information to **identify** the class of lever.



SOURCE 9 A young tennis player serving

SKILL DRILL

Lesson 3.11

Compare the effectiveness of levers in the production of speed in sport

Aim

To determine how levers can be used to gain an advantage in sport

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Measuring tape
- Baseball/softball tees (as many as possible to maximise efficiency)
- 20+ markers
- Baseball/softball bats
- Class set of softballs, baseballs or tennis balls
- Game Performance Assessment Instrument 4 (GPAI 4)
- Pen

Template: Game Performance Assessment Instrument 4 (GPAI 4)

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Method

Step 1

Run a tape measure from the tee into the field, marking every 5 metres with a marker.

Step 2

Form groups of five (one batter, one catcher and three recorders).

Step 3

Each group takes their positions on the field. In each group, the three recorders take position out in the "field" with markers, maintaining a safe distance from the hitting zone. The catchers also take position out in the field, ready to throw or roll balls back to the batting area.

Step 4

The batter in the group hits three balls off the tee, beginning each hit from the same "ready position" – feet shoulder-width apart, knees bent, bat drawn high over their dominant shoulder and elbows high.

It is important that the ball is struck consistently with the same degree of force and in the same spot in each of the following conditions:

- **Condition A –** Hold the bat with hands gripped in a neutral position in the middle of the handle.
- **Condition B –** Hold the bat with hands close to the hitting end of the bat in a position known as "choking" the bat.
- **Condition C –** Hold the bat with hands at the very end of the bat.

Step 5

The three recorders mark the final resting position of each ball with a marker.

Step 6

The batter completes GPAI 4.

Step 7

Rotate through the group so that each student gets a turn at batting, and so everyone can fill in GPAI 4 with their personal results.

			Level of control experienced during swing and contact		
Batting condition	**Length of lever (i.e. short, medium or long)**	**Approximate distance travelled (to the nearest metre)**	**High (i.e. result could be replicated consistently)**	**Moderate (i.e. result could be replicated most times)**	**Low (i.e. not confident about the degree to which the result would be replicated)**
Condition A					
Condition B					
Condition C					

SOURCE 1 GPAI 4

Analysis and discussion tasks

1 Identifying relationships or patterns in your data will help you form conclusions about your physical performance.
   - **a** **Summarise** your results.
   - **b** **Identify** any relationships or patterns between the length of the lever and distance travelled by the ball.

2 Primary data is most useful when it is gathered under controlled and stable conditions. This improves its validity and reliability.
   - **a** **Evaluate** the stability of the conditions across your three batting performances. What impact did control have on the reliability of the data that you collected in this experiment?
   - **b** How could you increase the control of this experiment? **Consider** the role of variables in your response.

3 Analysing secondary data can help you reach stronger conclusions about the data that you collect in your experiment.

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a **Determine** the relationship between lever length and force production by researching two secondary sources. (*Hint*: Start by reading about speed multipliers and force multipliers in Lesson 3.10 Levers, page 143.)

b **Evaluate** the degree to which your primary data aligns with the secondary data you gathered. **Justify** your response with specific examples from primary and secondary data.

4 The use of levers is not just about force production. Good performers need to find a balance between using levers to generate force and maintaining control of their skill execution.

a **Analyse** the image in Source 2 and explain how this hockey player is using her hands to change the lever length for optimal force production.

b What modification would the hockey player make to the lever length to optimise her control of the ball?

c **Identify** a specialised movement sequence from your chosen physical activity that involves the use of levers. Using primary and secondary data, **devise** a strategy for your use of the lever in optimising force production or optimising control. (*Hint*: levers can include the limbs of our body or external implements.)



SOURCE 2 In sport, a lever can increase the efficiency of movement, influence the speed of an object and help athletes produce force.

Lesson 3.12
Motion in physical activity

Key ideas

- → Motion is the change in position of an object over time caused by the application of force.
- → The study of motion is a key area of biomechanics.
- → Motion can be linear, curvilinear, angular or general.
- → We can apply formulas to calculate biomechanical concepts of motion such speed, velocity, displacement and acceleration.

Learning intentions and success criteria

Defining motion

Motion is the action or process of moving or being moved. To be more precise, it refers to the change in position of an object over time.

The study of motion – and the forces that contribute to this – is one of the key areas of biomechanics. For motion to occur in any object, a force must be applied to that object.

motion the action or process of moving or being moved; more specifically, the change in position of an object over time

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Retrieve it!

Which two types of bones are classified according to their location in the body rather than their shape? Check back to Lesson 3.2 The structure and function of bones (page 103) to see if you retrieved the information correctly.

This can be an:

- internal force – a force that is generated inside the body (e.g. movements and reactions that are the result of muscles inside the body contracting and relaxing to pull on tendons and joints)
- external force – a force that is generated outside the body or is the result of an interaction between the body and the external environment (e.g. gravity, resistance from the air or water, contact with other objects or people).

Motion is one of the most fundamental elements of sport and physical activity. Every sport on Earth involves motion of some kind – whether your sport involves the motion of bodies or implements (i.e. sporting equipment) or both.

This lesson will explore types and concepts of motion. Motion in physical activity will be further examined in the following lessons:

- Lesson 3.13 Newton's laws of motion (page 161)
- Lesson 3.14 Projectile motion (page 165)
- Lesson 3.15 Bernoulli's principle (page 171).

Types of motion

There are four main types of motion. They are:

- **linear motion**
- **curvilinear motion**
- **angular motion**
- **general motion**.

We will now look at each of these in more detail.

linear motion any movement that happens along a straight line

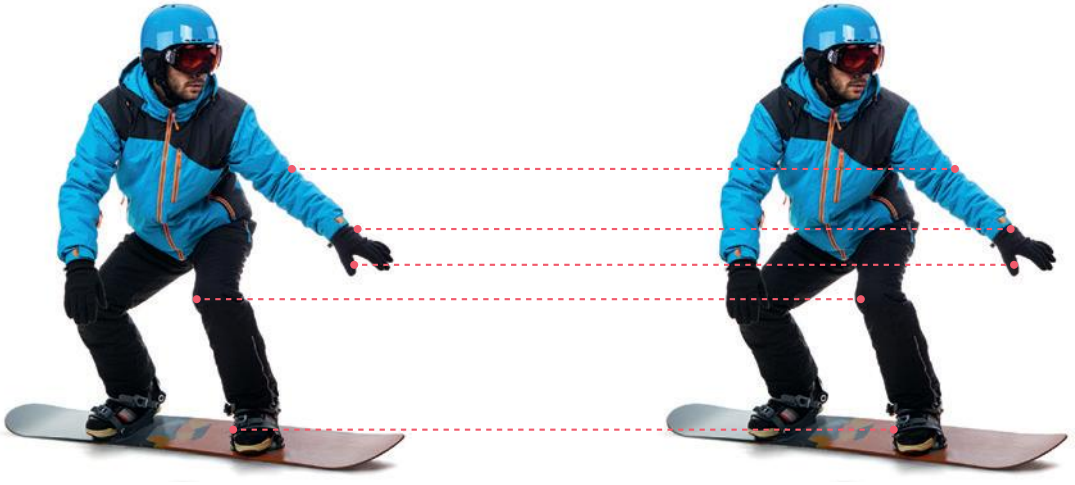
curvilinear motion any movement that happens along a curved line

angular motion any movement that happens along a circular line around an axis (i.e. central point)

general motion any movement that combines linear motion and angular motion

Linear motion

Linear motion is any movement that happens along a straight line. It is the most basic of all types of motion. To be truly considered linear motion, all parts of the object (e.g. a human body) must be moving in the same direction at the same time such that if lines were drawn connecting each body part at the start of motion to the same body part at the end, the lines would all be the same length (as shown in Source 1). For example, a snowboarder moving down a mountain slope in a straight line holding a set position is moving in linear motion.



SOURCE 1 Linear motion is any movement that happens along a straight line. A snowboarder moving down a mountain slope in a straight line holding a set position is an example of linear motion.

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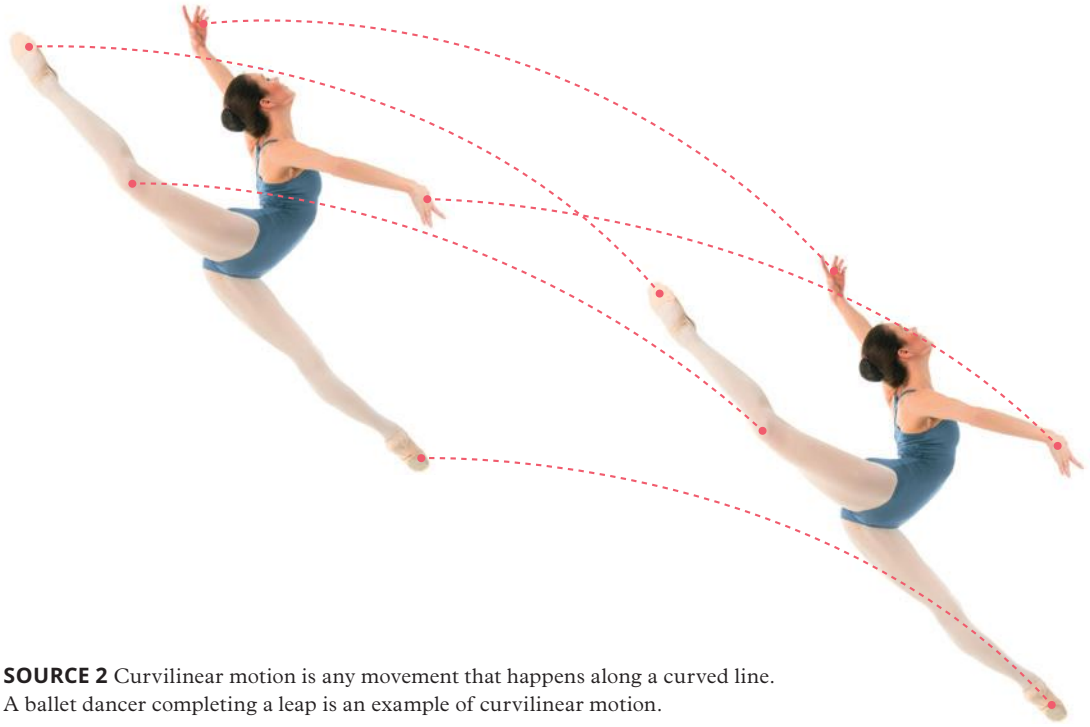
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Curvilinear motion

Curvilinear motion is any movement that happens along a curved line. For motion to be considered truly curvilinear, all parts of the object (e.g. a human body) must be moving in a curved line in the same direction at the same time.

Imagine a ballet dancer completing a grand jeté (split leap). As the dancer returns to the ground, they hold a set position. However, the momentum of their body combined with the effects of gravitational force pulling them back towards the ground results in a curved line (see Source 2). This is an example of curvilinear motion.

The natural arc of a tennis ball as it travels through the air after being lobbed is another example of curvilinear motion.



SOURCE 2 Curvilinear motion is any movement that happens along a curved line. A ballet dancer completing a leap is an example of curvilinear motion.

Angular motion

Angular motion is any movement that happens along a circular line around an axis (i.e. a central point) at the same angle, in the same direction, at the same time.

The axis around which angular motion occurs can be:

- internal – such as an arm rotating around the shoulder joint (i.e. axis) in a large circular "windmill" movement
- external – such as a gymnast rotating around a high bar (i.e. axis) during the execution of a giant (see Source 3).

Implements such as balls can also possess angular motion if they are spinning.



SOURCE 3 A gymnast swinging around a high bar performing a giant is an example of angular motion.

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General motion

General motion is the term used to describe movement that is a combination of linear motion and angular motion. Most of the movements studied in biomechanics are considered general motion.



SOURCE 4 General motion is any movement that combines linear motion and angular motion. This sprinter taking part in a race is an example of general motion. His arms and legs rotate in angular motion, propelling him forwards in linear motion.

When an athlete runs down a netball court in a straight line, they are creating angular motion. This is because their arms and legs are all moving along a circular line around an axis (i.e. all the joints in their body). At the same time, they are moving in a straight line, creating linear motion. This combination of angular and linear motion is an example of general motion.

Implements such as balls can also combine linear and angular motion in this way. A cricket ball bowled with a fast pace to a batter spins as it flies. As the ball is moving forward in a straight line while simultaneously pivoting on its own internal axis, it is also an example of general motion.

Describing and calculating motion

When investigating different types of motion, researchers and sports scientists need to use a common language to describe qualities of different types of motion. They also need a common system with which to calculate (or measure) them.

The most common concepts used to describe and measure different types of motion are listed in Source 5. An understanding of these concepts will help you to describe different types and qualities of motion accurately – both in your own performances and the performances of other athletes.

Concept	Definition	Formula	Unit of measure
Speed	A measure of the distance an object travels over time (e.g. 30 kilometres per hour)	$\text{speed} = \frac{\text{distance}}{\text{time taken}}$	Measured in metres per second (m/s) or kilometres per hour (km/h)
Velocity	A measure of the distance and direction an object travels over time (e.g. 30 kilometres per hour, due north)	$\text{velocity} = \frac{\text{displacement}}{\text{time taken}}$	Measured in metres per second (m/s) or kilometres per hour (km/h) usually with a direction or compass bearing attached

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Concept	Definition	Formula	Unit of measure
Acceleration	A measure of how quickly or slowly the velocity of an object changes over time	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$ $\text{acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time taken}}$	Measured in metres per second squared (m/s/s)
Displacement	A measure of the distance and direction travelled between a starting point and an end point "as the crow flies"	displacement = final position − initial position ("as the crow flies")	Measured in metres (m) or kilometres (km), often with compass direction
Distance	A measure of the length of space between two points	N/A	Measured in metres (m) or kilometres (km)

SOURCE 5 Common concepts used to describe and measure different types of motion

Speed and velocity

We will now look at how these concepts are used to describe and measure motion. Because real-life sporting situations often involve the combination of different types of motion all taking place simultaneously, the concepts used to describe and measure them are all interrelated. The examples below are designed to illustrate this.

As mentioned, speed describes how quickly an object is moving while velocity describes how quickly an object is moving in a certain direction. For example:

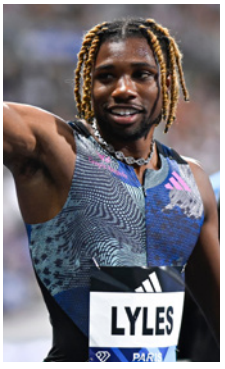
- the speed and velocity of a cricket batter running one run will be the same
- the speed and velocity of a cricket batter running two runs will be different.

The reason for this is the final position of the batter. A single run means they finish at the opposite end of the pitch (i.e. a different start and end point). The displacement here would be about 20 metres. Two runs means they return to where they started (i.e. same end and start point). The displacement here would be zero.

In other words, speed and velocity are equal only if movement occurs in a straight line. The difference is movement is not in a straight line. That is because velocity also measures displacement..

For the record!

Of the current crop of world-class sprinters, Noah Lyles is one of the fastest men on Earth, claiming the gold medal for the 100-metre final at the 2024 Olympic Games in Paris. Lyles won in 9.79 seconds and reached a top speed of of 43.5 km/h during the race. That is pretty fast, especially when considering the average sprinting speed for humans is 19–24 km/h. The final was extraordinary in that all eight runners finished in under 10 seconds – and all within 0.12 seconds of the winning time.



Worked example 3.12A Calculate it!

Speed

When calculating speed, the formula used is:

speed(s) = distance(d) ÷ time taken(t)

Example

Bonnie is a 17-year-old touch football player. Owing to her speed on the field, she usually plays in the wing position. Bonnie's maximum straight-line speed is 8 m/s. Her opposing player can run 49 metres in 7 seconds. Determine the likelihood of Bonnie being caught and touched by her opposing player during a full-field breakaway run towards the try line if both players run at their top speed.

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Answer

Step 1

Determine the maximum speed of the opposing player.

To calculate this, we can use the formula:

speed(s) = distance(d) ÷ time taken(t)

The opposing player runs 49 metres in 7 seconds so we substitute these values into the formula:

$s = 49 \div 7$

You can use a calculator or work it out in your head.

$49 \div 7 = 7$

Therefore, Bonnie's opposing player can run 7 m/s.

Step 2

You now need to circle back to answer the question: "Determine the likelihood that Bonnie will be caught by her opposing player." Bonnie runs at a maximum speed of 8 m/s and her opposing player runs at 7 m/s. Therefore, it is unlikely that Bonnie will be caught by her opponent before scoring a try.

Important: Make sure you use the correct units when conducting your calculation.

Distance and displacement

As mentioned, **distance** describes the length of space between two points, while **displacement** describes the distance travelled between a starting point and an end point "as the crow flies".

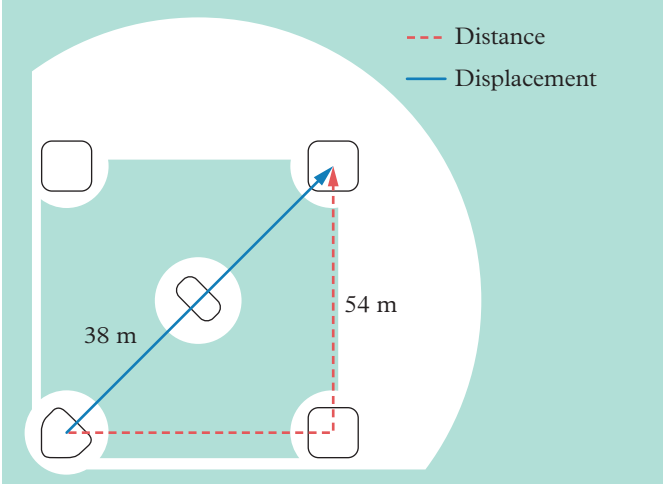
In a related example (see Source 6):

- a baseball player running from home to second base will travel a distance of approximately 54 metres (i.e. from home, through first base to second base)
- the same baseball player will have a displacement of 38 metres (i.e. cutting across the diamond straight from home to second base).

This difference in distance and displacement also has an effect on the player's speed and velocity. Their speed will take into account the distance they have travelled over time, while their velocity will take into account their distance and direction travelled over time; that is, their displacement.

SOURCE 6 When a baseball player runs from home to second base, their speed and velocity will differ. This is because speed is a measure of distance travelled over time, while velocity is a measure of distance travelled over time in a specific direction (i.e. the displacement).





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Worked example 3.12B Calculate it!

Displacement

When calculating displacement, the formula used is:

displacement(Δx) = final position(x_f) − initial position(x_i)

or

$\Delta \overrightarrow{x} = x_f - x_i$

Example

During a netball game, the Wing Attack, Sarah, is positioned at the edge of the goal circle. She passes the ball southward 1.5 metres to the Goal Shooter, Lucy, who passes the ball directly back to Sarah. Lucy then shuffles directly south 0.7 metres and receives the ball back from Sarah in a better position to make the shot. Calculate the total displacement of the ball from Sarah's original pass to the point at which Lucy is ready to take a shot.

Answer

Step 1

Determine the path of the ball.

Standing in a stationary position, Sarah throws the ball southward 1.5 metres to Lucy, causing an initial displacement of 1.5 metres. Lucy then returns the throw the same distance in the opposite direction, making the displacement 0 metres. After Lucy shuffles backwards 0.7 metres, the ball is thrown an extra 0.7 metres beyond the initial 1.5 metres.

Step 2

Calculate the total distance travelled in the same direction.

1.5 m + 0.7 m = 2.2 m

Step 3

Circle back to the original question to calculate the total displacement of the ball from Sarah's original pass to Lucy's shot.

displacement(Δx) = final position(x_f) − initial position(x_i)

Δx = 2.2 m − 0 m

Δx = 2.2 m

The total displacement of the ball from Sarah to Lucy is 2.2 metres.

acceleration a measure of how quickly or slowly the velocity of an object changes over time



SOURCE 7 Rugby union or league players carrying the ball need to be able to accelerate quickly to avoid being tackled. Pictured making a break with the ball is Toowoomba-born Shenae Ciesolka, who originally played rugby sevens but later switched to rugby league

Acceleration

As mentioned, **acceleration** refers to how quickly an object gains or reduces speed. In most sports, athletes need to be able to increase and decrease speed rapidly. For example:

- a rugby union or league player carrying the ball needs to accelerate quickly (i.e. build up as much speed as possible in a short amount of time) to cover ground and make it difficult to be tackled
- a basketball player on a fast break needs to both accelerate quickly to cover the distance to the hoop and then decelerate quickly to take the shot and avoid overshooting the edge of the court and running into the courtside obstacles.

The following are examples of linear acceleration and linear deceleration. When calculating acceleration, it is important to understand that:

- a negative answer, e.g. –2.2 m/s^2, refers to deceleration (slowing down)
- a positive answer, e.g. 2.2 m/s^2, refers to acceleration (speeding up).

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Worked example 3.12C Calculate it!

Acceleration

Timmo is a 400-metre sprinter who is training for his interschool athletics carnival in one week's time. His coach has been trying to improve Timmo's acceleration out of the blocks as she believes that Timmo needs to increase his acceleration over the first 50 metres to 1.5 m/s^2 to qualify for state championships. During his last training, Timmo reached a speed of 8 m/s by the 50-metre mark. It took him 5.9 seconds to reach this speed. Determine whether his acceleration has improved enough to meet his coach's recommendation.

Answer

Step 1

Determine Timmo's acceleration over 50 metres using the information given. To calculate acceleration, use the formula:

acceleration(a) = change in velocity(Δv) ÷ time taken(t)

Timmo started the race with a velocity of 0 m/s and increased to 8 m/s. Therefore, his change in velocity is 8 − 0 = 8 m/s. The time it took to do this was 5.9 seconds. When we substitute this into the formula we get:

8 ÷ 5.9 = 1.35 m/s^2

Step 2

Circle back to answer the question that has been asked: "Determine whether Timmo's acceleration has improved to 1.5 m/s^2".

The answer is "No, Timmo's acceleration is 1.35 m/s^2, therefore he has not met his coach's recommendation".

Important: Make sure you use the correct units when conducting your calculation.

Check your learning 3.12

Check your learning 3.12: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which term represents the rate of change of velocity with respect to time and can be negative, positive or zero?

A Speed **C** Displacement
B Velocity **D** Acceleration

2 Any movement that happens along a circular line around an axis (i.e. a central point) at the same angle in the same direction at the same time is classified as:

A linear motion **C** angular motion
B curvilinear motion **D** general motion.

Analytical processes

3 **Identify** four skills or specialised movement sequences from your selected physical activity and use the table (Source 8) to **analyse** the type (or types) of motion required to successfully complete each one.

Knowledge utilisation

4 **Evaluate** your acceleration in your current sport. Are you able to produce sufficient acceleration for the situations within your sport? **Justify** your response with examples.

5 Abbey is a javelin thrower and accelerates to a speed of 6.8 m/s in her run-up. On throwing the javelin, it takes her 2 seconds to come to a stop before the foul line. **Calculate** her deceleration after throwing the javelin.

6 **Propose** recommendations for modifications you could make to improve your acceleration in your current sport.

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	Skill 1:	Skill 2:	Skill 3:	Skill 4:
Linear motion				
Curvilinear motion				
Angular motion				
General motion				

SOURCE 8

Lesson 3.13
Newton's laws of motion

Learning intentions and success criteria

Key ideas

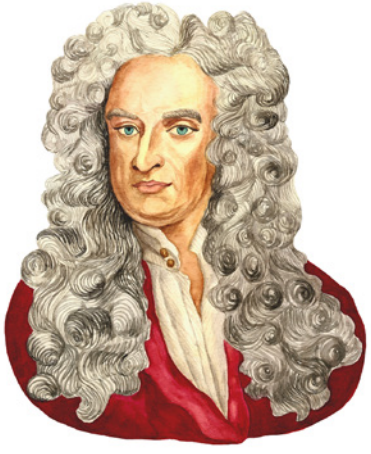
- → The work of scientist Isaac Newton describes the relationship between objects and the forces that act on them.
- → Newton's laws include three laws of motion: inertia, acceleration, and action and reaction.
- → These laws can help us understand how to optimise the performance of different skills in physical activity.

Defining Newton's laws

Sir Isaac Newton – an English mathematician, physicist, astronomer, theologian and author – developed a number of important theories that laid the foundations for modern physics. These include the law of universal gravitation (proposed in 1666) and the three laws of motion (proposed in 1686). These laws describe the relationship between objects and the forces acting upon them – as well as the responses of objects to those forces.

Newton's three laws of motion are as relevant and useful today as they were when they were first proposed. In the context of sport and physical activity, they can help us to understand the properties of moving objects to optimise the performance and execution of different skills. They include:

- **Newton's first law of motion** – commonly known as the law of inertia
- **Newton's second law of motion** – commonly known as the law of acceleration
- **Newton's third law of motion** – commonly known as the law of action and reaction.



SOURCE 1 Sir Isaac Newton (1642–1726) was an English scientist who proposed a number of important theories that laid the foundations for modern physics. These included the law of universal gravitation and the three laws of motion

Newton's first law of motion a fundamental law of the physical world; this law states that an object will remain at rest or maintain a constant velocity unless an external force acts on it; also referred to as the law of inertia

Newton's second law of motion a fundamental law of the physical world; this law states that the force required to accelerate an object at a given rate is proportional to the product of that acceleration and the mass of the body; also referred to as the law of acceleration

Newton's third law of motion a fundamental law of the physical world; this law states that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object; also referred to as the law of action and reaction

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Newton's first law of motion – inertia

Newton's first law of motion states:

> "A body continues in a state of rest or uniform velocity unless acted upon by an external force."

velocity a measure of the distance and direction an object travels over time taken (e.g. 30 kilometres per hour north)

inertia the tendency of an object at rest to remain at rest or of an object in motion to stay in motion (in a straight line) unless acted on by an external force

In other words, an object will either stay still or stay moving (at a constant speed in the same direction) unless an external force acts on it. This state of rest or constant **velocity** is referred to as **inertia**.

According to Newton's first law:

- a lawn bowls "jack" (small target ball) will sit stationary on its mark unless an external force acts on it to make it move (e.g. the force of a bowl [biased black ball] hitting it)
- a soccer ball that has been kicked and is rolling along the ground will continue to move at a constant speed and in a straight line unless an external force acts on it to slow it down (e.g. frictional force from the grass) or change its direction (e.g. a teammate taking possession).

In sport, forces such as gravitational force, drag force and friction force are constantly acting on objects. This means people and objects in motion will always eventually slow down or change direction.



SOURCE 2 According to Newton's first law of motion, a ball will remain at rest or remain moving at a constant velocity unless it is acted on by an external force. In practical terms, this means that the lawn bowls jack will remain still unless hit by a bowl. Additionally, a bowl will keep moving at a constant velocity if not for friction or the ditch

Retrieve it!

Explain the motor learning concept known as variability of practice. Check back to Lesson 2.6 Types of practice (page 61) to see if you retrieved the information correctly.

To overcome inertia and commence movement, athletes are usually required to apply a force using their muscular system. The more force the muscles generate, the greater the change in movement that occurs. An athlete crouched in starting blocks ready for their 100-metre race will need to apply a strong force through their quadriceps to overcome the inertia acting upon them and propel themselves forward once the gun fires. A defender trying to keep an opponent covered on the court will apply muscular force through a range of lower and upper leg muscles, including gastrocnemius, quadriceps and hamstrings, to accelerate, decelerate and change direction in response to the opponent's movement..

Newton's second law of motion – acceleration

Newton's second law of motion states:

> "When a force acts on an object, the acceleration experienced by the object is proportional to the size of the force and takes place in the direction in which the force acts."

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In other words:

- the acceleration of an object will be directly proportional to the amount of force applied to it (i.e. they will both increase at the same ratio)
- the acceleration of an object will be inversely proportional to the mass of the object (i.e. as one increases, the other will decrease at the same ratio).

Acceleration is a measure of how quickly or slowly the velocity of an object changes. This means that if a large force is applied to an object with a small mass (e.g. a tennis racquet hitting a tennis ball) it will produce a larger or faster acceleration. If the same force is applied to an object with a larger mass (e.g. a tennis racquet hitting a basketball) it will produce a smaller or slower acceleration.

This law can be expressed as the equation:

- Force(F) = mass(m) × acceleration(a)

  or
- $F = ma$.

This formula is discussed in more detail in Lesson 3.7 Force (page 129).

This means that as the force acting on an object increases, the acceleration of that object will increase. It also means that as the mass of an object increases, the force will increase if the acceleration remains the same.



SOURCE 3 According to Newton's second law of motion, an object will accelerate at a rate proportional to the amount of force applied to it.

Newton's second law is useful because it allows performances to be analysed scientifically. If the mass of an object is known and the rate of acceleration is known, then the force can be calculated. Likewise, if the mass of an object is known and force applied is known, then the acceleration can be calculated.

According to Newton's second law, the force exerted on a golf ball during a drive is equal to the mass of the ball (0.046 kilograms) multiplied by the rate of acceleration of the ball (i.e. around 150 000 m/s/s):

- $F = 0.046 \times 150\,000$
- $F = 6900$ N.

That is equivalent to the weight of around 703 kilograms being applied to the ball on impact.

For the record!

Newton's law of universal gravitation, proposed in 1666, was one of the first theories to explain the effects of gravity on bodies and objects. According to one of the most famous stories in the history of science, Newton – who was 23 years old at the time – was sitting in his garden when an apple fell from a tree onto his head. In a stroke of brilliant insight, he suddenly came up with the theory of gravity.

While Newton himself stated that the falling apple gave him inspiration for his work on gravity, there is no evidence to suggest it actually fell on his head!

Newton's third law of motion – action and reaction

Newton's third law of motion states:

> "For every action there is an equal and opposite reaction."

In other words, whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object. In this way the forces are paired – equal in size and opposite in direction.

According to Newton's third law, when a high jumper approaches the bar, they apply a force to the ground and the ground applies a force equal and opposite to the jumper, propelling them into the air. This has implications for a high jumper who wants to optimise their performance, as the more force they generate through their muscles to apply to the ground, the more force the ground will apply back on them and the greater their subsequent acceleration into the air.

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SOURCE 4 According to Newton's third law of motion, one object exerts a force on a second object, and the second object exerts an equal and opposite force on the first object, but the result on each object is not the same.

Although forces always act in pairs and are equal in size, the result on each object is not always the same. For example, when a softball bat hits a ball, it applies a force to that ball. The ball, in turn, applies a force that is equal and opposite to the bat, which is felt and absorbed through the athlete's hands and arms. This has implications for the softballer's grip, as a weak or loose grip can have an impact on the force that can be applied to the ball. In this example, the ball moves a great distance, but the bat does not really slow down that much. The relative effect on the ball is much greater than on the bat. This is due to the difference in mass of each object and the momentum of the bat at the point of impact.

Check your learning 3.13

Check your learning 3.13: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. **Identify** which of Newton's laws of motion applies to this situation: a soccer player kicks a ball, causing the ball to accelerate forward while the player experiences a backward force.
   - **A** Newton's first law of motion
   - **B** Newton's second law of motion
   - **C** Newton's third law of motion
   - **D** All of the above

2 Imagine you are playing lawn bowls, and you deliver a bowl with a constant force (F). Your bowl has a mass of 2 kg. You want to calculate the force required (F) to accelerate (a) the bowl to a speed of 5 m/s after it is released. What is the minimum force (in Newtons) required to achieve this acceleration?
   - **A** 2 N
   - **B** 5 N
   - **C** 10 N
   - **D** 25 N

3 According to Newton's second law of motion, the force produced is a product of two variables. **Identify** both variables.

Analytical processes

4 With reference to Newton's third law of motion, **determine** as many paired forces as you can from your selected physical activity. For example: "When I take off to move, my foot applies a downwards and backwards force to the ground. In response, the ground pushes forwards and upwards on my foot."

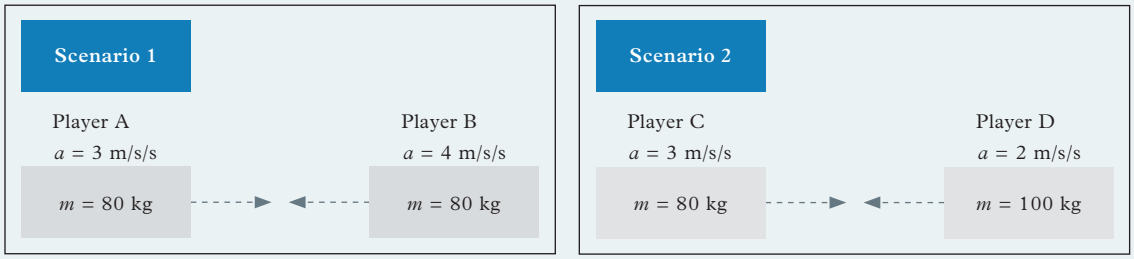
Knowledge utilisation

5 Source 5 depicts two separate rugby league tackles between opposing players. **Apply** Newton's second law of motion to **predict** which player in each scenario is more likely to gain ground during the tackle. **Justify** your prediction.

6 **Evaluate** your performance of one specialised movement sequence from the sport that is the focus of your studies. **Justify** which phase within your specialised movement sequence has to overcome inertial forces to improve one of the body and movement concepts (body awareness, space awareness, quality of movement, relationships). Make specific links to the sub-routines you would need to modify for improvement to occur.

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SOURCE 5 Rugby league tackles

Lesson 3.14
Projectile motion

Key ideas

- → Projectile motion describes the movement of a projectile, which is an object that has been launched or thrown into the air. Projectiles include implements (e.g. balls or javelins) and bodies (e.g. a gymnast or a badminton player).
- → The path along which a projectile travels is the trajectory.
- → The factors that affect the trajectory of a projectile are gravitational force, drag force, angle of release, height of release and speed of release.

Learning intentions and success criteria

Defining projectile motion

Projectile motion is a term used to describe the movement of any object that has been launched, hurled or thrown into the air. As soon as any object is released into the air, it is referred to as a **projectile**.

In a sporting context, there are two main types of projectiles:

- implements – these include any objects or pieces of sporting equipment that have been thrown, launched or hit into the air (e.g. balls, javelins, shot puts, shuttlecocks)
- bodies – these include the bodies of athletes that have been launched or propelled into the air (e.g. a gymnast performing a somersault, an alpine ski jumper flying through the air, a badminton player jumping for a shot).



SOURCE 1 "Projectile motion" is a term used to describe the movement of any object (i.e. projectile) that has been launched, hurled or thrown into the air. In a sporting context, there are two main types of projectiles: implements and human bodies. Both are shown in flight here.

projectile motion a term used to describe the movement of any object that has been launched, hurled or thrown into the air

projectile any object (i.e. sporting implement or human body) that is launched, hurled or thrown into the air

Retrieve it!

Which type of lever positions the effort between the resistance and the fulcrum? Check back to Lesson 3.10 Levers (page 143) to see if you retrieved the information correctly.

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Factors affecting projectile motion

trajectory the line along which a projectile travels

The line along which a projectile travels is known as a **trajectory**. The trajectory of every projectile is affected by two external forces:

- gravitational force – this non-contact force pulls a projectile down towards the centre of Earth; gravitational force affects all projectiles equally, regardless of their size, shape or mass
- drag force – this contact force (i.e. air resistance) opposes the movement of a projectile and slows it down. Air resistance will have different effects on projectiles depending on their size and shape (i.e. surface area). For example, air resistance has a greater effect on a soccer ball than on a javelin because of the soccer ball's larger surface area.

In addition to the effects of these external forces, three other factors influence the trajectory of every projectile. They are important to know about because each one can have a direct impact on the distance that a projectile travels. In sports where maximising the distance a projectile travels is key (e.g. javelin, shot put, long jump) these factors are essential. They include:

- **angle of release**
- **height of release**
- **speed of release**.

We will now look at each of these factors in detail.

angle of release the angle at which an object is launched into the air relative to the ground

height of release the height at which an object is launched relative to the ground (or the landing point)

speed of release the speed at which an object is travelling at the moment it is launched into the air

Angle of release

Angle of release refers to the angle at which an object is launched into the air relative to the ground. The angle of release is an important factor affecting the flight path of a projectile because it determines:

- the time the projectile stays in the air
- the horizontal distance (i.e. the distance over the ground) that the projectile travels.

Vertical force and horizontal velocity

As soon as a projectile is released into the air, its trajectory cannot be changed. This means that the distance it will travel and the time it will spend in the air are set after take-off. At the moment of release, a projectile possesses two kinds of velocity:

- vertical velocity – this affects the time a projectile spends in the air. The vertical velocity of a projectile is constantly changing due to the influence of gravity. This means the projectile travels unequal distances in a vertical direction in equal intervals of time.



SOURCE 2 In addition to the effects of external forces (such as gravity), angle, height and speed of release influence the trajectory of every projectile. Each can have a direct impact on the distance that a projectile travels. In sports such as javelin, this means the difference between success and failure.

For the record!

In the 1970s, biomechanical researchers suggested that the optimal angle of release for shot putters was somewhere between 41° and 43°. However, this was updated by Alexander Lenz and Florian Rappl in 2010 in their study of the world's best shot putters. Their analysis suggested that the optimal angle was in fact between 37° and 38°.

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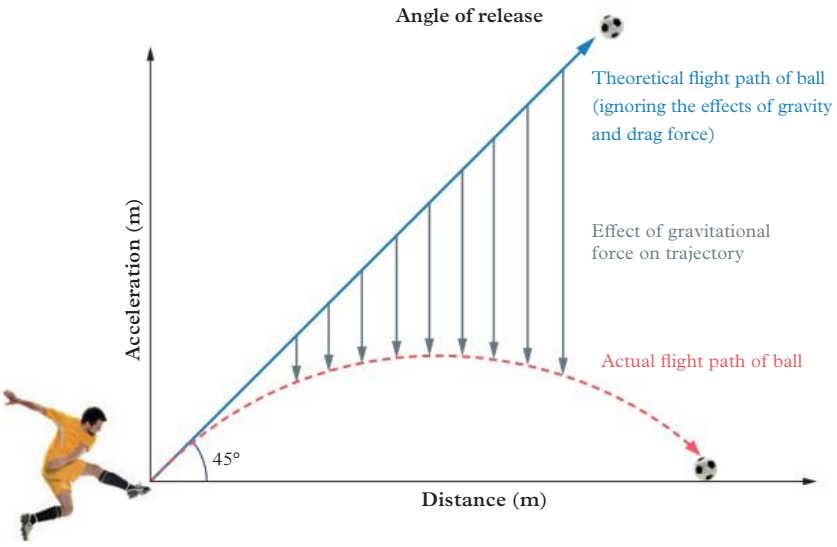
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- horizontal velocity – this affects the distance over the ground that the projectile will travel. The horizontal velocity of a projectile is constant. This means the projectile travels equal distances in a horizontal direction in equal intervals of time.

These forces will cause a projectile to move in both a vertical direction (i.e. height) and horizontal direction (i.e. distance) while it experiences the forces of gravity. The combination of horizontal and vertical velocity results in a flight path in the shape of a curve known as a parabola (see Source 3).

The gravitational pull applied to the vertical and horizontal force of the projectile affects how long a projectile will stay in the air and how far it will travel. For example:

- if a soccer ball is kicked vertically (i.e. straight up into the air), it will stay in the air for a long time but travel only a short distance from the point of release (i.e. where the person who kicked it is standing). This type of projectile possesses high vertical force and low horizontal force.
- if the same soccer ball is kicked horizontally (i.e. more or less parallel to the ground), it will travel further from the point of release, but its flight time will be short. This type of projectile possesses high horizontal force and low vertical force.



SOURCE 3 Angle of release refers to the angle at which an object (e.g. a soccer ball) is launched into the air, relative to the ground. In sports (or sporting situations) where maximising the distance that a projectile travels is the ultimate goal, athletes need to find the optimal angle of release.

Maximising and controlling distance through the angle of release

In some sports (or sporting situations), *maximising the distance* that a projectile travels is the ultimate goal. To do this, athletes need to find the **optimal angle of release**. This angle allows them to minimise the effects of both gravity and air and help ensure that the projectile travels as far as possible.

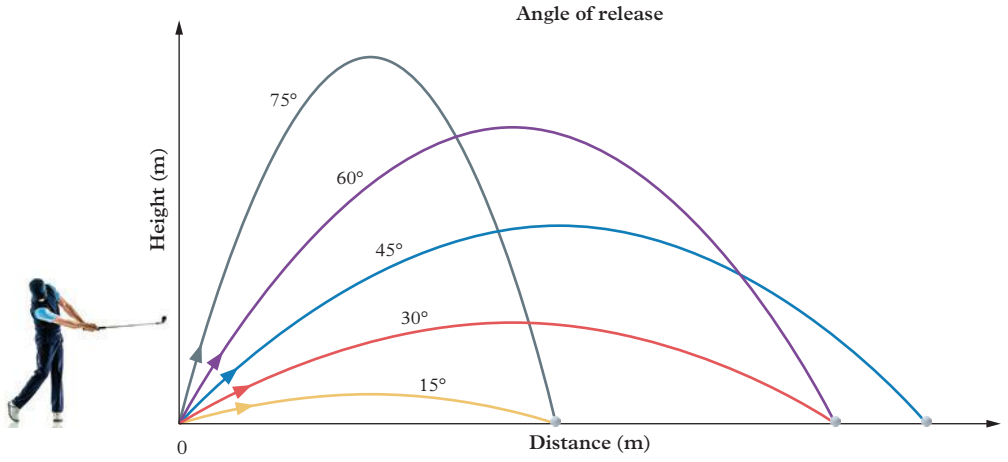
optimal angle of release the angle at which both vertical and horizontal forces are equally applied to the projectile (in order to maximise the distance it will travel); the optimal angle of release required to maximise distance is generally considered to be around 45°, but varies depending on different situations and sports

In theory, the optimal angle of release required to maximise distance is around 45°. However, this is only considered optimal for projectiles released from the ground (such as a soccer ball). For most activities that require maximum distance to be achieved, the object is thrown with an arm (i.e. it is thrown from a height above the ground) and therefore the optimal angle is usually between 35° and 45°.

In other sports (or sporting situations), carefully *controlling the distance* that a projectile travels (i.e. by controlling its trajectory) provides the best chance of success. Golf is a good example of this. Some shots are designed for maximum distance, whereas others are designed for controlled distance. Each has its place depending on the situation. As shown in Source 4 (page 168), the angle of release can affect the "hang" time (i.e. time the ball spends in the air) and distance travelled. A ball launched at 60° will spend longer in the air due to its vertical force, but will travel the same horizontal distance as an object released at 30° (which spends less time in the air).

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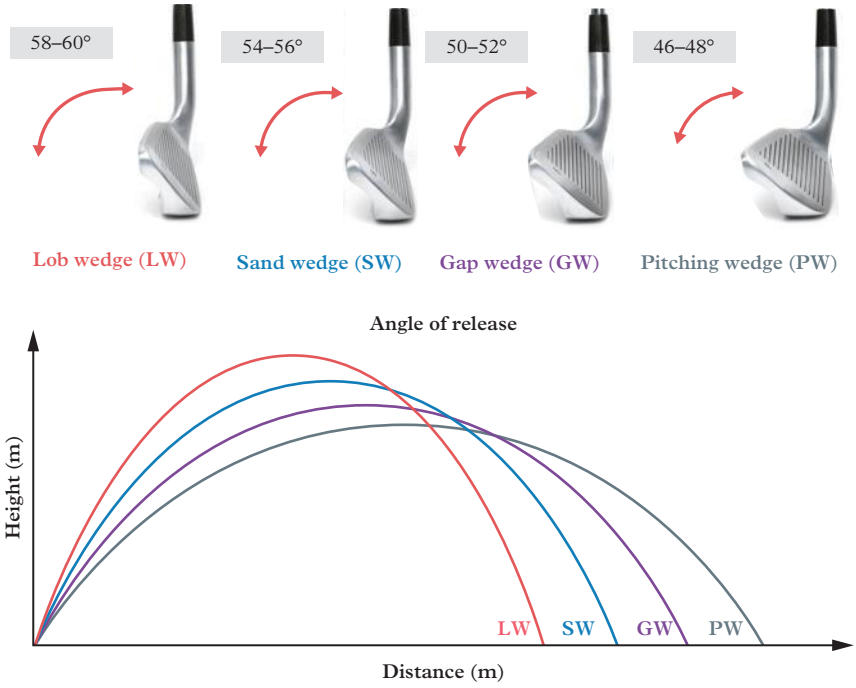


SOURCE 4 In some sports (or sporting situations), carefully controlling the distance that a projectile travels (i.e. by controlling its trajectory) provides the best chance of success. In golf, the angle of release can affect the "hang" time (i.e. time the ball spends in the air) and distance travelled. For example, a ball launched at 60° will spend longer in the air due to the vertical force but will travel the same horizontal distance as an object released at 30°. However, when it lands, it will not roll as far, as it will have less vertical speed, which is ideal for shots needing to travel a long distance but stop quickly, e.g. as it approaches the hole.

For the record!

Basketball shots travel through the air in a parabola (which differ in size depending on the basketball's angle of release). According to data from the NBA's SportVU motion tracking, top shooter Stephen Curry shoots with a 58.1° launch angle. This is higher than the average angle of release of 51° and gives him more margin for error – a major factor in his outstanding shooting skills.

The faces of golf clubs are designed with different lofts (i.e. angles) for this precise reason. Each loft produces a different angle of release that creates different trajectories for specific shots (see Source 5). A shot demanding plenty of height and not so much distance may require a club with a higher loft (e.g. 60°), while a shot played for greater distance will use a lower loft (e.g. 46°).



SOURCE 5 Golf clubs have different lofts (i.e. angles) for different shots. A lob wedge (LW) is designed to hit the ball high into the air over short distances while a pitching wedge (PW) is designed to hit the ball lower into the air over longer distances.

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The difference between theory and practice can be explained by other variables such as:

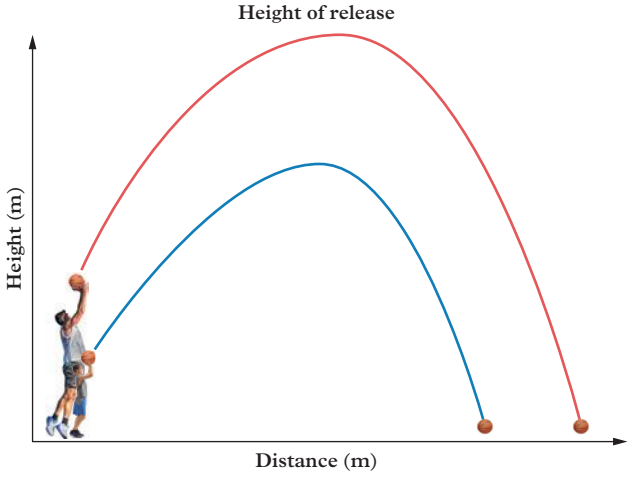
- the height of release and speed of release (to be discussed next)
- the effects of drag force (i.e. air resistance)
- differences in technique
- differences in the physical attributes of individual athletes (e.g. height, weight, strength).

If an athlete can get a higher velocity at a lower angle, then there is a trade-off between the optimum release angle and maximum release velocity. In the following examples we will not take into account the effects of drag force.

Height of release

Height of release refers to the height at which an object is launched relative to the ground (or the landing point). The height of release is an important factor affecting the flight path of a projectile because (assuming the angle of release and the speed of release are constant), a projectile launched from a greater height will travel further than one launched from a lower height.

For example, if a tall athlete and a short athlete were both to throw a basketball at the same speed and angle, the taller athlete's ball would travel further than the shorter athlete's ball (see Source 6). This is because the height of release is greater for the taller athlete, meaning that the ball will spend more time in the air.



SOURCE 6 Height of release refers to the height at which an object is launched relative to the ground (or the landing point). If two basketball players of different heights each throw a ball from identical positions at the same angle and speed, the ball thrown from a greater height will travel further.

The height of release of a projectile has a direct effect on the optimal angle of release. For example, when performing a free throw in basketball, different players will adjust the angle at which they release the ball to take their height of release into account. This means that shorter players will choose a higher angle of release and taller players will choose a lower angle of release when shooting a free throw.

According to Professor John Fontanella – author of a book called *The Physics of Basketball* – based on the heights of release:

- a 163 cm (5'4") player should launch the ball at a 52.2° angle
- a 173 cm (5'8") player should launch the ball at a 51.5° angle
- a 183 cm (6'0") player should launch the ball at a 50.8° angle
- a 193 cm (6'4") player should launch the ball at a 50.1° angle
- a 203 cm (6'8") player should launch the ball at a 49.4° angle
- a 213 cm (7'0") player should launch the ball at a 48.7° angle.

Relative height of release

When physical activities are performed on a level surface (e.g. soccer), the impact of an object's height of release is generally less of a factor. However, in some sports (e.g. volleyball) the release point for the projectile is often higher or lower than the landing point of the projectile.

For the record!

One of the most effective ways to maximise the distance a golf ball travels is to increase its speed of release.

To hit a golf ball as far as Ryan Winther, with a distance of 426 metres, your club will need to hit the ball at a speed of 378 km/h. As of 2024, Winther has been the World Long Drive champion three times.

Speed of release

Speed of release refers to the speed at which an object is travelling at the moment it is launched into the air. The speed of release is an important factor affecting the flight path of a projectile because (assuming the angle of release and the height of release are constant), a projectile launched at a greater speed will travel further than one launched at a lower speed.

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Speed of release is the most effective of all three factors when it comes to maximising the distance that a projectile travels. Once a projectile has been released, its horizontal velocity remains constant for the duration of its flight (without taking into account the effects of drag force). In sports that require projectiles to travel a great distance, athletes try to generate as much velocity as possible by releasing the projectile with the greatest possible amount of force.

Check your learning 3.14

Check your learning 3.14: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. To optimise the distance a goalkeeper can kick a ball from the ground, she needs to consider:
- **A** height of release.
- **B** speed of release.
- **C** the mass of the ball.
- **D** the position of the opposition.

2 Choose the correct answer. Which two external forces have an impact on a projectile?
- **A** Drag force and contact force
- **B** Contact force and frictional force
- **C** Frictional force and gravitational force
- **D** Gravitational force and drag force

3 **Explain** why the optimal angle of release of 45° does not apply for many sporting skills.

5 The optimal angles of release for three different sports are provided in the table below:
- **a** **Sketch** a graph to visually represent each skill. Be sure to label both axes and include all necessary information.
- **b** In a written response of 150 words, **compare** the angles of release.

Sport	Optimal angle of release
High jump	60°
Long kick in soccer	45°
Javelin throw	32°

6 Complete the following table to **identify** situations that rely on manipulating projectiles for a strategic advantage. An example has been completed for you.

Sport	Strategy	Application of projectile factors
Badminton	Hit the shuttlecock deep into the court to provide more time to get back into the rally.	Angle of release needs to be greater than 45° to clear opponent. Overhead clear requires lower angle than underhand clear due to height of release. Speed of hit increases as angle of release increases.
Touch football		
Soccer		
Volleyball		
Softball		

Analytical processes

4 When using a projectile, there are many factors that can affect the success of the skill. **Consider** how a shorter athlete can apply their knowledge of projectiles to increase their success in:
- **a** shooting skills
- **b** increasing distance.

Knowledge utilisation

7 **Investigate** the application of projectile motion in your current physical activity. Refer to the optimal angle, and height and speed of release for at least one specialised movement sequence and **evaluate** the effectiveness of your performance.

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Lesson 3.15
Bernoulli's principle

Key ideas

- → Bernoulli's principle states that any increase in velocity of a fluid (air or water) is accompanied by a decrease in pressure.
- → In sport, this can be used to explain how differences in air and water pressure can affect the speed and movement of objects (e.g. balls and javelins) and bodies (e.g. swimmers and long jumpers).
- → Bernoulli's principle can be used to understand how to recognise and apply topspin, backspin, sidespin and lift forces.

Learning intentions and success criteria

Bernoulli's principle a scientific theory that explains that any increase in the velocity of a fluid (e.g. air or water) is accompanied by simultaneous decrease in pressure; these differences in fluid velocity and pressure explain the movement of many objects (including how aeroplanes fly) as well as how lift force is generated

lift force any force that acts to push an object or body upwards

drag force a type of contact force that is generated by a fluid (e.g. air and water) opposing the movement of an object

Defining Bernoulli's principle

Bernoulli's principle is a scientific theory proposed by Swiss mathematician and physicist Daniel Bernoulli in 1738. In short, Bernoulli's principle states that any increase in the velocity of a fluid (e.g. air or water) is accompanied by a simultaneous decrease in pressure.

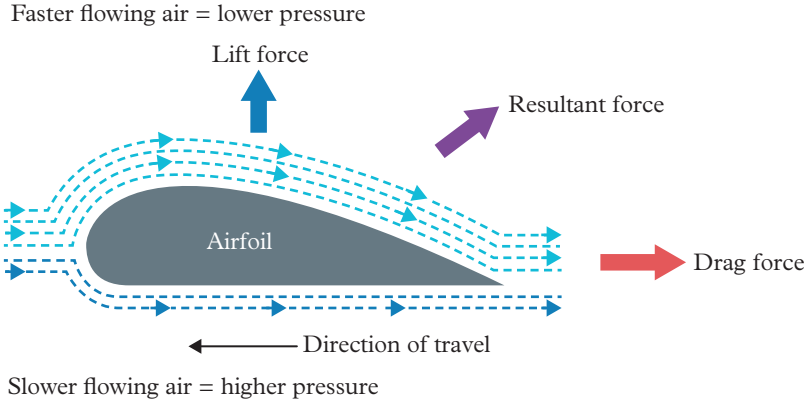
Bernoulli's principle can be challenging to grasp. One of the best ways to explain it is to look at it in action. Today, Bernoulli's principle is commonly used to explain how aeroplanes fly, so we will use this as an example to explain its basic principles.

Source 1 shows a cross-section of an aeroplane wing. This shape is known as an airfoil. It is the basic form of the wings in most aircraft today. As shown, when a fluid (in this case air) travels around the airfoil, the air travelling over the top of the wing has a higher velocity than the air moving underneath. This is because the curved shape of the air foil forces air travelling over the top of the wing to cover a greater distance than air travelling underneath – in the same amount of time.

As a result of these differences in velocity, the pressure above the wing is lower and the pressure under the wing is higher. Because particles generally move from high to low pressure zones, the wing is drawn upwards in a process called **lift force**.

As discussed in Lesson 3.6 Introduction to biomechanics (page 125), when any object travels through fluid (e.g. air or water), it encounters resistance. This resistance is commonly referred to as **drag force**. Drag force acts to slow the wing of the plane down as it moves through the air.

As a result, the overall force acting on the plane wing in Source 1 is a combination of the lift force and drag force that are being applied to it. Gravitational force is not considered in this example as it is a constant. Each of these forces have different strengths and directions. The sum of these two forces



SOURCE 1 Bernoulli's principle states that any increase in the velocity of a fluid (e.g. air or water) is accompanied by simultaneous decrease in pressure. It is commonly used to explain how aeroplane wings work. Air moving over the top of the wing at a higher velocity generates low pressure, and air moving under the wing at a lower velocity generates high pressure. Because particles generally move from high to low pressure zones, the wing is drawn upwards.

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SOURCE 2 Bernoulli's principle helps to explain lift in water in the same way that it does air.

resultant force the sum of lift force and drag force added together

gives the **resultant force** (i.e. the single force that has the same overall effect on the wing as all the individual forces acting together as one). The resultant force indicates the direction in which the wing will ultimately move.

Bernoulli's principle in sport

In addition to explaining how aeroplanes fly, Bernoulli's principle also has many useful applications in the world of sport and physical activity. In fact, it can be used to explain how differences in air and water pressure can affect the speed and movement of:

- objects through air (e.g. balls, javelins and discuses)
- bodies through air and water (e.g. long jumpers and swimmers).

It can also be used to explain how a number of forces act on these bodies and objects as they move. When an object or a body moves through a fluid (e.g. air or water), it exerts a force on that fluid and simultaneously encounters a resisting force from it. In sporting contexts, whenever a body or object exerts a force on a fluid, drag and lift forces are generated:

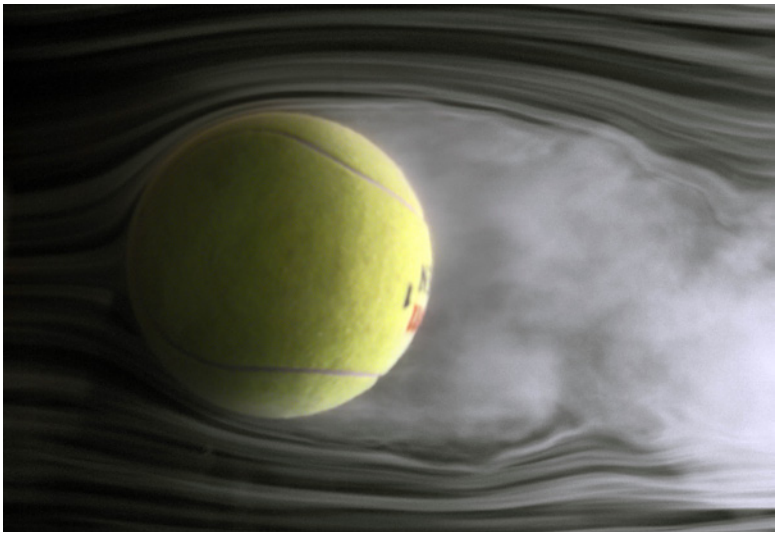
- lift force – any force that acts to push an object or body upwards
- drag force – any force that acts to oppose the movement of an object or body and slow it down.

A thorough understanding of these concepts at work can help athletes improve technique and optimise their performance.

Applying Bernoulli's principle in the water

In sport, the object is usually a projectile and lift is used to overcome the drag resistance caused by air (e.g. a discus moving through air); however, lift can also help overcome the drag in water (e.g. a swimmer moving through water). Bernoulli's principle helps to explain lift in water in the same way that it does air.

As shown in Source 4, when a swimmer's hand moves in a sideways sweeping motion through the water (e.g. when sculling water), the flow of water over the curved edge and back of the hand (i.e. known as the dorsal side) is much faster than the flow of water over the flatter palm side of the hand (i.e. known as the palmar side). This is because of the increased distance the water must travel over the dorsal side of the hand compared to the palmar side (in the same amount of time). The difference in the velocity of the water on the two sides of the hand creates areas of high pressure and low pressure – and generates lift. A swimmer can manipulate the angle at which they face the curved side of their hand to change the direction of the lift force.

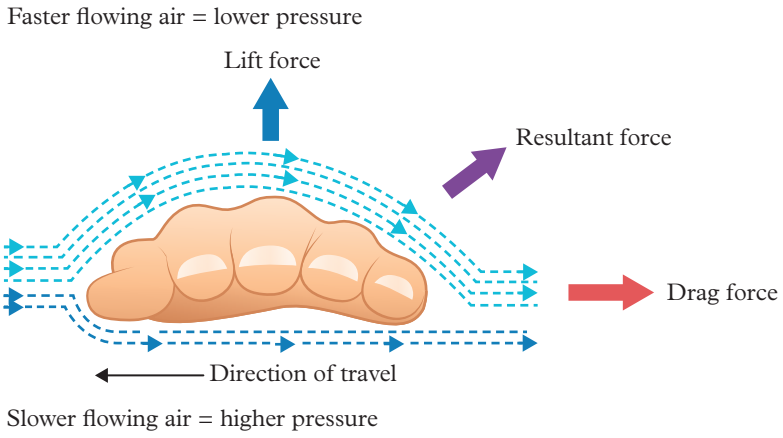


SOURCE 3 Differences in air pressure above and below this tennis ball affect its speed and movement through the air.

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Another example of Bernoulli's principle at work in the water is when an eggbeater kick is performed during a game of water polo. Lift force is created as the legs circle under the water, creating pressure differences between the top and bottom of the leg and foot. This lift force acts to push the athlete up above the surface of the water (as shown in Source 5). Similarly, synchronised swimmers can support themselves in the water by using continuous sculling actions of their hands and feet. The flow of water over these parts of the body creates a lift force that holds them steady in the water or propels them above the surface of the water.



SOURCE 4 Bernoulli's principle also applies to a hand sculling water. As shown, water moving over the top of the hand at a higher velocity generates low pressure, and water moving under the hand at a lower velocity generates high pressure. The difference in water pressure forces the hand upwards and gives it lift force.



SOURCE 5 The eggbeater kick is often used in water polo to create lift and propel players out of the water. It is an example of the application of Bernoulli's principle in water.

Applying Bernoulli's principle in the air

In many sports, athletes look for ways to achieve one or more of the following goals:

- to make objects travel through the air more efficiently – by increasing lift and reducing drag – to maximise the distance travelled (e.g. javelin, discus and shot put)
- to manipulate the speed, spin and direction of objects – by controlling lift and drag – to maximise their chances of success (e.g. cricket, soccer and tennis).

The ability of athletes to achieve these goals can often mean the difference between success and failure during performance. To succeed, many athletes rely on factors described in Bernoulli's principle.

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SOURCE 6 In many sports, athletes look for ways to maximise the distance travelled by objects (e.g. a discus throw), or manipulate the speed, spin and direction of objects (e.g. a ball bowled in cricket). In both cases, athletes rely on elements of Bernoulli's principle

The Magnus force

Magnus force a type of force that explains why objects that are spinning as they travel through the air curve away from the trajectory (i.e. pathway) they would ordinarily follow if they were not spinning

topspin when an object (i.e. projectile) rotates forwards, causing it to drop sharply during flight

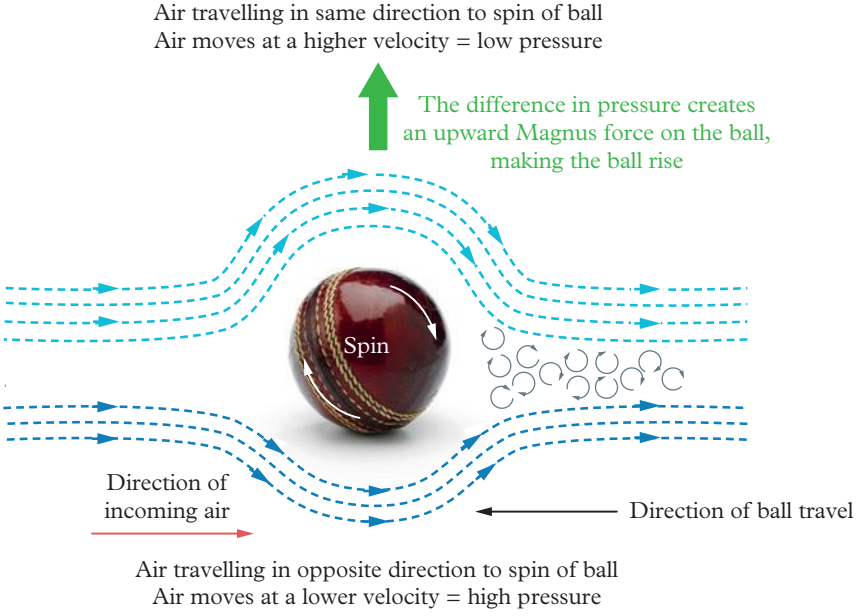
backspin when an object (i.e. projectile) rotates backwards, causing it to fall slowly towards the end of its flight

sidespin when an object (i.e. projectile) rotates sideways, causing it to curve left or right during flight

The **Magnus force** (also known as the Magnus effect) was proposed by German physicist Heinrich Magnus in 1852. Magnus force is the reason why objects that are spinning as they travel through the air curve away from the trajectory (i.e. pathway) they would ordinarily follow if they were not spinning.

Magnus force and Bernoulli's principle are closely related because Magnus force takes the central idea of Bernoulli's principle – that an object in fluid (air and water) will always move from an area of high pressure to an area of low pressure – and extends it by adding information relating to various types of objects and the ways in which they can spin. These include:

- **topspin** – when an object rotates forwards, causing it to drop sharply during flight
- **backspin** – when an object rotates backwards, causing it to fall slowly towards the end of its flight
- **sidespin** – when an object rotates sideways, causing it to curve left or right during flight.



SOURCE 7 Magnus force

You can see the Magnus force at work when watching the flight paths of balls that are given a spin at the same time as they are thrown, hit or kicked. In sports such as tennis,

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soccer, cricket, softball and many more, players rely on spin to curve the ball and increase their chances of scoring points or defeating their opponents. These athletes will often use various techniques to increase the efficiency of a projectile. For example, bowlers in cricket often deliberately apply spin to the ball to make it follow a curved flight path. This makes it difficult for the opposing batter to read the direction of the ball and hit it accurately.

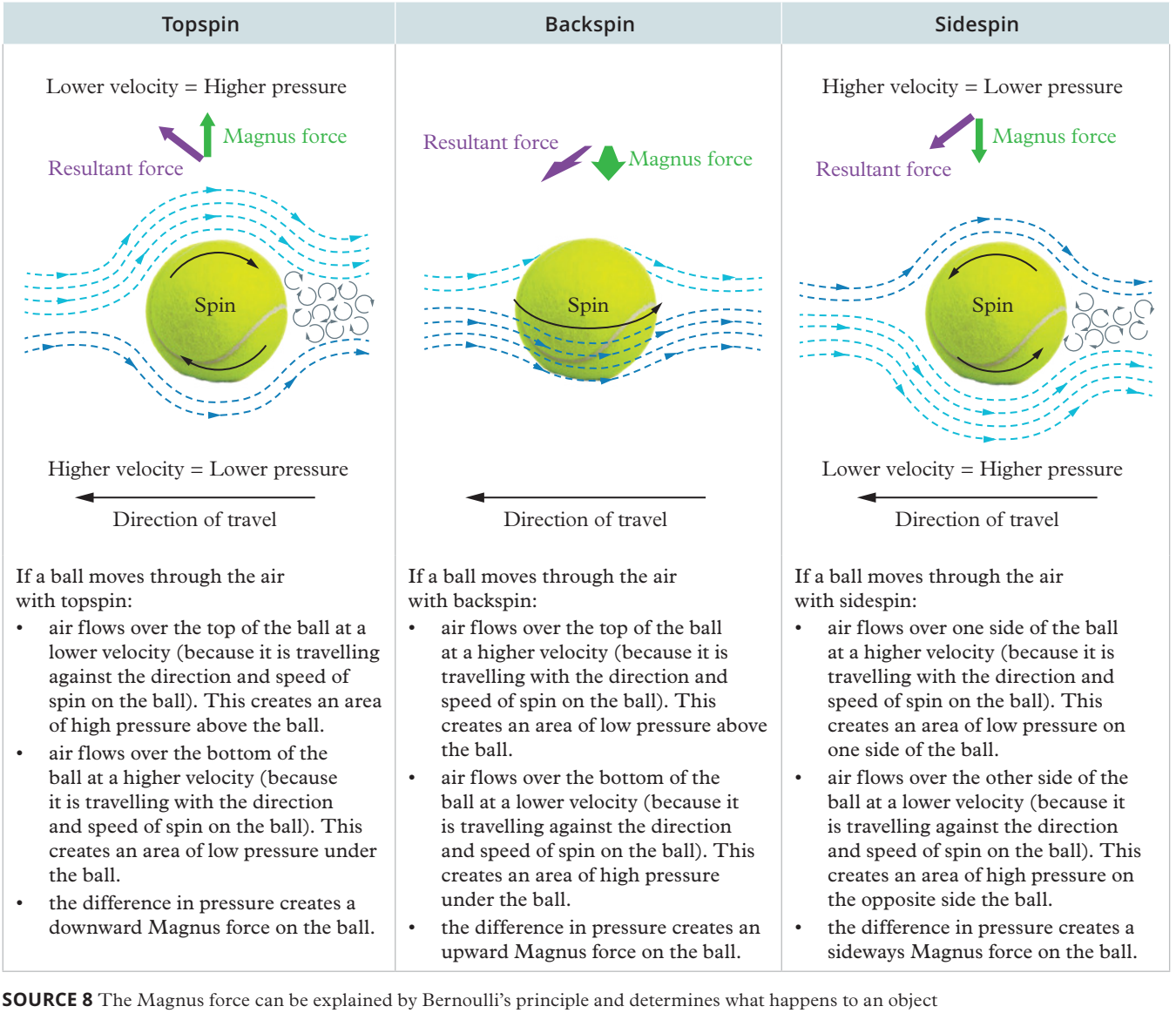
To illustrate the effect of Magnus force, we will now look at the example of a spinning cricket ball (see Source 8):

- As the ball moves through the air, its spinning motion causes the air pressure on one side to be less than on the other side.
- Velocity increases (and air pressure decreases) on the side of the ball that is travelling in the same direction as the air around it.
- Velocity decreases (and air pressure increases) on the other side of the ball where the spin is moving against the direction of the air flow around it.
- The effects of the different velocity and air pressure on each side of the spinning ball cause it to curve towards the side with the higher velocity and lower air pressure as a result of the Magnus force.

For the record!

Rafael Nadal hits the heaviest topspin forehand in the game of tennis! His average spin rate is 3200 rpm (revolutions per minute), but he has been measured at 5000 rpm (at peak).

By comparison, Roger Federer, who retired in 2022, had an average spin rate of 2500 rpm.



SOURCE 8 The Magnus force can be explained by Bernoulli's principle and determines what happens to an object when it undergoes topspin, backspin or sidespin.

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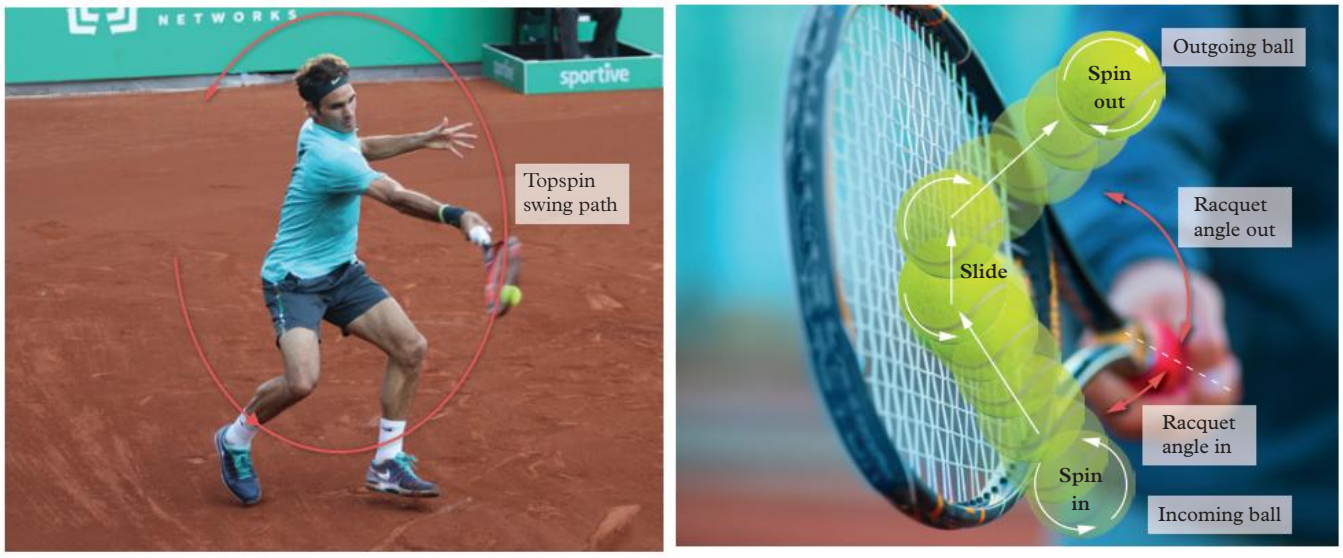
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Retrieve it!

What is the formula for calculating momentum? Check back to Lesson 3.8 Force production (page 133) to see if you retrieved the information correctly.

Tennis players, for example, use a variety of spins to control the height of their shots. This makes sense strategically. For example, a ball hit with topspin will have greater clearance over the height of the net due to the ball being hit into the air using a swing path from low to high through impact. This technique is demonstrated by Roger Federer in Source 9. Federer creates topspin by producing a racquet swing path (red line) from low to high. This swing path produces a Magnus force to bring the ball back into the court rather than flying out of the stadium.

Tennis players also manipulate the racquet face through impact to hit around the outside of the ball. This produces shots that can curve left or right through the air. Furthermore, when tennis players hit under the ball by using a relatively flat swing path (i.e. a slice or drop shot), this places backspin on the ball and forces it to "float" through the air. Various spins are created depending on where force is applied to the tennis ball (see Source 9). These spins can create tennis shots that move through the air at different heights and different arcs. They can also produce unpredictable results when balls bounce off the surface of the court.



SOURCE 9 The red line shows how Roger Federer imparts topspin by having a swing path that moves from low to high just prior to impact.

Theory in action Golf balls in flight



Have you ever wondered why golf balls are covered in small dimples? The answer is that dimples on golf balls actually improve their ability to travel greater distances. As a result, golf ball manufacturers spend a great deal of time determining the optimum depth and pattern of golf ball dimples.

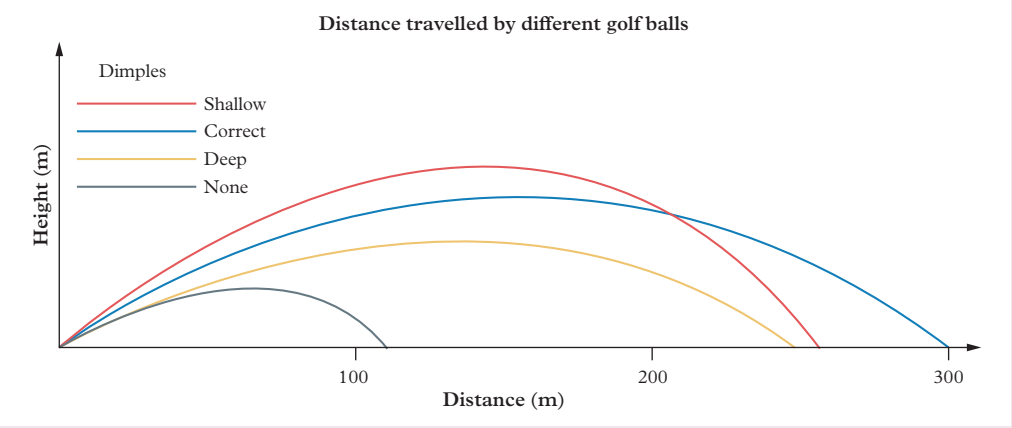
The dimples work in several ways:

- they reduce the air resistance – as the ball flies through the air, a boundary layer of air forms around the ball
- they act like small scoops to push air around and enhance the effects of Bernoulli's principle and the Magnus force – this helps to increase lift and reduce drag
- they help to force the air around the ball as it spins – less air pressure builds up behind the ball, reducing drag.

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Finally, the size of the dimples on a golf ball counts. If the dimples are too deep, they increase the ball's resistance through the air and shorten its trajectory. If the dimples are too shallow, they do not provide the benefits of reducing air pressure and increasing lift.



SOURCE 10 When hit with the same force, an old, worn-out golf ball with hardly any dimples will still travel higher and further than a golf ball with no dimples, or one with dimples that are too deep.

Summary

In summary, the effect that Bernoulli's principle and the Magnus force can have on a ball is determined by:

- how much force is applied at impact
- the angle of the implement (e.g. racquet) at impact
- the size and shape of the ball (e.g. a larger ball = greater surface area = more air resistance = more movement)
- the density of the air (e.g. greater density = more air resistance = more movement).



SOURCE 11 A tennis player will often apply more topspin to the ball on a second serve.

Check your learning 3.15

Check your learning 3.15: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Bernoulli's principle describes the relationship between which of the following variables in fluid dynamics?
   - **A** Pressure and volume
   - **B** Velocity and pressure
   - **C** Temperature and density
   - **D** Surface tension and spin

2 Choose the correct answer. When a tennis ball is hit with topspin:
   - **A** the difference in pressure creates a downward Magnus force on the ball.
   - **B** the difference in pressure creates an upward Magnus force on the ball.
   - **C** the difference in pressure creates a sideways Magnus force on the ball.
   - **D** no Magnus force is applied to the ball.

Analytical processes

3 In 2018, members of the Australian cricket team were involved in a ball tampering scandal when they were caught scratching the ball with sandpaper. **Reflect on** what you have learnt about Magnus force and **explain** what the cricketers were hoping to achieve by making one side of the

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ball rough while keeping the opposite side smooth. **Apply** what you have learnt about Bernoulli's principle and the Magnus force to suggest how a volleyball player who cannot reach above the height of the net might use the principles of spin to perform an effective spike or serve. Your response should include a diagram to illustrate your suggested solution.

Knowledge utilisation

4 A first and second serve in tennis should be hit with the same velocity, but a tennis player will often apply a different spin to the ball on a second serve. **Evaluate** which type of spin would be most effective for a second serve and **justify** your choice in a 150-word written response.

5 When treading water, water polo players can move their hands in a sculling motion or move their feet using the eggbeater technique – or do both simultaneously. With reference to Bernoulli's principle, **justify** whether using just your hands or just your feet is more efficient.

6 A volleyball player consistently floats their serve out over the baseline. **Analyse** the type of spin likely being applied to the ball at the point of contact and **justify** your recommendations to improve this player's accuracy.

Lesson 3.16
Balance and stability

Learning intentions and success criteria

Key ideas

- → Balance and stability are separate, but closely related, biomechanical concepts.
- → Balance and stability can affect force production and movement, including the body's base of support and centre of gravity.
- → An athlete can improve their skill execution by altering their body's balance and stability.

balance a term used to describe the ability of a person or thing to control their state of equilibrium (i.e. distribute their weight evenly in order to remain upright and not fall over)

stability the ability of an individual to control the influence of internal and external factors on their performance of a motor skill

static balance a term used to describe the ability of a person or thing to maintain balance when stationary (e.g. a gymnast holding a position on a balance beam)

Defining balance and stability

Balance and **stability** are two important concepts in biomechanics that are separate, yet closely interrelated. In short:balance is a term used to describe the even distribution of weight that enables a person or thing to remain upright and not fall over. This state is often referred to as equilibrium. As a result, balance can also be defined as the ability of a person or thing to control their state of equilibrium. There are two types of balance (see Source 1):

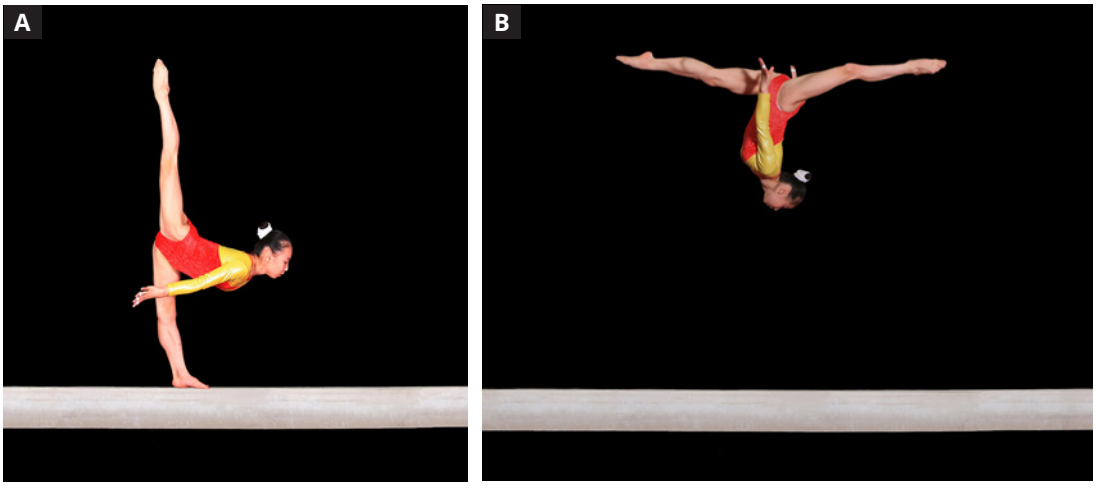
- **static balance** – balance when the body is stationary (e.g. a gymnast holding needle scale position on a balance beam)
- **dynamic balance** – balance when the body is moving (i.e. a gymnast performing a back aerial on a balance beam).

- stability is a term used to describe the degree to which a person or thing can resist challenges to their state of equilibrium.

Balance and stability are essential in many sports and physical activities. A thorough understanding of these concepts can also help to improve technique and performance outcomes.

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SOURCE 1 Balance is the ability of a person or thing to control their state of equilibrium. There are two types of balance: (A) static balance and (B) dynamic balance. Stability is the degree to which a person or thing can resist challenges to their state of equilibrium.

dynamic balance a term used to describe the ability of a person or thing to maintain balance while moving (i.e. a gymnast performing a jump on a balance beam)

The ability of a person or thing to maintain balance and stability is dependent on a number of factors. These include:

- **base of support**
- centre of gravity
- **line of gravity**
- mass.

We will now learn about each of these factors in detail.

base of support the area beneath a person or thing that is in contact with a supporting surface

line of gravity the direction in which gravity is acting on a person or thing

Base of support

Base of support is the area beneath a person or thing that is in contact with a supporting surface. In general, the larger the base of support, the greater the stability of a person or thing. For example:

- a boxer standing with their feet shoulder-width apart and knees bent (see Source 2) will have a large base of support and therefore greater stability
- a yoga teacher standing on one foot demonstrating a complex position (see Source 2) will have a small base of support and therefore less stability.



SOURCE 2 Base of support refers to the area beneath a person or thing that is in contact with a supporting surface; the larger the base of support, the greater the stability of a person or thing.

Modifying base of support

Athletes can modify their base of support depending on demands of a particular situation, or the requirements of a particular skill. This is because a body may be stable in one direction but not in another. For this reason, it is essential to consider the orientation of the base of support relative to the force an athlete may encounter.

For example, a wrestler wanting to prevent being pushed backwards will adjust their base of support by placing their feet in a long stance, one foot behind the other. This increases their front-to-back stability.

If the same wrestler wants to prevent being pushed sideways, they will adjust their base of support by placing their feet in a wide stance in line with each other. This increases their side-to-side stability.

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Retrieve it!

When an athlete retrieves visual, tactile, auditory and proprioceptive feedback as they complete a specialised movement sequence, what type of feedback are they receiving? Check back to Lesson 2.8 Types of feedback (page 69) to see if you retrieved the information correctly.

An athlete may also need to place more pressure on one aspect of their base of support to increase stability. A classic example is passing a ball in rugby. In a static position, the base of support is evenly distributed between the two feet and balance can be maintained when passing the ball. However, it becomes more difficult when passing a ball on the run as the base of support will often be just one foot. It is much easier to pass the ball if the weight is on the outside foot to maintain balance – for example, when passing to the left, the weight should be on the right leg.

Transferring momentum is essential for generating maximum power. Transferring weight from one part of the body to another is one way to transfer momentum. Athletes can often promote this through changing the weight displacement on their base of support. When striking in sports such as baseball, golf, tennis and cricket, it is common to see the athlete move their weight to their back leg prior to commencing the stroke. This allows their weight to transfer to the front foot at the point of impact.



SOURCE 3 Athletes can often transfer momentum by changing the weight displacement on their base of support. Batters can improve the efficiency of transferring momentum by starting the swing on their back leg.

Study tip

One way to increase body awareness is to practise a skill with your eyes closed. Removing one sense can heighten the awareness of how your body moves through the various skill segments.

Practising the swing of a tennis racquet or golf club, or a basketball set shot, are examples of activities that can be safely performed with your eyes closed.

Centre of gravity

Centre of gravity is the central point around which the mass of a person or thing is distributed and balanced. Every person and thing has a centre of gravity, which can shift depending on the position (or movement) of that person or object.

Understanding where an athlete's centre of gravity is located during different sporting skills and on objects (such as bats and balls) can often be the key to improving technique and optimising performance.



SOURCE 4 Locating the centre of gravity of most objects is generally quite simple. If an object is perfectly round (such as a tennis ball), the centre of gravity is found in the centre of that object.

Locating the centre of gravity

Locating the centre of gravity of things (i.e. inanimate objects) is generally quite simple. For example, to locate the centre of gravity of a

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SOURCE 5 Locating the exact position of the centre of gravity of a person is not always simple.

ruler, place it across one finger until you find the point at which it stays horizontal and does not fall to the ground. The point at which it is balancing on your finger is its centre of gravity.

If an object is perfectly round (such as a tennis ball, cricket ball or soccer ball) or uniform in shape (such as a cube or block), then the centre of gravity is always found in the exact centre of that object. If an object is an irregular shape (such as a boomerang or a shuttlecock), the centre of gravity can be quite far away from the centre of the object – and sometimes even outside it – but will be the position at which the weight is balanced.

Unfortunately, locating the exact position of a person's centre of gravity is not quite so simple – particularly when it comes to sport and physical activity. Unlike many objects, the human body is not uniform in shape when it is stationary, nor is it stationary very often. Instead, the human body is flexible and can assume many different positions and move constantly. As a result, an athlete's centre of gravity can shift very rapidly. In addition to this, individual body parts (such as arms and legs) have their own centres of gravity.

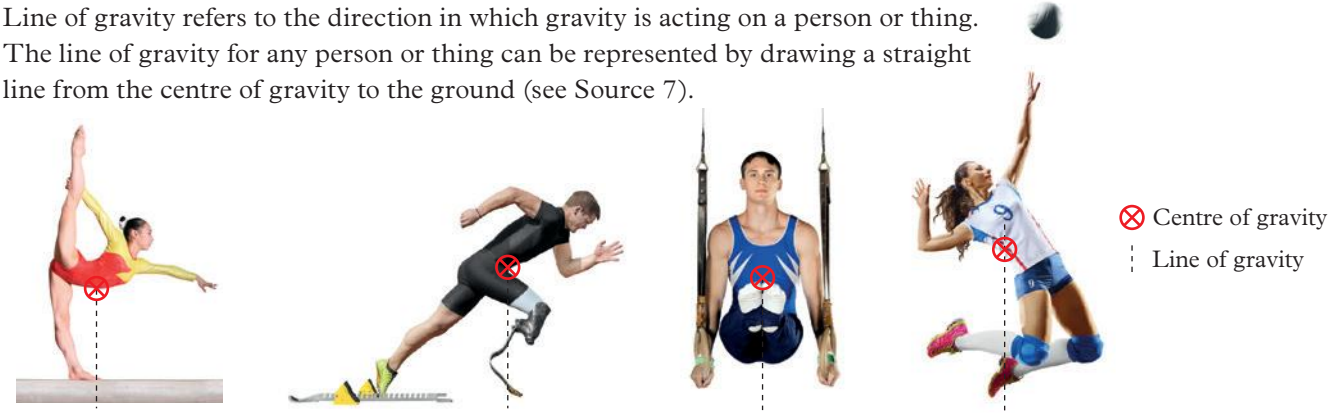
Because the body is so flexible, in some cases the centre of gravity may even be located outside the body of the athlete. An example of this is a high jumper clearing a bar. Because of the way in which high jumpers performing the Fosbury Flop technique bend their bodies, the centre of gravity is actually lower than the bar they are clearing. Manipulating the shape of their bodies to achieve this makes it a much more efficient movement.



SOURCE 6 An athlete performing the Fosbury Flop

Line of gravity

Line of gravity refers to the direction in which gravity is acting on a person or thing. The line of gravity for any person or thing can be represented by drawing a straight line from the centre of gravity to the ground (see Source 7).



SOURCE 7 An athlete's centre of gravity can shift as they take on different positions.

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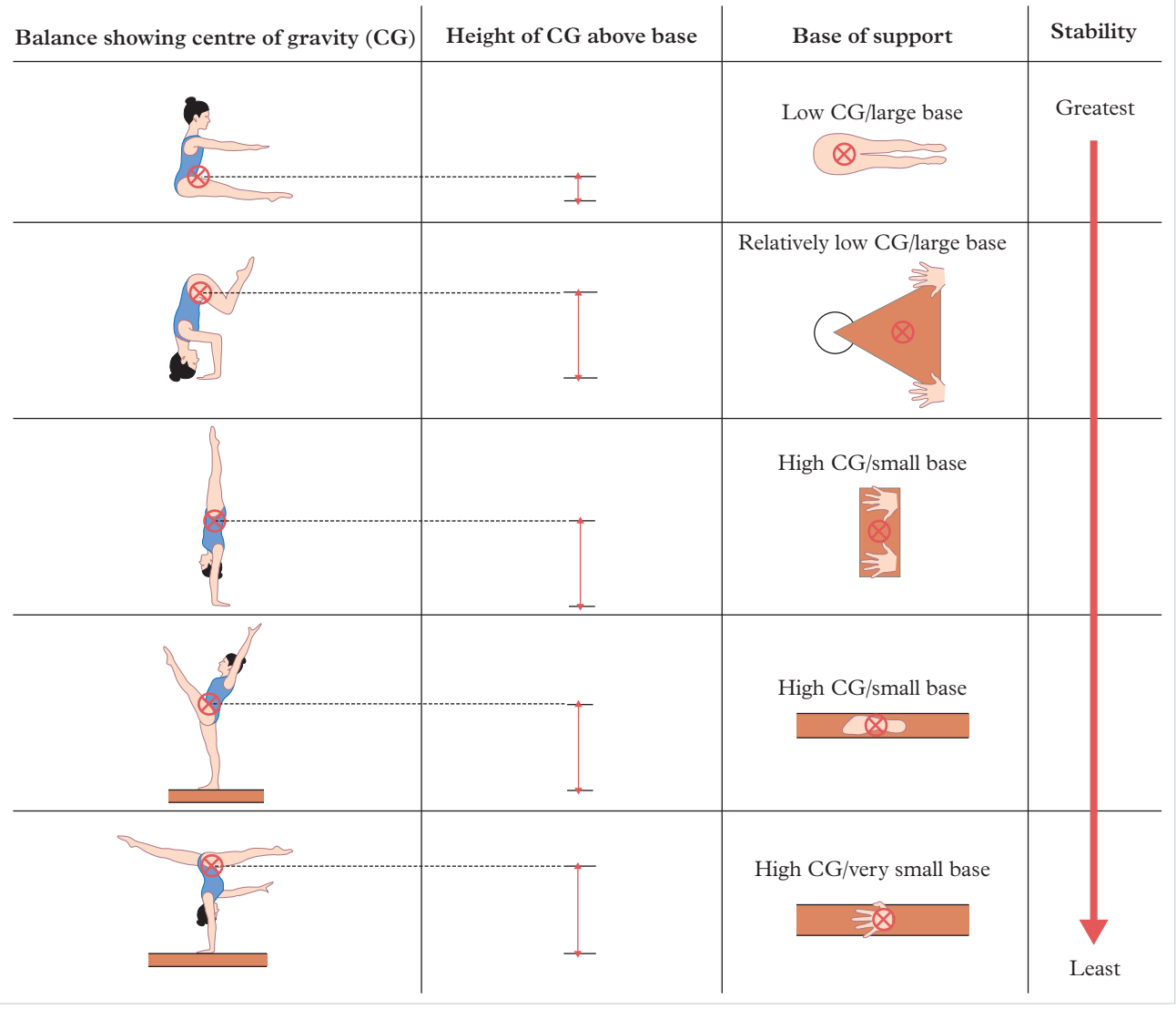
An object is most stable when the line of gravity lands in the centre of the base of support. This is because it increases the distance that the centre of gravity must be moved before balance is compromised.

Moving the line of gravity towards the edge of the base of support reduces a body's stability. The further off-centre from the base of support the centre of gravity is, the less stable the body. This is most noticeable when a person is not balanced while performing a skill. Being aware of the body's position throughout a skill execution can allow an athlete to make minor adjustments to their position to regain an optimum level of stability.

Mass

Mass is a measure of how much matter (i.e. particles and atoms) there is in an object. When it comes to balance and stability, the mass of an object or thing is one final factor to consider.

The greater the mass of an object, the greater its stability. It takes more force to accelerate a heavy body at a given rate. Sumo wrestlers are the ultimate example of using weight to increase stability.



SOURCE 8 Stability is related to the size of the base of support and the relative height of the centre of gravity

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Many sports have specific positions that use an athlete's mass for particular movement sequences and movement strategies – for example, defensive positions require more stability. Defenders in sports such as rugby league, rugby union, soccer and basketball require stability at certain points in the game (such as at the point of impact to either maintain possession or defend a field or court position), and as such they are often the biggest players in the team. Lighter athletes are at an advantage in sports where agility and speed are required.

Maximising balance and stability

Maximising balance and stability during training and performance can improve technique, optimise performance and lead to improved outcomes. As shown in Source 8, balance and stability can be maximised by:

- increasing the base of support as required (i.e. extending the base of support in the direction of an oncoming force)
- ensuring the line of gravity falls within the base of support (see Source 9).
- shifting the line of gravity towards the oncoming force
- lowering the centre of gravity
- increasing mass.



SOURCE 9 Centre of gravity, line of gravity and base of support

Retrieve it!

What are the six types of synovial joints? Check back to Lesson 3.3 The structure and function of joints (page 107) to see if you retrieved the information correctly.

Check your learning 3.16

Check your learning 3.16: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** four factors that have a direct impact on a person's stability.

2 **Describe** how you can improve weight transference for striking skills.

Analytical processes

3 **Differentiate** between static and dynamic balance.

4 **Analyse** the specialised movement sequences within your selected physical activity in terms of their need for balance and stability. **Determine** how you can increase stability in one of the movement sequences.

Knowledge utilisation

5 "A stable base of support is essential for generating maximum power." Do you agree or disagree with this statement? **Justify** your response in a 150-word written response. Be sure to include relevant examples from your selected physical activity.

Study tip

Every piece of assessment in Physical Education requires you to apply and evaluate two body and movement concepts when developing specialised movement sequences and movement strategies.

From a biomechanical perspective, body awareness is a significant body and movement concept that considers the importance of stability, balance and transfer of weight – these are worth considering when developing your assessment response.

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SKILL DRILL

Lesson 3.17

Evaluate the impact of base of support on quality of movement

Aim

To investigate the impact of base of support and centre of gravity on performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Equipment relevant to one physical activity from either the invasion, net and court, or striking and fielding categories
- Game Performance Assessment Instrument 5 (GPAI 5)
- Pen

Template: Game Performance Assessment Instrument 5 (GPAI 5)

Position A	Position B	Position C	Position D	Position E
In this position, perform this skill as you usually would.	In this position, perform this skill while bending your knees to about 150 degrees.	In this position, perform this skill while bending your knees to about 90 degrees.	In this position, perform the skill with your feet close together.	In this position, perform the skill with your feet greater than shoulder-width apart.

Selected skill:									
	Accuracy Describe how close to the target you were able to throw or hit the ball.			**Flow of movement** Describe how easily you were able to throw or hit the ball.			**Force development** Describe the force you were able to apply.		
Balance and stability variations	Worse than usual	Same as usual	Better than usual	Worse than usual	Same as usual	Better than usual	Worse than usual	Same as usual	Better than usual
Position A									
Position B									
Position C									
Position D									
Position E									

SOURCE 1 GPAI 5

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Method

Step 1

Select one of the following specialised movement sequences as the focus of your Skill drill:

a shooting/scoring

b throwing

c striking an object.

Step 2

Perform your selected specialised movement sequence (e.g. serving a ball in tennis) in position A (see the balance and stability variations in the table).

Step 3

Assess the quality of your specialised movement sequence by describing whether the accuracy, flow and force development of your skill is worse than usual, the same as usual or better than usual. Record your result in the position A row of GPAI 5.

Step 4

Repeat steps 2 and 3 for positions B to E.

Analysis and discussion tasks

1 Through analysing the primary data that you have gathered in this Skill drill you can draw conclusions about the impact of balance and stability of your chosen specialised movement sequence.

- **a** Which positions provided the most stability? Which provided the least?
- **b** In which position was movement easiest? In which position was movement hardest?
- **c** **Compare** and **contrast** your performance (accuracy, fluency, etc.) across the five positions.
- **d** Based on these results alone, form a conclusion about the role of stability in this specialised movement sequence.

2 It is important to **reflect on** the reliability and validity of the data you collected in this Skill drill to ensure that your final conclusions are strong.

- **a** **Describe** the factors that increase and those that decrease this data's reliability.
- **b** **Describe** the factors that increase and those that decrease this data's validity.
- **c** Form conclusions about the overall reliability and validity of your data. **Justify** your answer.

3 Following the primary data analysis, a deeper inquiry can be made using secondary sources. This enables the information to be used in a meaningful way to make decisions about movement strategies. **Synthesise** the primary data you have gathered in this Skill drill with secondary data sources to answer the following questions.

- **a** **Explain** how the different conditions of stability affect your ability to transfer weight effectively.
- **b** **Distinguish** which quality of movement criteria (accuracy, flow of movement, force development) had the greatest variation due to changes in stability.
- **c** **Consider** your usual position. How would you describe the relationship between your stability and your movability in this position?
- **d** **Consider** three other specialised movement sequences from your selected physical activity. **Analyse** how balance and stability is optimised in these movement sequences. You may need to conduct additional research to answer this question.
- **e** Make suggestions to modify any of the sub-routines within your own performances of these movement sequences. **Justify** your recommendations based on the primary data you collected, as well as at least two other secondary data sources.

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Lesson 3.18
Analysing specialised movement sequences

Learning intentions and success criteria

Key ideas

- → Specialised movement sequences in physical activity are made up of phases and sub-routines that can be investigated as part of a biomechanical analysis.
- → Primary data and secondary data can be analysed and synthesised to understand the influence of biomechanical and functional anatomy concepts and principles on specialised movement sequences and strategies.

Putting theory into action

Throughout this module you have learnt many new concepts and skills from two specialised fields of science: functional anatomy and biomechanics. These concepts and skills work together to inform our understanding of:

- how the muscles and bones in the body work together to produce movement
- how the laws of mechanics relate to motion (i.e. the movement of people and things) and the forces that produce motion.

Understanding how these concepts apply to various sports and physical activities can help you to:

- **improve technique** by identifying errors early and correcting them
- **optimise performance** by implementing the most effective techniques at the right times (while identifying and exploiting weaknesses in the technique of opponents)
- **improve safety and reduce the risk of injury** by identifying potential risks and detecting issues early.

Retrieve it!

What does mass measure? Check back to Lesson 3.7 Force (page 129) to see if you retrieved the information correctly.

In this lesson, we will model an approach for putting all the theory you have learnt in this module into action. We will provide the general framework and tools you will need to analyse a specialised movement sequence of your choice (from your selected physical activity). The framework is presented in stages that will provide general recommendations and tips applicable to a whole range of skills from different sports.

Choosing the best approach

The goal of any analysis is to identify strengths and weaknesses in the performance of specialised movement sequences (i.e. motor skills) by collecting, recording and analysing movement and skill data. Before you begin your performance analysis, you need to decide on the types of data you will collect and the type of approach you will take for data collection.

Types of data

There are two types of data that can be useful and relevant when carrying out a performance analysis. These include:

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- **primary data** – any data that you collect yourself that relates directly to your performance (e.g. video footage or photographs of your performance, sketches, personal performance statistics)
- **secondary data** – any data that you do not collect yourself, but which offers information about a model of effective technique (e.g. video footage or photographs of elite athletes, information on how to perform a skill, performance data for other athletes).

When conducting your own performance analysis over the two-year course, you will be expected to use a combination of primary and secondary data.

primary data any data that you collect yourself that relates directly to your performance (e.g. video footage or photographs of your performance, sketches, personal performance statistics)

secondary data any data that you do not collect yourself, but which offers information about effective technique (e.g. video footage or photographs of elite athletes, information on how to perform a skill, performance data for other athletes)

Approaches to analysis

There are two types of approaches to carrying out a performance analysis:

- **quantitative analysis** – this approach focuses on collecting and analysing data that can be recorded in numbers (e.g. measuring and analysing aspects of performance such as heart rate, stride length, distance covered, time spent in the air, total force, momentum and impulse, or effectiveness of performance through GPAIs)
- **qualitative analysis** – this approach focuses on collecting and analysing data that can be recorded in words (e.g. describing and analysing aspects of performance such as personal journals or diaries describing "quality" of movement, personal observations, feelings and thoughts).

When conducting your own performance analysis this year, you may choose to carry out a quantitative analysis or qualitative analysis; however, to get the most out of the process, it may be wise to incorporate elements from both approaches.

quantitative analysis a type of analysis that focuses on data that can be recorded in numbers (e.g. measuring and analysing aspects of performance such as heart rate, stride length, distance covered, time spent in the air, total force, momentum and impulse, or effectiveness of performance through GPAIs etc.)

qualitative analysis a type of analysis that focuses on data that can be recorded in words (e.g. describing and analysing aspects of performance such as personal journals or diaries describing "quality" of movement, personal observations, feelings and thoughts)



SOURCE 1 The goal of any analysis is to identify strengths and weaknesses in the performance of specialised movement sequences (i.e. a combination of fundamental movement skills) – and devise strategies for improvement – by collecting, recording and analysing movement and skill data.

Performance analysis framework

There are four stages to conducting an effective performance analysis of a specialised movement sequence:

- **Stage 1:** Select your specialised movement sequence for a movement strategy and identify its demands (secondary data).
- **Stage 2:** Observe your performance and gather primary data.
- **Stage 3:** Synthesise primary and secondary data to determine areas for improvement.
- **Stage 4:** Devise and implement a strategy for improvement.

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Stage 1 – Select your specialised movement sequence for a movement strategy and identify its demands

Before you can begin any kind of performance analysis, you will need to:

Select a specialised movement sequence for a movement strategy (from your selected physical activity)

Choosing the right movement strategy is the key to conducting a successful and beneficial analysis. You will need to choose a movement strategy in which you can see areas of need in your performance. In a biomechanical analysis, you will focus on the specialised movement sequence that is required to perform the movement strategy. Examples of specialised movement sequences include a drop shot or smash in badminton, a set or a serve in volleyball or a lay-up or jump shot in basketball.

Choosing to analyse a specialised movement sequence that you consider to be an area of personal weakness will give you the opportunity to better understand how to improve it so you can achieve its objective. For example, the objective of the drop shot is to outsmart your opponent, resulting in the shuttlecock hitting the floor before it can be reached.

For the record!

Technology has revolutionised the way we analyse and optimise skill performance. Simple two-dimensional imagery has been replaced by such things as cameras that can capture movement using 500 frames per second (fps) at high resolution to 10 000 fps at a reduced resolution; digital floors that can measure force production; and electromyography devices that use wireless probes attached to an athlete to provide a dynamic analysis of muscle activity. The rise of artificial intelligence (AI) will have a considerable impact on analysing skill performance.

Identify the individual phases and sub-routines of the specialised movement sequence

Once you have selected your specialised movement sequence, you can begin to break it down into its components. To do this, you will need to look for a model of effective technique and conduct some secondary research to ascertain the ideal performance of the specialised movement sequence for the movement strategy. For example, for the specialised movement sequence of stumping from a spin bowler in cricket, Alyssa Healy and Alex Carey would be models of effective technique as they consistently achieve the objective of taking the wicket.

1. Once you have video footage and still images of your model of effective technique, you need to firstly identify the various skill phases that combine to form the specialised movement sequence. This makes it easier to analyse and compare how body and movement concepts are applied effectively throughout execution.
2. Next, break these down further by looking at the specific sub-routines that make up each phase. This allows for a more detailed analysis that can identify which phase or, more specifically, which sub-routine, has the greatest impact on your performance.
3. Similar specialised movement sequences across different sports have similar phases. As an example, Source 2 shows six striking activities across different sports that all share common phases. Common phases also exist for kicking activities in different sports.

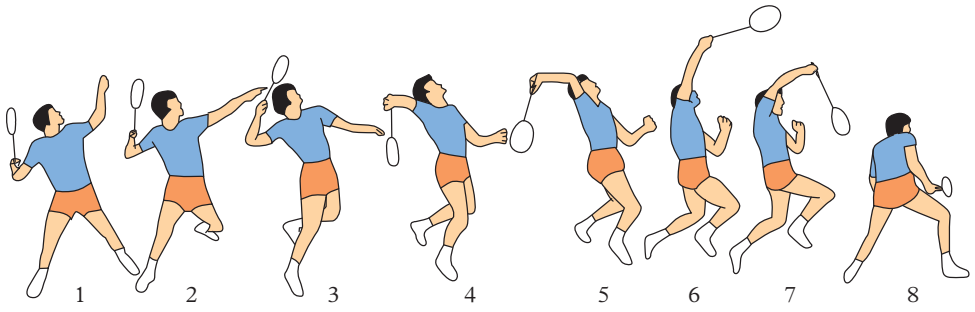
Badminton smash	Volleyball spike	Volleyball serve	Tennis forehand	Softball hit	Golf swing
Approach	Approach	Preparation	Approach	Preparation	Stance
Take off (optional)	Take off	Ball toss	Preparation		Backswing
Swing	Preparation	Swing	Swing	Swing	Downswing
Impact	Impact	Impact	Impact	Impact	Impact
Follow through	Follow through	Follow through	Follow through	Follow through	Follow through

SOURCE 2 Phases for striking activities

We will use a badminton smash (Source 3) to illustrate the process of breaking a specialised movement sequence into phases and sub-routines.

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SOURCE 3 The phases of a forehand smash in badminton

Identify the demands of the specialised movement sequence in the movement strategy

Correctly identifying the demands of the specialised movement sequence in achieving its objective is also important for a successful analysis. Demands are the requirements and qualities of the specialised movement sequence; that is, the things that need to happen to achieve an ideal performance like that of the model of effective technique.

Once you know the demands of your selected specialised movement sequence, you must articulate them clearly. To continue with the cricket example, the demands of the wicketkeeper when stumping from a spin bowler include crouching with a stable base until the ball pitches, watching the ball intently, rising with the ball, waiting for the ball to settle into the gloves (rather than grabbing at it), and cleanly gloving the ball before swiftly forcing the gloved ball into the stumps.

Source 4 demonstrates the phases, sub-routines and demand of a forehand smash in badminton.

Retrieve it!

What are the four body and movement concepts? Check back to Lesson 2.10 Body and movement concepts (page 74) to see if you retrieved the information correctly.

Phase	Sub-routine	Demands for ideal performance
Approach (also called preparation)	Footwork	Quick steps to gain momentum towards the shuttlecock. This could involve a shuffle, a lunge or a crossover step depending on the location of the shuttle
	Body positioning	Lowering the body's centre of gravity for stability and power generation
	Grip	Holding the racquet with a forehand grip
Take off (optional)	Jump	A vertical jump to gain height for a steeper smash angle (optional, depending on desired power and opponent's position)
Swing (also called acceleration)	Racquet preparation	Raising the racquet head behind the back with a loose grip for a full swing
	Torso rotation	Rotating (opening up) the torso forcefully to generate power for the smash. This involves engaging core muscles
	Arm extension	Pulling the non-racquet arm down and extending the hitting arm rapidly to increase racquet head speed at impact
	Wrist action	Snapping the wrist at contact for a sharper smash
Impact (also called contact point)	Racquet head orientation	Tilting the racquet head slightly upwards for a steeper smash or straighter for a powerful drive
	Shuttlecock contact	Focusing on hitting the sweet spot of the racquet, in front of the head, for optimal power and control
Follow through	Continuing arm and torso movement	Maintaining momentum by following through with the swing after impact
	Racquet recovery	Bringing the racquet down in a controlled manner to prepare for the next shot
	Balance recovery	Regaining balance for stability after the smash

SOURCE 4 The phases, sub-routines and demands of a forehand smash in badminton

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Stage 2 – Observe your performance and gather primary data

In the second stage of the performance analysis, it is time to observe yourself performing the specialised movement sequence you have chosen (and collect a range of data relating to your performance).

Data collection is the process of gathering and recording information. The most common way to gather data is through observation. Observation is a practical method of data collection, but there are a number of factors to consider before you complete this stage of the analysis. These are summarised in Source 5.

Method	Description
Choose the most suitable environment	• Identify the best environment in which to perform your chosen movement sequence: – Performing in a closed environment (e.g. alone in a quiet area) allows for greater control of the environment and execution of the skill. – Performing in an open environment (i.e. during a game) allows for more authentic performance conditions. • You may like to observe the performance of the skill in both situations to achieve the best outcome.
Choose the most suitable day and time of day	Perform your chosen movement sequence at a time when you are: • well rested • free from injury and illness • used to performing the skill (e.g. early in the morning or later in the afternoon).
Choose the most appropriate method of data collection	There are a number of methods that can be used to help you observe and record the performance of your chosen movement sequence. These include: • Visual methods – digital video recordings (e.g. smartphones, digital cameras, GoPro) – continuous high-speed photography (e.g. smartphone "burst" mode or digital cameras) – video analysis apps (e.g. Coach's Eye, Spark Motion, Coach My Video, Dartfish) – motion capture (e.g. specialised infrared cameras and body markers) – camera drone (e.g. a mobile drone fitted with video camera to capture game play from above) • Non-visual methods – performance diaries (e.g. personal recounts of performances) – training logs – statistical data (e.g. heart rate, distance travelled) – game performance assessment instruments (GPAIs).
Choose the most suitable angles and viewing position	• Consider the following factors when observing your chosen movement sequence: – angles – in most cases, the observation should be recorded from a position at right angles to the performance (i.e. side on); however, in some cases it is also very helpful to observe performance from multiple angles (e.g. side, front, back, above) – viewing position – the viewing position needs to have a clear, uninterrupted line of sight to the performer. It cannot be too far from the action (as the recording will be unclear) or too close to the action (as aspects of the performance will be out of frame and the equipment may interfere with the performance). • Always conduct a number of test performances to check that your recording equipment is functioning correctly and that the images captured are suitable in terms of clarity and action being captured.
Choose a suitable number of performances	• Identify the right number of performances required for a representative indicator of your overall abilities. • It may be sufficient to record the movement sequence being performed four to five times in a single environment. Alternatively, you may wish to record the movement sequence being performed five to ten times across a number of different environments (i.e. closed and open).

SOURCE 5 There are a number of methods (and types of equipment) that can be used to help you observe and record the performance of your chosen movement sequence – some of the most useful and widely available include digital video recordings and smartphone apps.

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Stage 3 – Synthesise primary and secondary data to determine areas for improvement



SOURCE 6 Badminton players need agility and, therefore, have to find the right balance between being stable and being nimble. A lunge, as pictured, increases the base of support but makes it harder for the player to overcome inertia and quickly change direction.

In the third stage of the performance analysis, it is time to synthesise all the data you have gathered and determine which areas of your performance to focus on for improvement. To do this, you will need to:

- watch all the video footage
- review any non-visual material you have collected
- compare and contrast your performance of the movement sequence with the model of effective technique, paying particular attention to:
  - differences in technique
  - any errors or issues in your performance
  - any strengths in your performance.

Once you have observed your performance, you will be able to determine the most important element (or elements) to correct.

In many cases, it is the initial phase of the movement sequence that requires most attention. This is due to technique errors involving larger muscle groups used (e.g. in the legs) and the base of support. The base of support qualities will dictate what type of force is required for your movement sequence. Skills that require agility require a smaller base of support for changing direction as the smaller base of support makes you less stable and it is therefore easier to overcome your body's inertia (resistance to change). Jumping for height (e.g. a badminton smash take-off) requires explosive power to be transferred to smaller body parts. This requires a more stable base, as explained in summation of forces (Lesson 3.8 Force production (page 133)). Another factor to consider is the angle at which your legs bend prior to jumping to exert maximal force.

The easiest way to collate data and evaluate your performance is through a qualitative observations table like that in Source 7 (page 192). A full version of this table is available to download.

Study tip

When you are searching for a model of effective technique, make sure that any video footage you locate has been captured from a similar perspective to the skill sequence you have recorded (or vice versa). This will allow you to annotate your footage and identify the phases and sub-routines more easily. This will also help you compare techniques more consistently.







Qualitative analysis of badminton smash

In Source 7, the body movement concept that has been identified for improvement is accuracy. First reflections could determine that the "impact phase" is the source of the problem – a shuttlecock hit too late due to the body moving backwards when jumping will produce erratic forehand smashes. The root cause of hitting the shuttlecock at the wrong time is being in the wrong position to execute the forehand smash. Therefore, one way for this player to improve their accuracy would be to modify the sub-routine of how they move into position.

For the record!

Badminton is the fastest racquet sport in the world, with shuttlecock speeds reaching more than 300 km/h. Maximising technical efficiency through biomechanical analysis is crucial to being able to keep up with such speed. The original concept for badminton was invented in China, but instead of the shuttlecock being hit with a racquet, players used their feet. This would have required significant technical prowess!

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Qualitative observations				
Specific movement sequence: Badminton smash: Forehand				
Body movement concept to frame the observations: Accuracy (quality of movement)				
When I move to hit the shuttlecock, I am facing front on. When jumping (not very high), I am often overbalancing and falling backwards at impact. I make impact with the shuttlecock above or behind my head. The result is that the shuttlecock often goes upwards – not desirable for a smash!				
Phase	**Model of effective technique (sub-routines performance)**	**Can you successfully complete this element?**	**If not, what did you do instead?**	**Relevant biomechanical concept/s**
Approach	Weight on balls of feet	✓	N/A	• Newton's first law • Momentum • Base of support • Balance
	Moves to anticipate impact point	✓	N/A	
	Pivots to turn side-on	–	Facing front on	
	Starts momentum for shuffle steps to get into position	–	No shuffle steps and not very balanced	
	Wide stance	✓	N/A	
	Feet parallel to back line	✓	N/A	
	Weight on the back leg	✓	N/A	
	Back leg is bent to absorb force	✓	N/A	
	Racquet back	–	Racquet starting in front of body and then down (no back swing)	
	Strings facing down	✓	N/A	
	Shoulder alignment (hitting shoulder lower)	✓	N/A	

SOURCE 7 Qualitative analysis of badminton smash

Stage 4 – Devise and implement a strategy for improvement

Now that you have established the error or problem in your specialised movement sequence, you must devise a strategy for improvement and then implement it over a period of time under the supervision of your teacher and/or coach, incorporating practice methods from Module 2 Motor learning (page 28).



SOURCE 8 Biomechanical analysis will allow you to maximise your technical ability. This lesson uses examples from the sport of badminton.

A strategy is any plan of action that aims to directly address the identified error or problem. There is no such thing as a perfect strategy as each individual athlete is unique and responds differently to an intervention. As a starting point, any strategy is better than no strategy at all because through the collection of sufficient feedback, the individual can continually adapt the plan as necessary on their path to improvement. Source 9 builds on the error identified in Source 7 with an example strategy.

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The strategy	
Error or problem	**Overall plan**
Hitting the shuttlecock from behind the head resulting in the shuttlecock trajectory being upward or flat rather than straight down for a winner	Complete footwork and positioning drills over several weeks to practise getting side on with a wide base of support to increase stability. When jumping, jump from behind the shuttlecock rather than directly underneath it. During the take-off and swing phases, practise aligning the hitting arm/shoulder with the shuttlecock; raising the non-hitting arm, pointing to the shuttlecock out in front of the head.
Implementation considerations	
Practice plan	Begin with closed environment, easing into the open environment with a high specificity of practice. Massed practice to begin with, becoming more whole and distributed with evidence of improvement.
Feedback plan	Mostly extrinsic feedback – both knowledge of performance and knowledge of results – gathered in a timely manner. If specific errors are determined, return to part practice immediately to isolate the technical issue.
Success indicator/s	Knowledge of results: increased winners from smashes on the scorecard. Knowledge of performance: Positive synchronous (immediate) feedback from teacher, peer or coach where possible.

SOURCE 9 An example of an implementation strategy for a badminton smash

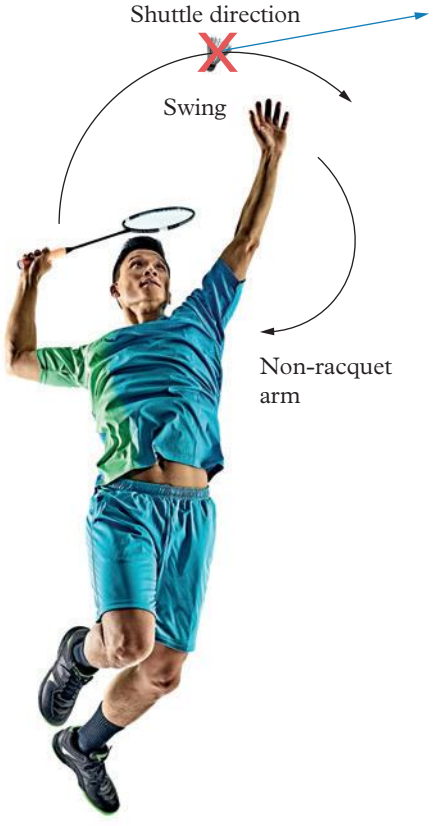
Some considerations when implementing your strategy include:

- skill complexity – if the skill is complex, part practice is recommended, where you work on the specific sub-routines before practising the whole specialised movement sequence
- type of environment – a closed environment allows you to control the variables within the sub-routines and ensure that the specific modifications are developed and stored as a new motor program
- type of practice – associative and autonomous learners can benefit from massed practice to increase the automaticity and fluency of the specialised movement sequence; cognitive learners require more frequent breaks and should use distributed practice to increase their efficiency and ability to identify errors
- feedback – extrinsic feedback from a teacher or video can help refine minor technical modifications.

To make an objective assessment about whether or not the modifications to your technique have improved your performance of the movement sequence, you will need to observe yourself performing the skill again (under the same environment as you did in Stage 2 – Observe your performance and gather primary data). Your stage of learning should dictate whether your skill comparison is in an open or closed environment. Cognitive learners would show successful modifications more consistently in closed environments. Associative and autonomous learners should have sufficient fluency and skill level to demonstrate modifications in problem-solving drills or authentic situations. Problem-solving drills are easier to set up as they are more predictable in ensuring the performance of your selected movement sequence.

Once you have collected this data, you can make direct comparisons between your original data, your new data and the model of effective technique.

Source 5 (page 190) identifies other methods of collecting data to help substantiate justifications. GPAIs and journal reflections can also provide specific data to support justifications and insightful modifications to your specialised movement sequence.



SOURCE 10 In badminton, the impact point for the smash is in front of the body, which will result in a more attacking shuttlecock trajectory

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Check your learning 3.18

Check your learning 3.18: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. What is the second stage in conducting an effective performance analysis?
   - **A** Synthesise primary and secondary data to determine areas for improvement.
   - **B** Select your specialised movement sequence for a movement strategy and identify its demands (secondary data).
   - **C** Synthesise primary and secondary data to determine areas for improvement.
   - **D** Observe your performance and gather primary data.

2 Choose the correct answer. What is a sub-routine within the impact phase of a badminton smash (forehand)?
   - **A** Torso rotation
   - **B** Arm extension
   - **C** Racquet head orientation
   - **D** Wrist action

3 When collecting video footage of your specialised movement sequence, **explain** what considerations are involved.

Analytical processes

4 **Differentiate** between a quantitative analysis and qualitative analysis.

5 **Determine** the objective and demands of your selected specialised movement sequence based on a selected model of effective technique.

6 **Determine** the phases and sub-routines relevant to the specialised movement sequence you have selected.

7 **Compare** and **contrast** the differences between jumping into a striking action (volleyball serve, badminton smash) or hitting from a stationary position (feet on the ground). Reflect on how these impact on the generation of force.

Knowledge utilisation

8 **Evaluate** your performance of one specialised movement sequence from your selected physical activity. Use the four body and movement concepts in your analysis and discussion.



Lesson 3.19

Assessment support – Internal assessment: Project – folio

Overview of internal assessment: Project – folio

As part of your assessment for Unit 1 of the QCE Physical Education syllabus, you will be required to complete a Project – folio. The Project – folio is a complex task with many components.

This section of the module is designed to support you as you complete your own Project – folio (see the Practice assessment task, page 201). It includes practical tips and advice to ensure that what you produce meets the criteria set in the instrument-specific marking

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guide (ISMG). Detailed information on how to structure, create and present your Project – folio is provided in Lesson 1.3 Tips for success on the Project – folio (page 8). In addition to this, Lesson 1.4 Skill drill: Planning, creating and presenting a Project – folio (page 9) provides a number of useful tips and instructions to help you.

The Project – folio is made up of two sections. We will model one possible approach to completing the task.

- **Section 1 – Presentation**: a multimodal task presented as an mp4 video up to 11 minutes
- **Section 2 – Demonstrating and applying**: supporting visual evidence presented as an mp4 video up to 3 minutes



Section 1 – Presentation

Your presentation will be the main part of your Project – folio. It is a multimodal task, and in this approach we have chosen to produce an mp4 video up to 11 minutes in length. Do not exceed the 11-minute time limit as any content included after 11 minutes will not be counted in the awarding of your grade. Your multimodal presentation must consist of at least two modes (visual, written or spoken). One way you might meet this requirement is to make a slideshow with embedded videos, images and text. You could then use a program such as Screencastify to produce a voiceover whereby you explain the different elements on your slides and tell your story from beginning to end.

Section 1 will include the following tasks:

- analysing primary and secondary data
- devising and justifying a motor learning strategy
- evaluating the effectiveness of the strategy
- justifying the maintenance and modification of the strategy.

These tasks are detailed below.

Task 1 – Analysing primary and secondary data

The first part of your presentation requires you to analyse primary and secondary data, looking for relationships between:

- biomechanical demands of the specialised movement sequences for one movement strategy
- biomechanical concepts and principles relevant to the specialised movement sequences and one movement strategy
- personal performance of the demonstrated specialised movement sequences and one movement strategy.

To do this, you will need to:

- gather secondary data about the above relationships
- collect video footage of your performance of specialised movement sequences for a movement strategy from your selected physical activity to demonstrate not only your performance but also the biomechanical demands
- explore the impact of a variety of different biomechanical concepts and principles on your performance.

Breaking your specialised movement sequence into phases and sub-routines is crucial to fully exploring the biomechanics at play throughout the routine. An example of how you might work through this process is provided below.

Retrieve it!

What is drag force? Check back to Lesson 3.15 Bernoulli's principle (page 171) to see if you retrieved the information correctly.

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Example

Jack is developing his volleyball skills through drills and authentic game environments in his Physical Education lessons. He begins his data collection process by obtaining video footage of himself performing the specialised movement sequences for the movement strategy of "use different attack, serve or hit options, e.g. back-court setter, triple front-court hitters, short serve, topspin or jump serve". He is drawn to this movement strategy because of his desire to improve his consistency when serving the ball over the net using a topspin serve, as he often serves the ball out over the baseline.

By analysing his primary data (including video footage, heat maps and GPAIs) and secondary data about volleyball, Jack determines that an ideal topspin serve is projected with force and spin that cause it to drop down into open space in the opponent's court. He determines that the key biomechanical principles needing to be exploited for a good topspin serve are Bernoulli's principle, Newton's law of action and reaction, projectile motion and summation of forces. Jack compares his own topspin serve to those of experienced players and notices that he is not applying topspin to the ball by snapping his wrist on contact. He can also see that his angle of release is too high and that, while he effectively applies summation of forces to gain effective force production, the direction of his arm swing at contact means that the ball is propelled in directions that are not controlled or purposeful and reduce the effectiveness of his serve.

Jack uses the information he gathers in his analysis to devise (and justify the development of) a biomechanics strategy.

Task 2 – Devising and justifying a biomechanics strategy

Study tip

When you are presenting your primary data to make a point, research to find some relevant secondary data (from a credible source such as a textbook) to back up your idea. This will help you to show discerning synthesis of primary and secondary data.

Once you have determined the most significant relationships between the biomechanical demands of the specialised movement sequence, relevant biomechanical concepts and principles, and your personal performance of the specialised movement sequences, you should have enough data to devise a biomechanics strategy to optimise your performance of your selected movement strategy. This strategy should consist of the biomechanical concepts and principles that could optimise your performance of the movement strategy based on identified biomechanical problems within your performance of the specialised movement sequences. You will also need to synthesise (combine) the primary data collected in your analysis with relevant secondary data to justify the development of your strategy.

Once you have devised your strategy, it is recommended that you implement the strategy during class time over the course of two to three weeks and collect primary data on the impact on your performance of the movement strategy.

Example

Through the analysis of his topspin serve, Jack recognises that he needs to develop a biomechanics strategy to better meet the demands of the serve. He refers to his primary and secondary data to determine that his strategy should use biomechanical concepts such as Bernoulli's principle, projectile motion and Newton's law of action and reaction to improve his serving performance. He describes exactly how he will need to modify his service technique, exploiting each identified biomechanical concept in doing so.

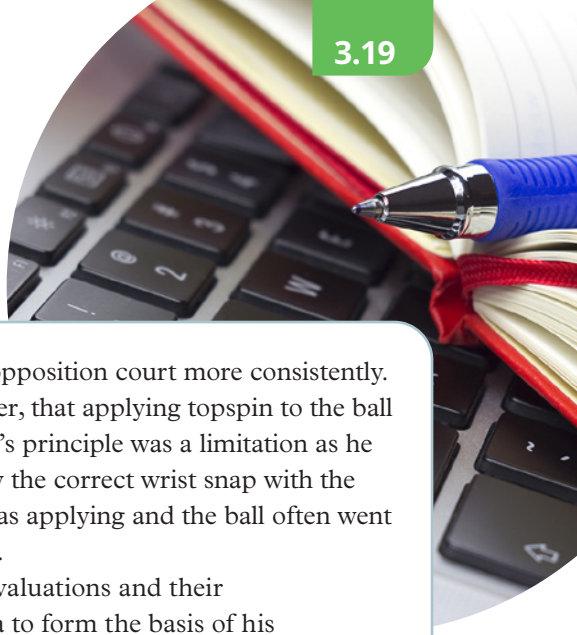
Jack will then implement his strategy over a period of time, collecting a range of data (e.g. through video footage and GPAIs) on the changes he notices in his serving performance during that time.

Task 3 – Evaluating the effectiveness of the strategy

Once you have implemented your devised strategy for two to three weeks and collected data on your performance, you are required to evaluate the effectiveness of your strategy. To do this, you need to determine the effectiveness of the biomechanical strategy in optimising your performance of specialised movement sequences and one movement strategy using

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relevant biomechanical principles to appraise the outcome and limitations. In other words, you will need to discuss what did and did not work. Referring to primary and secondary data here will enable you to justify the parts of your strategy that you recommend keeping and those you should modify. This part will be outlined in more detail next.

Example

Jack reviews all the data gathered while he implemented his strategy and uses the information to evaluate the effectiveness of the strategy by appraising the outcomes and limitations. He reflects on video footage, heat maps and GPAIs and concludes that using Newton's law of action and reaction, he was able to apply less force, resulting in the ball reacting equally and opposite and travelling less distance, landing inside the opposition court more consistently. He did find, however, that applying topspin to the ball to exploit Bernoulli's principle was a limitation as he was unable to apply the correct wrist snap with the reduced force he was applying and the ball often went into the net instead.

He uses these evaluations and their accompanying data to form the basis of his recommendations moving forward.

Task 4 – Justifying the maintenance and modification of the strategy

The final task of your Project – folio requires you to make recommendations for parts of your strategy you should maintain and parts you should modify or change. To do this properly, you will need to use evidence from primary and secondary data. It is also recommended that you explain your modifications by detailing what you should do differently and why.

Example

Based on his evaluations, Jack decides that some elements of his strategy helped him to improve his topspin serve and these should be maintained, and some elements were not as beneficial at this stage and therefore should be modified. He is able to support his recommendations with primary data presented in his evaluation of the strategy synthesised with secondary data from textbooks, websites and journal articles.

Section 2 – Demonstrating and Applying

The second section of your Project – folio requires you to collect video footage of your practical performance in your selected physical activity as evidence of your demonstrating and applying ability. Specifically, your video will be up to 3 minutes in length and will need to show evidence of your demonstration of two movement strategies from two principles of play. Do not exceed the 3-minute time limit as any content included after 3 minutes will not be counted in the awarding of your grade.

Demonstration footage must show you applying these strategies in authentic performance environments, i.e. showing performance within game play. Preferably, this footage will show complete plays, rallies and so on, rather than parts of play. While it is a highlights reel of your best performances, to be considered effective your footage must show the full picture of your performance rather than repeated little snippets within rallies or gameplay.

Finally, your video must include demonstration of quality of movement concepts (speed, accuracy, force, flow and so on) and one other body and movement concept, such as body awareness, space awareness or relationships. These body and movement concepts are discussed in detail in Module 2 Motor learning (page 28).

Study tip

When compiling your presentation, it is useful to justify modifications and maintenance in conjunction with your evaluations of limitations and outcomes respectively. You can therefore link your justifications to the primary data already provided and simply add relevant secondary data to make your justifications more discerning.

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MODULE 3

Lesson 3.20
Review: Functional anatomy and biomechanics

Summary

3.1
- Functional anatomy is the study of how muscles and bones in the body work together to produce movement.
- An understanding of functional anatomy can assist in the analysis of specialised movement sequences.

3.2
- The skeletal system provides a framework for movement. It consists of bones, tendons, ligaments and cartilage.
- Bones contain two types of bone tissue: compact bone and spongy bone.
- Bones are classified according to their shape: long bones, short bones, flat bones and irregular bones.
- Bones are also classified according to their location in the body: sesamoid bones and sutural bones.

3.3
- Joints are formed where two or more bones meet, and they allow the body to move.
- There are three types of joints: fibrous, cartilaginous and synovial.
- Synovial joints are the most important for movement.

3.5
- There are three types of muscles: skeletal, cardiac and smooth.
- Skeletal muscles are responsible for moving the skeleton. They produce movement by contracting and relaxing.
- There are two main types of contractions: istonic and isometric.
- Reciprocal inhibition is when the central nervous system sends a message for a muscle on one side of a joint to contract and the muscle on the other side to relax.

3.6
- Biomechanics is a field of science that studies how the laws of mechanics relate to movement.
- Biomechanics can be used to improve performance and prevent injury in sports.
- An understanding of biomechanics can assist in the analysis of specialised movement sequences.

3.7
- Force is a push or pull that happens when two objects interact.
- Force is made up internal forces (i.e. inside the body) and external forces (i.e. contact and non-contact forces between the body and the environment).
- Force can affect performance in a physical activity.

3.8
- Force production is the ability of the body to generate internal force (movement) against an external force (resistance).
- Momentum, summation of forces and impulse are biomechanical concepts that combine to produce force.
- We can apply formulas to calculate biomechanical concepts such as momentum, summation of forces and impulse.

3.10
- Levers are simple machines designed to help move a heavy load.
- There are three types of levers: first-class, second-class and third-class.
- Levers play a role in the performance of physical activities.
- Athletes may combine anatomical levers (i.e. from the body) with external levers (sporting equipment) to increase force (force multipliers) and speed (speed multipliers).

3.12
- Motion is the change in position of an object over time caused by the application of force.
- The study of motion is a key area of biomechanics.
- Motion can be linear, curvilinear, angular or general.
- We can apply formulas to calculate biomechanical concepts of motion such speed, velocity, displacement and acceleration.

3.13
- The work of scientist Isaac Newton describes the relationship between objects and the forces that act on them.
- Newton's laws include three laws of motion: inertia, acceleration, and action and reaction.
- These laws can help us understand how to optimise the performance of different skills in physical activity.

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3.14
- Projectile motion describes the movement of a projectile, which is an object that has been launched or thrown into the air. Projectiles include implements (e.g. balls or javelins) and bodies (e.g. a gymnast or a badminton player).
- The path along which a projectile travels is the trajectory.
- The factors that affect the trajectory of a projectile are gravitational force, drag force, angle of release, height of release and speed of release.

3.15
- Bernoulli's principle states that any increase in velocity of a fluid (air or water) is accompanied by a decrease in pressure.
- In sport, this can be used to explain how differences in air and water pressure can affect the speed and movement of objects (e.g. balls and javelins) and bodies (e.g. swimmers and long jumpers).
- Bernoulli's principle can be used to understand how to recognise and apply topspin, backspin, sidespin and lift forces.

3.16
- Balance and stability are separate, but closely related, biomechanical concepts.
- Balance and stability can affect force production and movement, including the body's base of support and centre of gravity.
- An athlete can improve their skill execution by altering their body's balance and stability.

3.18
- Specialised movement sequences in physical activity are made up of phases and sub-routines that can be investigated as part of a biomechanical analysis.
- Primary data and secondary data can be analysed and synthesised to understand the influence of biomechanical and functional anatomy concepts and principles on specialised movement sequences and strategies.

 **Revision notes: Module 3**

 **Module 3 summary**

Review questions 3.20 Exam-style revision questions and tasks

Section A

- Ten multiple-choice questions

Question 1

Functional anatomy is a field of science that studies:

A how the skeletal system and muscular system interact to produce movement.
B how the skeletal system and nervous system interact to produce movement.
C how the skeletal system and muscular system interact to produce new blood cells.
D how tendons, ligaments and cartilage interact to produce movement.

Question 2

There are three main types of muscles in the human body. These include:

A skeletal muscle, cardiac muscle and smooth muscle.
B skeletal muscle, cardiac muscle and internal muscle.
C skeletal muscle, striated muscle and non-striated muscle.
D skeletal muscle, voluntary muscle and involuntary muscle.

Question 3

The appendicular skeleton is:

A made up of 206 bones.
B attached to the axial skeleton and provides support for the long axis of the body.
C attached to the axial skeleton and provides support for the arms and legs.
D attached to the axial skeleton and provides support for the vertebral column.

Question 4

The structure of a joint determines:

A how it functions.
B how big it is.
C which ligaments are required to hold it together.
D how effective the articular cartilage is at cushioning the bones.

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Question 5

Isometric contraction is:

A a process in which the muscle fibres produce tension as they shorten or lengthen.

B a process in which the muscle fibres produce tension but neither shorten nor lengthen.

C a process in which the muscle lengthens to release the bones and move them further apart.

D a process in which the muscle shortens to pull on bones and bring them closer together.

Question 6

Force is defined as:

A an interaction that causes (or has the potential to cause) a change in the motion of an object.

B an interaction that causes (or has the potential to cause) a change in the mass of an object.

C an interaction between the body and the external environment.

D an interaction that is generated inside the body.

Question 7

General motion is a combination of:

A linear and curvilinear motion.

B linear and angular motion.

C angular and curvilinear motion.

D linear, angular and curvilinear motion.

Question 8

Bernoulli's principle explains that as the velocity of a fluid or gas increases:

A its pressure increases.

B its pressure decreases.

C its pressure stays the same.

D it moves from an area of high pressure to low pressure.

Question 9

Newton's first law of motion states: "A body continues in a state of rest or uniform velocity unless acted upon by an external force." This is known as:

A inertia.

B acceleration.

C action and reaction.

D gravity.

Question 10

Levers with a longer resistance arm are known as:

A force multipliers.

B speed multipliers.

C first-class levers.

D second-class levers.

Section B

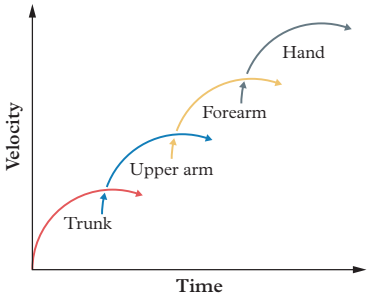
- Two short-response questions
- One extended written response question

Question 11 (8 marks)

The graph below shows how force is produced and transferred during a stationary throw.

a Annotate the graph to show how force production is maximised during the throw.

b Explain the concept of summation of forces, using examples from your selected physical activity to support your explanation.



Question 12 (8 marks)

Annotate this image to show where each of the six forces listed in the table below occur. Provide a brief description in the table for how each force is acting on its surroundings.



Force	Description
Ground reaction force	
Joint reaction force	
Friction force	
Drag force	
Inertial force	
Elastic force	

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Question 13 (12 marks)

Read the following quote from US Olympic bobsled world champion Elana Meyers Taylor:

> "We're all playing with Newton's laws. And whoever can navigate those laws the best, wins the race."

Drawing on specific examples from your selected physical activity, discuss how effectively you have "played with" and "navigated" Newton's laws to optimise your performance.

Practice assessment task

Subject	Physical Education
Instrument number	
Technique	Project – folio
Unit	1 Motor learning, functional anatomy, biomechanics in physical activity
Topic	2 Functional anatomy and biomechanics in physical activity

Conditions	
Duration	5 hours of class time
Mode	Presentation – visual and written and/or spoken: up to 11 minutes
Length	Up to 11 minutes
Individual / Group	Individual
Other	Presentations include: • a pre-recorded presentation submitted digitally • a presentation conducted in front of an audience (class or teacher) • a digital portfolio of video, images and diagrams with annotations or commentary • a multimedia movie or slideshow that may combine images, video, sound, text and a narrative voice.

Context

In this topic, you have engaged in integrated learning experiences applying functional anatomy and biomechanical strategies to improve your performance of a specialised movement sequence from your selected physical activity. To optimise your performance, you have modified your technique based on a qualitative biomechanical analysis.

Task

Analyse the biomechanical principles involved in your performance of a specialised movement sequence used in a movement strategy in your selected physical activity. Devise a biomechanics strategy to optimise your performance of this specialised movement sequence. Evaluate the effectiveness of the strategy by considering the outcomes and limitations, and justify recommendations for which elements from your strategy you would modify and which elements you would maintain to optimise your performance.

This task requires students to:

- Analyse primary data and secondary data to ascertain the most significant relationships between the
  - biomechanical demands of the specialised movement sequences for one movement strategy
  - biomechanical concepts and principles relevant to the specialised movement sequences and one movement strategy
  - personal performance of the demonstrated specialised movement sequences and one movement strategy.
- Synthesise the most significant relationships to devise a biomechanical strategy to optimise performance of the specialised movement sequences for one movement strategy.
- Justify the development of the biomechanical strategy to optimise performance of specialised movement sequences for one movement strategy, using evidence from primary data and secondary data.
- Evaluate the effectiveness of the biomechanical strategy using the selected biomechanical and functional anatomy concepts and principles to appraise the outcome and limitations.
- Justify the modification and maintenance of the biomechanical strategy to optimise performance of specialised movement sequences for one movement strategy, using evidence from primary data and secondary data.

A detailed instrument-specific marking guide (ISMG) for this task is available for teachers to download.

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UNIT 2

Sport psychology and equity in physical activity

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Unit 2 objectives

In this unit you will:

1. Recognise and explain sport psychology and equity concepts and principles about selected physical activities.
2. Demonstrate specialised movement sequences and movement strategies in selected physical activities.
3. Apply concepts to specialised movement sequences and movement strategies in selected physical activities.
4. Analyse and synthesise data to devise strategies about sport psychology and equity.
5. Evaluate sport psychology, equity and movement strategies.
6. Justify sport psychology, equity and movement strategies.
7. Make decisions about and use language, conventions and mode-appropriate features for particular purposes and contexts.

Source: Physical Education 2025 v1.0 General Senior Syllabus © Queensland Curriculum & Assessment Authority

Unit 2 topics

The learning for this unit has been divided into two topics. The table below shows how each topic aligns with the modules in this course and lists the notional hours of teaching time for each topic.

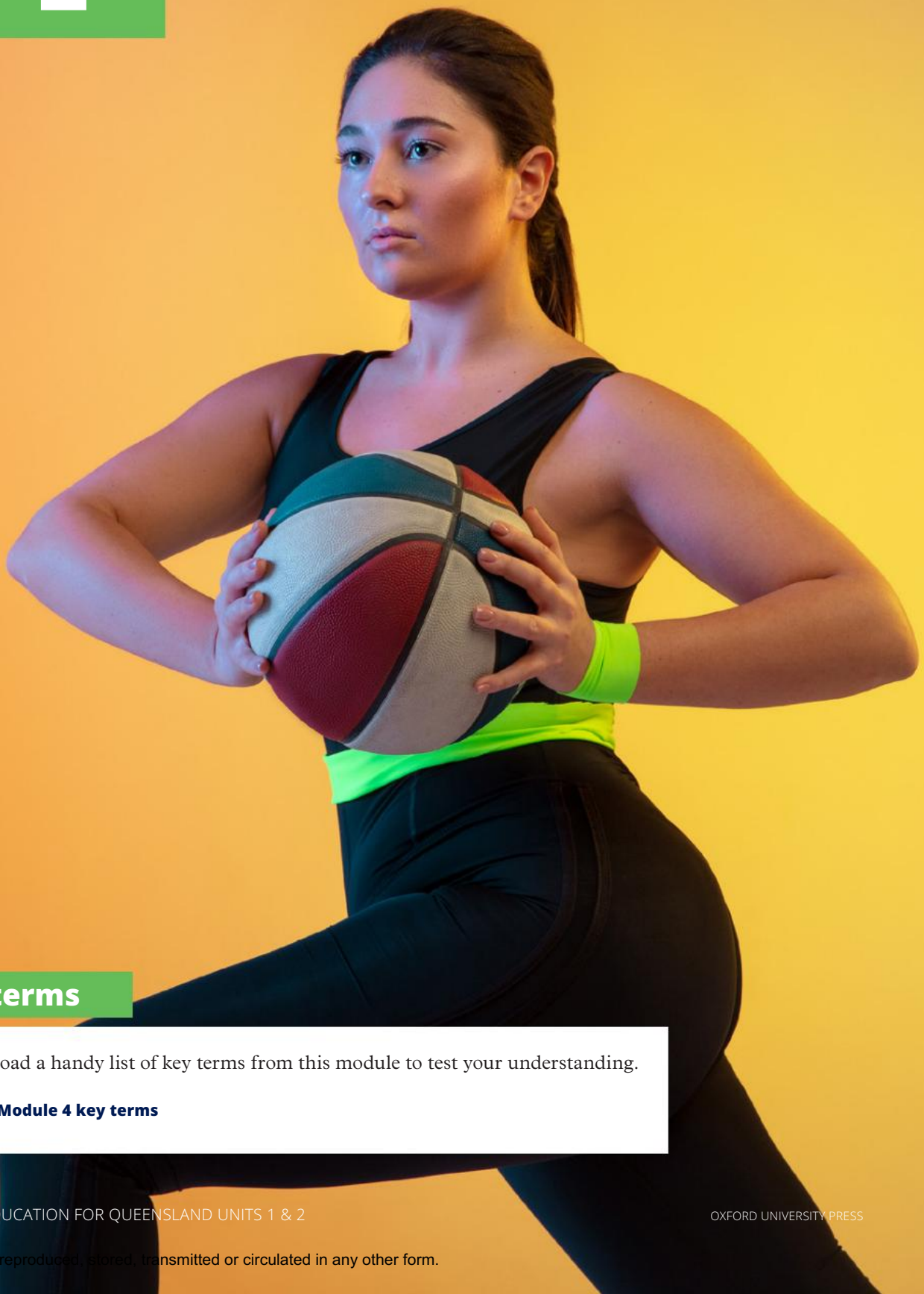
Syllabus topic	Course module	Notional hours
Topic 1 Sport psychology in physical activity	Module 4 Sport psychology (page 204)	33
Topic 2 Equity – barriers and enablers	Module 5 Equity – Barriers and enablers (page 280)	22

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MODULE 4

Sport psychology



Key terms

Download a handy list of key terms from this module to test your understanding.

Module 4 key terms

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Subject matter outcomes covered in Module 4

The following table lists all the subject matter dot points you are required to cover in **Unit 2 – Topic 1** of the Physical Education General Senior Syllabus. It also shows you exactly where that subject matter is covered in this course.

Unit 2 – Topic 1: Sport psychology in physical activity

In Unit 2 – Topic 1, students engage in learning that involves the integration of sport psychology subject matter and the subject matter from a selected physical activity.

Subject matter	Lesson/s
• Recognise and explain that sport psychology aims to optimise performance through the application of psychological knowledge and strategies.	Lesson 4.1 Introduction to sport psychology (page 208)
• Recognise and explain the concept of: – motivation as a continuum, from extrinsic to intrinsic.	Lesson 4.2 Motivation (page 212)
• Recognise and explain the concept of: – confidence, including self-confidence, self-belief and self-efficacy.	Lesson 4.3 Confidence (page 216)
• Recognise and explain the concept of: – arousal as a continuum, from relaxed drowsiness, wakefulness, curiosity and attentiveness to joy, exhilaration, anxiety, panic and rage, including inverted U theory.	Lesson 4.4 Arousal (page 220)
• Recognise and explain the concept of: – attention and concentration, including broad, narrow, internal and external foci.	Lesson 4.6 Attention and concentration (page 228)
• Recognise and explain the concept of: – team dynamics and cohesion, including group roles, group norms and social support.	Lesson 4.7 Team dynamics and cohesion (page 232)
• Analyse and synthesise primary data and secondary data about the influence of sport psychology concepts and principles on specialised movement sequences and movement strategies.	Lesson 4.5 Skill drill: Evaluate the impact of arousal on performance (page 226) Lesson 4.8 Skill drill: Assess the impact of team cohesion on performance (page 236) Lesson 4.12 Skill drill: Assess the impact of mental rehearsal on performance (page 248) Lesson 4.16 Skill drill: Determine the impact of pre-task routines on performance (page 259)
• Identify and explore the impact of motivation, confidence, arousal, attention, concentration and team dynamics on personal performance in physical activity.	
• Investigate information about psychological techniques that can be used to optimise performance: – goal-setting techniques – process goals, outcome goals and performance goals.	Lesson 4.9 Psychological techniques to optimise performance (page 238) Lesson 4.10 Goal-setting techniques (page 240)

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Subject matter	Lesson/s
• Investigate information about psychological techniques that can be used to optimise performance: – mental rehearsal techniques – mental rehearsal of the entire performance, visualisation of one aspect of skill execution prior to performance, and internal and external perspectives of imagery.	Lesson 4.11 Mental rehearsal techniques (page 244)
• Investigate information about psychological techniques that can be used to optimise performance: – positive self-talk techniques – using positive cue words and positive emotions to create self-belief.	Lesson 4.13 Positive self-talk techniques (page 250)
• Investigate information about psychological techniques that can be used to optimise performance: – self-confidence techniques – identifying how thoughts can affect self-confidence, e.g. situation, thoughts, emotions and reactions, using affirmations to change personal reactions to situations.	Lesson 4.14 Self-confidence techniques (page 253)
• Investigate information about psychological techniques that can be used to optimise performance: – pre-performance techniques – construction of a pre-performance routine and checklist; investigating mental rehearsal and pre-event tasks and cues to prepare for training and competition, e.g. technical points, triggers or competition segments.	Lesson 4.15 Pre-performance techniques (page 255)
• Investigate information about psychological techniques that can be used to optimise performance: – relaxation and energiser techniques – progressive muscle relaxation (PMR), deep breathing techniques, music and visualisation techniques.	Lesson 4.17 Relaxation and energiser techniques (page 261)
• Investigate information about psychological techniques that can be used to optimise performance: – attention and concentration techniques – selective attention, using trigger words, performance segmenting, pre-performance routines and within-competition routines.	Lesson 4.18 Attention and concentration techniques (page 264)
• Investigate information about psychological techniques that can be used to optimise performance: – team dynamics and cohesion techniques – leadership, communication, norms, rules and discipline.	Lesson 4.19 Team dynamics and cohesion techniques (page 266)
• Investigate the use of psychological techniques on personal performance in authentic performance environments.	Lesson 4.5 Skill drill: Evaluate the impact of arousal on performance (page 226) Lesson 4.8 Skill drill: Assess the impact of team cohesion on performance (page 236) Lesson 4.12 Skill drill: Assess the impact of mental rehearsal on performance (page 248) Lesson 4.16 Skill drill: Determine the impact of pre-task routines on performance (page 259)
• Gather primary data about the influence of psychological techniques on personal performance of specialised movement sequences and movement strategies in authentic performance environments.	

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Subject matter	Lesson/s
• Use secondary data to analyse how the sport psychology concepts and principles can influence performance in the selected physical activity.	Module 4
• Analyse primary data and secondary data to ascertain relationships between the sport psychology and movement strategies, concepts and principles, and personal performance.	Lesson 4.5 Skill drill: Evaluate the impact of arousal on performance (page 226) Lesson 4.8 Skill drill: Assess the impact of team cohesion on performance (page 236) Lesson 4.12 Skill drill: Assess the impact of mental rehearsal on performance (page 248) Lesson 4.16 Skill drill: Determine the impact of pre-task routines on performance (page 259) Lesson 4.21 Review: Sport psychology Practice assessment task (page 278)
• Optimise performance in physical activity by devising personal and team sport psychology strategies that consider the: – influence of sports psychology concepts and principles on specialised movement sequences and movement strategies – effect of the psychological techniques on personal and team motivation, confidence, arousal, attention, concentration and/or team dynamics – factors affecting the implementation of the techniques.	
• Justify the development of sport psychology and movement strategies using evidence from primary data and secondary data.	
• Implement the sport psychology strategies and movement strategies to gather primary data about the outcomes and limitations of decisions.	
• Reflect on primary data and secondary data to evaluate the effectiveness of sport psychology and movement strategies to achieve a determined outcome, including: – meeting the requirements of personal and team performance in physical activity – using suitable sport psychology techniques to optimise personal and team motivation, confidence, arousal, attention, concentration and/or team dynamics – optimising the performance of specialised movement sequences and movement strategies.	
• Make decisions to maintain or modify the sport psychology strategies and movement strategies.	
• Justify maintenance or modification of the sport psychology and movement strategies using evidence from primary data and secondary data.	

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Lesson 4.1
Introduction to sport psychology

Learning intentions and success criteria

Key ideas

- → Sport psychology is a field of science that studies how an athlete's mental processes influence their participation and performance in sport and physical activity.
- → Sport psychology aims to assist athletes to improve performance and achieve optimum mental health.

Defining sport psychology

sport psychology a field of science that investigates how an athlete's mental processes (e.g. their thoughts and emotions) influence their participation and performance in sport and physical activity; the discipline of sport psychology aims to assist athletes to achieve optimum mental health and to improve performance

choke (in sport) a term used to describe the failure of an athlete or team to perform to their full potential (e.g. freezing under pressure or making unnecessary errors due to nerves)

Sport psychology is a field of science that investigates how an athlete's mental processes – such as their thoughts, feelings and emotions – influence their participation and performance in sport and physical activity. The discipline of sport psychology aims to help athletes achieve optimum mental health and improve performance.

Early attempts at applying psychological theories in the sporting world began in the late 1800s, but it was not until the late 1900s that the field of sport psychology became accepted in its own right. Today, most professional athletes consult with sport psychologists on a wide range of issues, such as how to deal with pressure or overcome anxiety.

When training for any sport or physical activity, the best programs ensure an athlete is both physically and mentally ready to perform at their best. In sporting history, countless athletes in peak physical condition have been known to **choke** under pressure or fail to perform at their best during competition (see Source 1), because they did not have the necessary psychological knowledge, skills and techniques to help them deal with a range of situations. In fact, when competing athletes are matched in terms of their physical fitness and ability, the difference between the winner and the loser often comes down to their mental strength.



SOURCE 1 The intense pressure of competition can cause athletes to choke, even when they are at peak physical fitness. Tennis player Nick Kyrgios is well known for taking out his frustrations on his racquet.

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Theory in action Greg Norman's 1996 US Masters meltdown

Greg Norman is an Australian golfing legend. During his career, he enjoyed 91 professional victories internationally and spent a total of 331 weeks ranked at world number one. Norman won two major tournaments and was runner-up eight times.

Ask your parents or grandparents about Greg Norman and they will probably be familiar with his nickname: "the Great White Shark". They might also remember that Norman was involved in one of the most famous "chokes" in sporting history. It took place at the 1996 US Masters Tournament – the most prestigious event on the golfing calendar. Norman started out in near-perfect form and by the final day, he had set up an almost unbeatable lead of six shots.

However, on the final day of competition, rival golfer Nick Faldo was "**in the zone**", playing the best round of the day at five under par. After the seventh hole, Norman's performance took a sudden turn for the worse. With each hole, his nerves began to get the better of him and his lead was whittled away. Norman was definitely not "in the zone" – by the eighteenth hole, not only had he lost the tournament; he had lost it by five shots!

In a press conference afterwards, Norman admitted that the only thing he could do at the end of the day was walk down to the beach to sit, cry and ponder how it all went wrong.



SOURCE 2 Greg Norman's performance at the 1996 US Masters will go down as one of the greatest chokes in the history of sport.

Video: Greg Norman's 1996 US Masters meltdown

Key concepts in sport psychology

There are many different concepts used in sport psychology to help athletes build mental strength, reduce the risk of failing to perform and optimise performance. Some of the most important psychological concepts include:

- **motivation** – a general desire, need or want that drives a person to behave in a particular way
- **confidence** – the belief that a person can have faith in (or rely on) themselves, someone or something
- **arousal** – a feeling of mental and physical alertness or excitement
- **attention and concentration** – the level of focus and attentiveness a person dedicates to a task or stimulus
- **team dynamics and cohesion** – the relationships between members of a group of people (who are working together to achieve a common goal) and the degree to which they can stick together as a united whole.

Each of these concepts will be explored in detail in this module. They are central to the study of sport psychology because a thorough understanding of these concepts will help every athlete (from beginner through to athlete) maximise their potential and optimise their performance.

in the zone
(in sport) a term used to describe a state of focused concentration that allows an athlete or team to perform at the peak of their physical and mental ability

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Most athletes already have a basic understanding of the importance of these psychological concepts, but it is important to be aware that levels of motivation, confidence, arousal, attention and concentration in athletes do not remain constant. Instead, the levels of each of these characteristics can vary widely on a monthly, weekly, daily, hourly or even minute-by-minute basis, due to a range of factors.



SOURCE 3 Sally Pearson was "in the zone" when she won gold in the women's 100-metre hurdles at the London 2012 Olympic Games.

For example, an athlete's confidence levels may be high at the start of the week, but may decrease as the week progresses. That same athlete's motivation and concentration might also reduce as a result. It is therefore important for athletes to constantly evaluate their mental state during training and competition so that they can take the necessary steps to get into the right "zone". When all these characteristics are at their optimum levels, an athlete can enter a state of focused concentration that enables them to perform at the peak of their physical and mental ability. This state is often referred to as being "in the zone". This optimum zone is different for every athlete and sport – for example, some athletes perform best when they are hyped up during competition, while others perform best in a more relaxed state.

For the record!

Many professional athletes and elite sporting teams now employ sport psychologists. Sport psychologists may travel with an individual or team to offer advice and support during training and competition, and even during downtime. According to payscale.com, top sport psychologists working with elite athletes can expect to earn more than $100 000 per year.

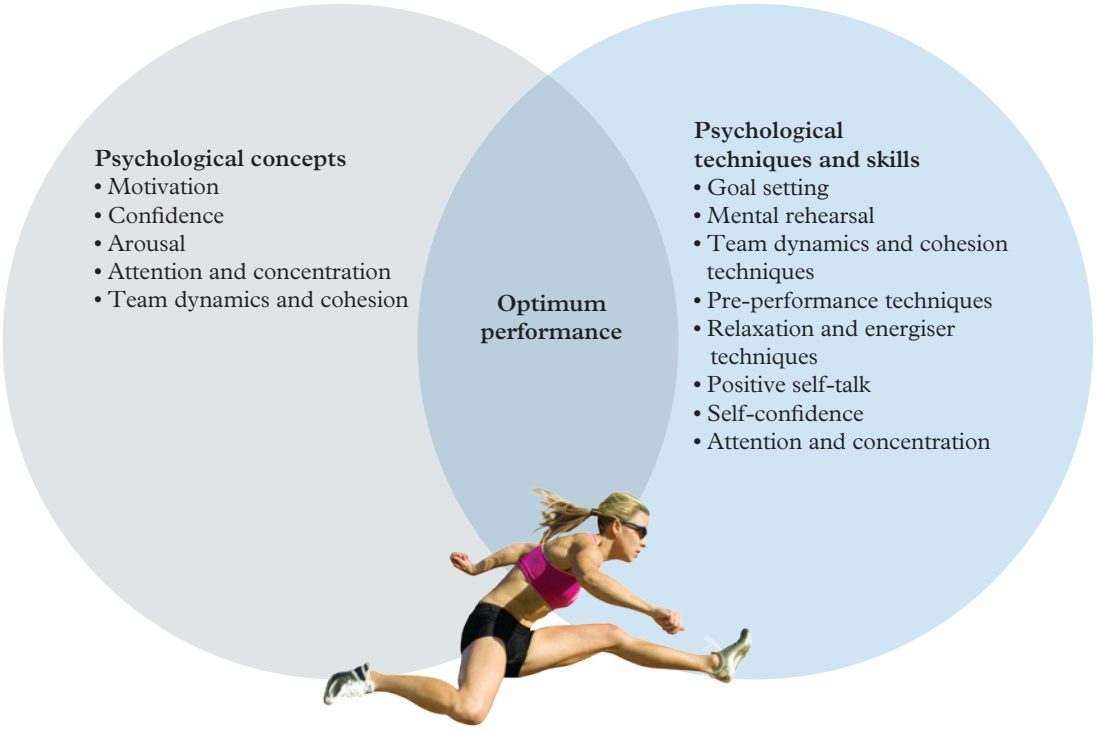
Key techniques in sport psychology

To optimise the psychological concepts mentioned, there are a number of practical psychological techniques that athletes can apply at any stage during training and competition. These are listed in Source 4 and will be discussed in detail later in this module. Research has shown that these sport psychology techniques can assist athletes to:

- enhance their performance
- cope with the pressures of competition
- recover from injuries
- stay motivated and keep up with a training program
- get more enjoyment out of their chosen sport or physical activity.

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SOURCE 4 Athletes can apply different psychological concepts, techniques and skills to optimise their performance. Psychological concepts are discussed in Lesson 4.2 to Lesson 4.7 (pages 212–235) of this module, and psychological techniques are discussed in Lesson 4.10 to Lesson 4.18 (pages 240–266).

Study tip

Diagrams and flow charts are great tools to enhance your understanding of a concept. If you are struggling to grasp a particular idea, try creating your own diagram to explain it. Alternatively, you could redraw a diagram in your own style and add in extra details. It can also help to have a go at explaining a concept diagram to a friend.

Retrieve it!

In sport psychology, what does it mean to "choke"? Check back to earlier in this lesson to see if you retrieved the information correctly.

Check your learning 4.1

Check your learning 4.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Sport psychology is best defined as:
   - **A** being concerned with the impact an athlete's mind has on their performance in sport.
   - **B** being in a "zone".
   - **C** performing optimally in all sporting events.
   - **D** training the whole body, including the mind.

2 When an athlete can enter a state of focused concentration that enables them to perform at the peak of their physical and mental ability, they are said to be:
   - **A** peak zoned.
   - **B** "in the zone".
   - **C** "zoned up".
   - **D** ultimately zoned.

3 **Describe** some of the benefits and advantages that sport psychology can offer athletes.

4 **Identify** five key concepts that underpin sport psychology. **Select** one and provide an example of the impact it has on your performance in your selected physical activity.

Analytical processes



5 Copy the "Looks like, feels like, sounds like" Y-chart provided into your notebook, and use it to help you **compare** the sights, sounds and feelings of a situation (either during training or competition) when you or someone you know choked under pressure. **Determine** the impact these had on your or the other person's performance in the sport.

Knowledge utilisation

6 Read "Theory in action: Greg Norman's 1996 US Masters meltdown". It states that Nick Faldo was "in the zone" on the final day of play and had the best round of the day. **Evaluate** the effect that Faldo's strong performance may have had on Greg Norman's poor performance that day.

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Lesson 4.2
Motivation

Learning intentions and success criteria

Key ideas

- → Motivation refers to the drive we have to behave in a particular way to achieve our goals.
- → There are two types of motivation: intrinsic and extrinsic.

Defining motivation

motivation a desire, need or want that causes a person to behave in a particular way

Motivation is a key concept in sport psychology. It refers to the drive within us to behave in a particular way to achieve our goals. Most people would agree that any athlete who wants to succeed in their chosen sport will need high levels of motivation – but what does that actually mean?







SOURCE 1 Athletes are motivated by many different things, including medals or prize money, belonging to a team or cheering fans.

Different things motivate people at different times and to different extents. For example, one athlete might be motivated by awards (such as trophies and prize money), another might be motivated by the thrill of participating in sport, while another might be motivated by the roar of the crowd. Some athletes might be motivated by all these things at the same time. In fact, there are many variables that can influence the motivation levels of an individual athlete on any given day.

Often, a coach's emphasis is solely on increasing the quantity of motivation – the assumption being that higher motivation will lead to better performance. However, research has shown that the *quality* of motivation, rather than the *quantity*, is a greater predictor of sporting success.

Self-determination theory

Unlike many theoretical frameworks of motivation, **self-determination theory (SDT)** makes a distinction between the *quality* and *quantity* of motivation. SDT was developed in 1985 by US psychologists Edward Deci and Richard Ryan. It is a theoretical framework used to analyse human behaviour and is very useful for understanding what motivates people to participate in sport and physical activity in the ways they do. The central argument of SDT is that all people are born with three basic psychological needs:

- **autonomy** – a person's need to control their own life and make their own decisions
- **competence** – a person's need to learn and master skills that challenge their abilities
- **relatedness** – a person's need to feel a sense of belonging by interacting with others and feeling part of a group or community.

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When an athlete feels in control of their behaviour (autonomy), experiences success (competence), and feels accepted and valued by their coach and teammates (relatedness), they will demonstrate a more positive mindset during training and display a healthier psychological state. How well these psychological needs are met in an athlete has an impact on the quality of motivation they experience.

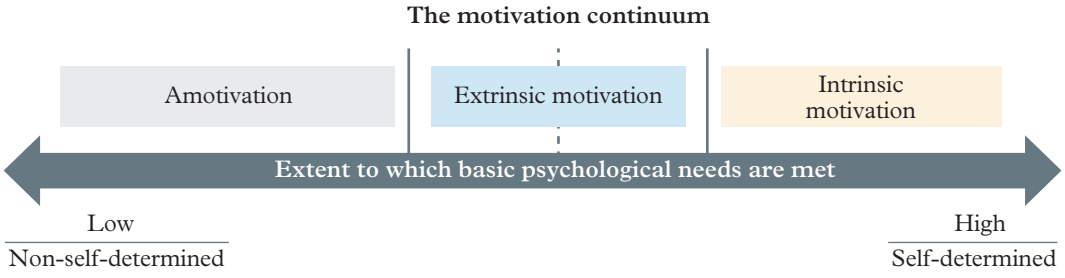
SDT suggests that there are three main types of motivation that exist on a continuum:

- **amotivation** – the absence of motivation
- **extrinsic motivation** – a type of motivation driven by external factors (i.e. factors that come from outside a person)
- **intrinsic motivation** – a type of motivation driven by internal factors (i.e. factors that come from inside a person).

The motivation continuum

As shown in Source 2, SDT defines motivation in terms of a continuum from amotivation (on the left), through extrinsic motivation to intrinsic motivation (on the right). The continuum moves from **non-self-determined motivation** to more **self-determined motivation**. If a person's basic needs for autonomy, competence and relatedness are not being met at all, there will be a complete absence of motivation (referred to as "amotivation"). As these needs are increasingly met, levels of motivation become more self-determined.

A thorough understanding of SDT can be beneficial for coaches and training staff, as it is often their responsibility to help optimise the motivation levels of the athletes they are working with. The more self-determined an athlete's motivation, the more beneficial it is for their performance and their psychological wellbeing. We will now look at extrinsic and intrinsic motivation in more depth.



SOURCE 2 Self-determination theory explains motivation in relation to three basic needs and suggests there are three main types of motivation that can be placed on a continuum, based on the degree of self-determination an individual feels.

Extrinsic motivation

Extrinsic motivation is a type of motivation that is driven by external factors. In other words, when a person is extrinsically motivated to perform a task, they value the likely outcome more than the task itself. In a sport setting, extrinsic motivation can include things such as:

- awards, trophies and prize money
- praise and recognition from friends, family, teachers or the public (spectators or fans)
- expectations from friends, family or teachers
- a desire to be popular or make friends
- a desire to improve fitness.

self-determination theory (SDT) a theoretical framework used to analyse human behaviour and explain what motivates people

autonomy a person's need to control their own life and make their own decisions

competence a person's need to learn and master skills that challenge their abilities

relatedness a person's need to feel a sense of belonging by interacting with others and feeling part of a group or community

amotivation the total absence of motivation

extrinsic motivation a type of motivation driven by external factors (i.e. factors that come from outside a person) such as money and fame

intrinsic motivation a type of motivation driven by internal factors (i.e. factors that come from inside a person) such as fun, enjoyment and personal satisfaction

non-self-determined motivation a type of motivation that is not controlled by the individual

self-determined motivation a type of motivation that is controlled by the individual

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SOURCE 3 Praise from spectators is an example of an externally controlled extrinsic motivator.

Types of extrinsic motivation

Not all forms of extrinsic motivation are the same. According to the SDT, they vary in type depending on the amount of control a person has over the activity they are performing (i.e. the degree of autonomy they have).

Extrinsic motivation can be categorised generally into two groups:

- externally controlled
- internalised and integrated.

When an athlete is given very little choice about what to do (i.e. low autonomy), they are motivated purely by an external demand and its associated reward – their extrinsic motivation is externally controlled. An example of this is an athlete going for a run because their coach has threatened them with bench time if they do not improve their fitness. Externally controlled motivation is low in self-determination and therefore sits to the left of the motivation continuum (see Source 2). It is important to note that, generally, punishment-based motivation can be detrimental to athletes and has been linked to increased rates of dropout over time.

Retrieve it!

Define the term "sport psychology". Check back to Lesson 4.1 Introduction to sport psychology (page 208) to see if you retrieved the information correctly.

By contrast, when an athlete enjoys more choice about what to do (i.e. high autonomy) and is motivated, for example, by a desire to win a trophy, there is an alignment between the task they are performing, its associated reward and their personal values. In this case, the reward comes from outside the athlete, so the motivation is still extrinsic. It seems to come from within because the reward and the values associated with it have been internalised by the athlete and integrated into their sense of who they are and what is important to them. An example of this is a runner who goes for a run because they value fitness, having had the importance of keeping fit and healthy instilled in them by those around them. Running helps them to meet their goals for improved fitness. Although more self-determined than the earlier example of the athlete who runs in response to the threat of bench time, the motivating factor in this instance is still extrinsic because it comes from an external, societal-based source.

There are different types of extrinsic motivation that sit at different points along the motivation continuum based on how self-determined they are. However, the consistent feature in each case is that the motivating factor is external to the individual.

For the record!

Many people assume that elite athletes possess high levels of intrinsic motivation, but that is not always the case – for example, Australian tennis player Bernard Tomic shocked the tennis world with his admission that he was "bored" and struggling to find motivation during the 2017 Wimbledon Championships.

Extrinsic motivation can be a very strong motivator, especially for young athletes or people who are new to a sport. For some athletes, praise and prizes can serve as strong encouragement to keep trying and not to give up. Nevertheless, there are limits to the effectiveness of praise and prizes over the longer term. It is important that externally regulated motivation is complemented by more self-determined forms of motivation for the athlete to experience longevity in participation and to find strength and motivation during challenging times in the sporting journey.

Intrinsic motivation

Intrinsic motivation is a type of motivation that is driven completely by internal factors. For example, an athlete who goes for a run purely because they love the feeling of running is said to be intrinsically motivated. In a sport setting, intrinsic motivation can include things such as:

- feelings of fun, pleasure and accomplishment

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- the enjoyment of taking on a challenge
- a personal desire to learn new skills and experience new things.

Athletes who are intrinsically motivated tend to achieve much better long-term results and stay active in their chosen sport for longer periods of time. Athletes who have a strong sense of autonomy, competence and relatedness are more likely to experience intrinsic motivation. They become their own motivator in difficult times (e.g. when they are under pressure) and continue to perform well in the absence of extrinsic motivators. However, studies have shown that athletes who are predominantly intrinsically motivated tend to lack the strong competitive drive needed to be a champion. They enjoy mastering tasks in their chosen sport but are less concerned about pushing themselves to compete against others and win.

Achieving and maintaining optimum motivation

Sport psychologists generally agree that a combination of both intrinsic and extrinsic motivation results in optimum performance. This mixture of intrinsic and extrinsic factors leads to desirable characteristics such as:

- persistence and perseverance
- a positive attitude
- enduring focus and concentration.

These characteristics can help athletes achieve long-term success and enjoyment in their chosen sport.



SOURCE 4 A combination of intrinsic and extrinsic motivation results in optimum performance.

Check your learning 4.2

Check your learning 4.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Martha did not sign up for competitive basketball because she prefers playing basketball with her friends. When she scores goals, she feels a sense of accomplishment that keeps her motivated. She is often unaware of the score. Martha is said to be:
   - **A** motivated by rewards.
   - **B** motivated intrinsically.
   - **C** motivated extrinsically.
   - **D** amotivated.

2 Choose the correct answer. In self-determination theory it is said that athletes have three basic needs. These are:
   - **A** autonomy, relatedness and competence.
   - **B** autonomy, relatedness and intrinsic motivation.
   - **C** autonomy, intrinsic motivation and extrinsic motivation.
   - **D** competence, relatedness and intrinsic motivation.

Analytical processes

3 **Categorise** the following examples as either "controlled extrinsic motivation" or "internalised and integrated motivation".
   - **a** Pushing through the pain of the last kilometre of a 5-kilometre run because this will help you win the cross-country trophy
   - **b** Joining a local lawn bowls club because you love playing the sport
   - **c** Getting up at 5 am to swim 30 laps of the town pool to stay fit and healthy
   - **d** Trying your hardest to win at the local archery tournament because your mum was a champion archer and is so excited to see you compete

Knowledge utilisation

4 **Evaluate** the following statement about self-determination theory: "Athletes need to have high levels of autonomy, competence and relatedness to become optimally motivated."

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5 In relation to the statement in question 4, consider your own experience – does this statement ring true for you? **Explain** why or why not.

6 Refer to the motivation continuum (Source 2, page 213) and **decide** where you currently sit regarding your selected physical activity. Use primary and secondary data to **justify** your decision.

- **a** **Develop** and record one or two practical strategies that could help you move along the continuum towards the right (i.e. towards intrinsic motivation).
- **b** Each week over the course of Unit 2, revisit your strategies and **assess** if they are helping you to develop intrinsic motivation. Provide evidence (e.g. primary data) to support your response.

7 **Evaluate** the types of motivation you have experienced in sport throughout your life. Provide an example of a time you:

- **a** were amotivated
- **b** had externally controlled motivation
- **c** had internalised and integrated motivation
- **d** had intrinsic motivation.

8 **Examine** whether children should be given extrinsic rewards for participating in sport. Use secondary data and the table below to help generate discussion points in your response.

Reasons for extrinsic rewards	Reasons against extrinsic rewards
1 2	1 2

Lesson 4.3
Confidence

Learning intentions and success criteria

Key ideas

- → Confidence is the belief that a person can have faith in (or rely on) themselves, someone or something.
- → Internal factors affecting an athlete's overall level of confidence include: self-confidence, self-belief and self-efficacy.

Defining confidence

confidence
the belief that that an individual can have faith in (or rely on) themselves, someone or something

Confidence is another key concept in sport psychology. In simple terms, confidence is the belief that a person can have faith in (or rely on) themselves, someone or something.

Confidence plays an important role in every athlete's overall performance. In fact, confidence underpins most of the other psychological characteristics demonstrated by successful athletes because it is critical to building mental strength. For example, take the following two athletes:

- a tennis player who is making repeated unforced errors on court during an important match and starts visibly slumping between points
- a soccer player who has to kick for goal to win the match in a penalty shootout.

In both cases, each athlete's future performance will be strongly influenced by the degree of confidence they have in their ability to perform at the level required. For this reason,

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understanding confidence – and developing an appreciation of the role it plays in overall performance in different situations – is an important part of sport psychology.

The faith that an athlete has in other people and things can have an impact on their confidence. Coaches and teachers who are supportive and demonstrate a genuine belief in the athlete can boost confidence, encouraging the athlete to approach challenges with optimism. In team sports, the faith that an athlete has in the skills and abilities of their teammates can increase or diminish their level of confidence.



SOURCE 1 Confidence contributed to the extraordinary success of the Matildas, who achieved their best-ever placing of fourth overall at the 2023 FIFA Women's World Cup, which was held in Australia.

The perceived strength of an opponent can also be an influencing factor of confidence. A weaker opponent can boost the athlete's trust in themselves to take control of the game, while a stronger opponent can cause the athlete to feel intimidated. In sports involving equipment, confidence can be influenced positively or negatively by the athlete's ability to rely on the necessary equipment. For example, the belief that a bike will last the distance in a 30-kilometre road race.

While these external factors can significantly influence an athlete's confidence, sport psychologists often describe an athlete's overall confidence in terms of three factors:

- **self-confidence**
- **self-belief**
- **self-efficacy**.

The relationship between these three factors – and the role that each one plays in an athlete's overall confidence – can be complex. Sometimes these terms are used interchangeably, while at other times they have a particular meaning. We will now explore each factor in more detail.

self-confidence an athlete's conviction that they have the skills and abilities to succeed

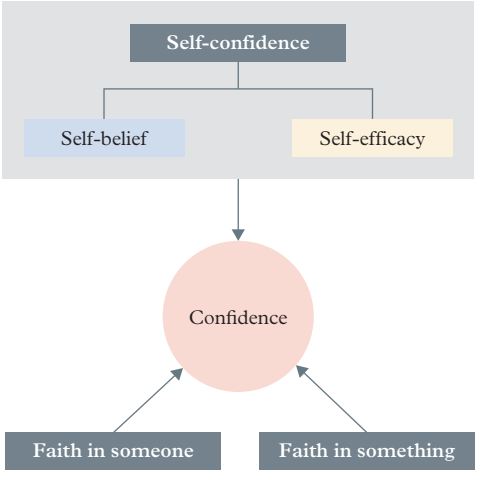
self-belief an athlete's trust in their ability to succeed, regardless of their previous achievements and competencies

self-efficacy an athlete's belief in their ability to perform a particular task

Self-confidence

Self-confidence is a general term used to describe a feeling of trust in one's own abilities, qualities and judgments. In a sporting context, self-confidence is often defined as the acceptance and conviction that an athlete has the resources (i.e. the skills and abilities) to achieve success and win.

Self-confident athletes are composed, thrive on pressure, challenge themselves and rarely doubt their ability to perform at their best. By contrast, athletes who lack self-confidence hesitate more, persist less, doubt their ability to perform at their best and make more errors.



SOURCE 2 Self-belief and self-efficacy are components of self-confidence. All three factors combined determine an athlete's confidence.

Retrieve it!

What are the five major psychological concepts covered in this module? Check back to Lesson 4.1 Introduction to sport psychology (page 208) to see if you retrieved the information correctly.

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Self-belief

Self-belief is another general term used to describe the overall trust an athlete has in their ability to succeed, regardless of their previous achievements and competencies. Self-belief can therefore be understood as one component or ingredient of self-confidence. Australian tennis star Lleyton Hewitt is a good example of an athlete with a very high level of self-belief. With his "never give up" attitude, Hewitt was famous for coming back from the edge of defeat to grasp victory.



SOURCE 3 During his career, Australian professional tennis player and former world number 1 Lleyton Hewitt drew on reserves of self-belief when he needed it most.

Self-efficacy

Self-efficacy is a specific term used by sport psychologists to describe an athlete's confidence. It refers to the belief an athlete has in their ability to perform a particular task to achieve a pre-determined outcome. In other words, the level of self-efficacy an athlete has when completing a specific activity is a measure of the perception they have of their ability to successfully meet the demands of that particular task. This means that an athlete might have high self-efficacy in cricket and low self-efficacy in badminton. It may also mean that a cricketer has high self-efficacy in bowling, but low self-efficacy in batting.

The concept of self-efficacy was developed by US psychologist Albert Bandura. He saw self-efficacy as an indicator of self-confidence. While self-confidence is a general, slightly "fuzzy" term, self-efficacy is a more specific and more useful term for sport psychologists to use when helping to improve the performance of athletes.

It is important to recognise that self-efficacy refers to an athlete's *perception* of their ability in a task, rather than their *actual* ability. This distinction between self-efficacy and true capability is crucial in situations where an athlete's level of self-efficacy in a task leads them to be over- or under-confident about their prospects. Mismatches of self-efficacy and true capability in either direction can have a negative impact on an athlete's performance. Losing a match due to underestimating an opponent is one example of how self-efficacy can impact an athlete's performance in this way.

Theory in action Appearing confident versus being confident

The lead up to any world-class boxing match provides a fascinating spectacle. Pre-bout hype can involve weigh-ins, intense press conferences and theatrical face-offs. Boxers typically use these opportunities for showmanship, displaying extreme levels of confidence that are designed to intimidate their opponent. It also helps them to prepare psychologically to perform.

Muhammad Ali believed his words were his cannons. He defended his incessant pre-match trash talking by exclaiming: "It ain't bragging if you can back it up." It could be said that his self-efficacy and his capabilities matched. At just 22 years of age, Ali came up against Sonny "Big Bear" Liston – an imposing figure with a criminal record. On the eve of the fight, Ali announced that he would use Liston's body as a bear rug in his home! He went on to win the fight and claim his place in the history books. Researchers at Florida State University have found that trash talking can improve performance by as much as 46 per cent. It boosts self-confidence and the belief that your opponent is weaker because of it.

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SOURCE 4 "Fake it till you make it" is a common saying regularly used by boxers. The idea being that if they proclaim their greatness enough, both they and their opponent will have no choice but to believe it.

Check your learning 4.3

Check your learning 4.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Franklin has a belief in his ability to perform a high-risk jump serve down the sideline to win the next point in a crucial volleyball match between the top two teams on the ladder. His plan is to force the weakest passer to make a serve-receive error. Of the following concepts, what is this scenario the best example of?
   - **A** Self-assurance
   - **B** Self-belief
   - **C** Self-confidence
   - **D** Self-efficacy

2 Self confidence involves:
   - **A** a feeling of trust in one's own abilities.
   - **B** a feeling of trust in one's own qualities.
   - **C** a feeling of trust in one's own judgments.
   - **D** all of the above.

Analytical processes

3 Read "Theory in action: Appearing confident versus being confident". **Analyse** how having a "fake it till you make it" attitude can contribute to a successful performance.

4 **Reflect on** situations in sport when your self-efficacy did not match your true capability. **Determine** how this affected your self-confidence.

Knowledge utilisation

5 **Create** your own diagram, flow chart or table to explain the interrelationship between self-confidence, self-belief and self-efficacy. You may like to expand or modify Source 2 (page 217) to do this.

6 **Justify** a response that supports or refutes the following statement: "Appearing confident is just as important as being confident". Use "Theory in action: Appearing confident versus being confident" to help develop arguments for your response.

7 **Conduct** some online research to compile a list of three strategies that you could use to overcome low self-efficacy in a particular skill within your selected physical activity. **Justify** your selection of strategies using primary and/or secondary data.

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Lesson 4.4
Arousal

Learning intentions and success criteria

Key ideas

- → Arousal is a feeling of mental and physical alertness or excitement.
- → There are several key stages on the arousal continuum, which include relaxed drowsiness, joy and exhilaration, and panic and rage.

Defining arousal

arousal a feeling of mental and physical alertness or excitement

fight-or-flight response an innate (instinctive) physiological response to a threat of danger or harm that prepares the body to defend or flee

Arousal is another key concept in sport psychology. In simple terms, arousal is a feeling of mental and physical alertness or excitement.

Arousal is linked to our body's **fight-or-flight response**, an instinctive reaction that all human beings have when they are faced with the threat of danger or harm. During the fight-or-flight response, the body prepares to fight or flee danger by undergoing a range of physiological changes (such as increased heart rate, more rapid breathing, increased perspiration and increased brain activity). Blood is diverted away from the abdominal organs and the skin, towards muscles in the arms and legs that are necessary to defend the body or propel it away from danger.



SOURCE 1 The arousal levels experienced by athletes when they are training or competing simulate the body's fight-or-flight response.

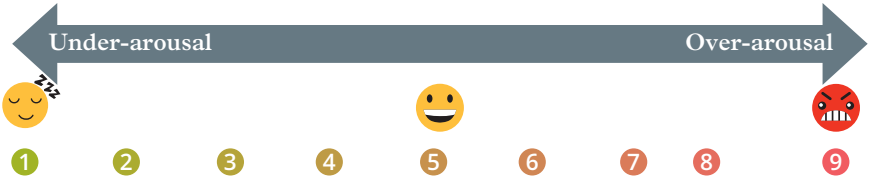
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When an athlete is preparing for or competing in an important event, their arousal levels simulate a fight-or-flight response. Throughout training, pre-performance and performance, athletes need to ensure that their mind and body are in an optimum state of arousal. Whether a boxer is in training for a title fight, a gymnast is about to take the floor for their final routine, or a volleyball player is serving at match point, their arousal levels will need to be controlled and matched to suit their performance needs.

The arousal continuum

Similar to motivation, arousal is often defined in terms of a continuum. As shown in Source 2, athletes performing at the lower end of the continuum are often described as being under-aroused, whereas athletes performing at the higher end of the continuum are said to be over-aroused.



1	**Relaxed drowsiness**	a state of low arousal, low stress and low awareness
2	**Wakefulness**	a state of consciousness and awareness
3	**Curiosity**	a state of desire to know or learn
4	**Attentiveness**	a state of paying close attention to detail
5	**Joy**	a state of pleasure and happiness
6	**Exhilaration**	a state of excitement, extreme happiness or elation
7	**Anxiety**	a state of nervousness and worry
8	**Panic**	a state of sudden uncontrollable fear or extreme anxiety
9	**Rage**	a state of violent uncontrolled anger or aggression

SOURCE 2 The arousal continuum organises common states on a scale from under-arousal to over-arousal.

The arousal continuum is a useful tool to help understand the impact that different arousal levels can have on performance. Generally speaking, the most beneficial arousal levels for most athletes and physical activities are located towards the middle of the continuum. However, this is not always the case.

In a state of optimum arousal, athletes will be both mentally and physically prepared for the type of activity and situation they are facing. It is therefore more helpful to think of optimum arousal levels in relation to individual athletes and the different tasks that they are required to perform. To illustrate this point, compare an archer with a discus thrower.

- The optimum level of arousal for an archer is probably not a state of joy or exhilaration. In fact, these are both likely to be considered states of over-arousal because archers try to slow their heart rate and release arrows between heartbeats to improve aim and reduce extraneous (unnecessary) movement.
- The optimum level of arousal for a discus thrower is not likely to be a state of joy or exhilaration either. Instead, they will probably produce their best throw when they reach a level of arousal that exceeds these states. An experienced discus thrower who is "pumped" (i.e. in a state approaching rage) is likely to channel this arousal into activating their muscles and increasing the distance of their throw.

All athletes need to be conscious of their arousal levels and manage them appropriately to maintain the best levels for their situation. When athletes fail to do this, they risk entering states of **under-arousal** or **over-arousal**, both of which will prevent them from performing at their best.

Study tip

Throughout this unit, keep track of your arousal levels during training and competition by recording:

- dates and times of physical activity
- playing conditions (e.g. weather)
- position played
- your arousal levels before and during activity
- your rating on the arousal continuum (before and during activity).

Reflect on the interrelationship between these factors and how they affected your performance on the day.

under-arousal
a state of arousal generally considered too low for optimum performance

over-arousal
a state of arousal generally considered too high for optimum performance

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SOURCE 3 Serena Williams' state of over-arousal during the 2018 US Open final cost her the match; this followed a similar incident at the 2009 US Open semi-final.

Understanding anxiety

anxiety psychological and physical symptoms brought on by a sense of apprehension about something

cognitive anxiety anxiety felt as an emotional response

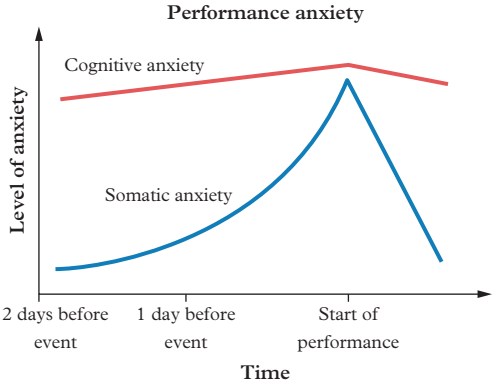
somatic anxiety anxiety felt as a physical response

Anxiety is one of the most common forms of over-arousal. Even the most experienced and talented athletes can struggle to manage anxiety. Anxiety is made up of two components:

- **cognitive anxiety** – the emotional and mental responses to over-arousal, such as feelings of worry and panic
- **somatic anxiety** – the physical responses to over-arousal, such as sweaty palms and shallow, rapid breathing (known as hyperventilation).

As Source 4 shows, in the lead-up to a performance, cognitive anxiety is initially much higher than somatic anxiety, as worrying thoughts occupy the mind of an athlete. However, somatic anxiety increases as the event gets closer, causing a physiological response.

Anxiety can cause athletes to feel threatened, seize up, be unable to think clearly and underperform. In such cases, it is important for athletes to adopt relaxation techniques to manage the anxiety they are experiencing. These are discussed in Lesson 4.17 Relaxation and energiser techniques (page 261).



SOURCE 4 In the lead-up to a performance, cognitive anxiety is initially much higher than somatic anxiety, but somatic anxiety increases as the event gets closer.

Trait and state anxiety

It is also common to distinguish between two types of anxiety:

trait anxiety personality-based anxiety

state anxiety situation-based anxiety

- **trait anxiety** – an athlete's natural tendency (i.e. a personality trait) to perceive something as threatening or non-threatening. Those with high levels of trait anxiety will naturally perceive a situation to be more threatening than a person with low levels of trait anxiety.
- **state anxiety** – anxiety that is induced by a particular situation or environment. The emotional response they feel is a direct result of the event or experience. The higher the pressure of the situation, the greater the state anxiety experienced. An athlete's level of state anxiety is often related to their self-confidence.

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The interrelationship between trait and state anxiety will determine a person's anxiety levels from moment to moment. For example, it is common for athletes to feel nervous when playing an important match (state anxiety); however, the level of this anxiety is also influenced by their personality (trait anxiety).

The two most important factors that determine an athlete's level of anxiety are:

- the importance of the situation to the individual
- the uncertainty of the outcome of the situation.

Trait and state anxiety questionnaire

Study tip

An individual's trait and state anxiety can be measured using questionnaires. One of these questionnaires is provided for you. Download and complete the questionnaire to get a better understanding of your personal anxiety levels.

Theory in action Gymnast affected by the "twisties"

Simone Biles, widely considered the greatest gymnast of all time, suffered from both trait and state anxiety during the 2020 Tokyo Olympics. Biles said that she had always had anxiety, and it had "got really bad" in the months leading up to the Olympics. Biles said that she was overwhelmed and felt like she was going to pass out before her first event in Tokyo.

Biles said she felt immense stress as a world-class athlete. She talked about being plagued by the "twisties", a mental block that some gymnasts experience and which caused her to lose track of where she was in the air during twists and flips.

Biles recognised that this lack of concentration due to extreme anxiety was unsafe and she made the decision to withdraw from the competition.



SOURCE 5 Simone Biles during the 2020 Tokyo Olympics

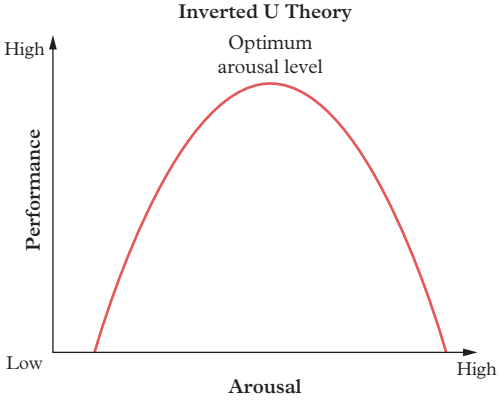
Achieving and maintaining optimum arousal

Sport psychologists generally agree that achieving and maintaining a level of arousal that is right for the individual athlete and their situation will result in optimum performance. However, there are so many differences in athletes' arousal levels that determining the optimum level for every individual is almost impossible. Over the past century, a number of theories have been developed that try to explain the relationship between arousal and performance. We will now examine three of the most common theories:

- inverted U theory
- zones of optimal functioning theory
- the catastrophe model.

Inverted U theory

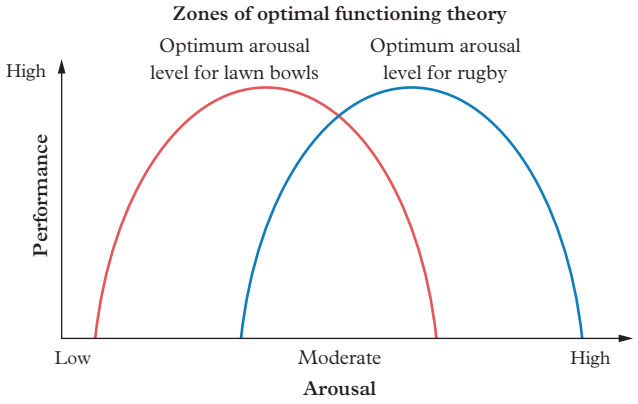
Inverted U theory was proposed by US psychologists Robert Yerkes and John Dodson in 1908. It suggests that performance increases as a result of mental and physical arousal, but only up to a certain point. For every individual and every activity, there is a point at which arousal levels become too high and performance decreases. As shown in Source 6, the relationship between performance and arousal is often presented as an inverted U-shaped curve, which increases and then decreases in response to rising levels of arousal.



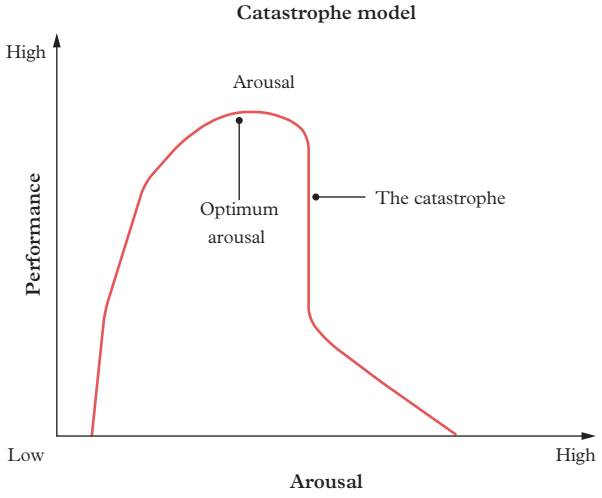
SOURCE 6 According to the inverted U theory, an increase in arousal causes improvement in performance up to an optimum point. After this point, increased arousal leads to a decline in performance.

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SOURCE 7 According to the zones of optimal functioning theory, the zone of optimum arousal differs for different activities.



SOURCE 8 According to the catastrophe model, when an athlete experiences both cognitive and somatic anxiety, they can experience a sudden decline in performance.

Zones of optimal functioning theory

The zones of optimal functioning theory was proposed by Russian sport psychologist Yuri Hanin in 1980. Like the inverted U theory, it suggests that a narrow range (or zone) of arousal levels will produce the best performance; however, it goes further by suggesting that the zone of optimum arousal differs for different activities. As shown in Source 7, lawn bowlers will optimise performance by maintaining lower levels of arousal so they can perform controlled movements. Rugby players, on the other hand, will optimise performance by maintaining higher levels of arousal so they can generate maximum power during tackles and sprints.

The catastrophe model

The catastrophe model, proposed by John Fazey and Lew Hardy in 1988, extends on the inverted U theory by suggesting that the interplay between cognitive and somatic anxiety has an impact on the shape of the arousal curve. An athlete experiencing the physiological impact of anxiety or arousal (without accompanying cognitive effects) will follow the gentle curve of the U shape. A combination of both cognitive and somatic anxiety, however, will inevitably lead to a catastrophic decline in the athlete's performance, as shown in Source 8.

Retrieve it!

What are the three most common theories that explain the relationship between arousal and performance in sport? Check back to earlier in this lesson to see if you retrieved the information correctly.

Retrieve it!

Explain the difference between trait and state anxiety. Check back to earlier this lesson to see if you retrieved the information correctly.



SOURCE 9 For modern pentathletes, such as Australia's Chloe Esposito, achieving and maintaining the optimum zone of arousal is tricky – for example, they require stillness and accuracy for shooting but also aggression and speed for running.

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Check your learning 4.4

Check your learning 4.4: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. In the context of a basketball game, which of these factors are most likely to contribute to heightened arousal levels in athletes?
   - **A** Intense crowd noise and cheering
   - **B** Relaxing background music
   - **C** Visualisation techniques before the game
   - **D** Low-stakes friendly matches

2 On the arousal continuum from relaxed drowsiness (1) to rage (9), what is the sixth state?
   - **A** Joy
   - **B** Exhilaration
   - **C** Anxiety
   - **D** Panic

3 **Describe** the relationship between arousal and performance.

4 Use the zones of optimal functioning theory to **construct** an inverted U graph comparing optimal arousal level in your current selected physical activity with optimal arousal in one other physical activity.

Analytical processes

5 **Compare** and **contrast** the arousal levels required for optimum performance in two or more of the physical activities you have studied so far this year.

6 **Differentiate** between trait and state anxiety. Use examples from your own experiences to enhance your response.

Knowledge utilisation

7 Look carefully at the image of Serena Williams (Source 3, page 222). **Conduct** some additional online research to find out what events contributed to Serena's state of over-arousal. **Evaluate** the impact of the situation on her arousal levels and subsequent performance.

8 Download the trait anxiety versus state anxiety questionnaire provided earlier in this lesson. Complete the questions. In one paragraph, **synthesise** and **evaluate** your results.

9 Look at the images of Chloe Esposito (Source 9). **Conduct** some online research to **assess** how she was able to reduce her arousal levels after a 3-kilometre run (in a packed stadium) to a level that allowed her to shoot so quickly and accurately that she was able to jump from seventh to first place in the women's modern pentathlon at the 2016 Olympic Games.



SOURCE 10 Achieving and maintaining optimum arousal levels will result in optimum performance.

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SKILL DRILL

Lesson 4.5
Evaluate the impact of arousal on performance

Aim

To evaluate the impact of different arousal levels on personal or team performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Sporting equipment specific to your selected physical activity
- Game Performance Assessment Instrument 6 (GPAI 6)
- Pen
- A portable music player (e.g. a smartphone or digital audio device) and headphones
- A calming/meditative piece of music (selected by the teacher and downloaded to the music player in advance)
- A high-energy/upbeat piece of music (selected by the student and downloaded to the music player in advance)

Template: Game Performance Assessment Instrument 6 (GPAI 6)

Method

Step 1

Select a sport or physical activity. This should be the same physical activity that you have chosen to study this term.

Step 2

Complete a standard teacher-led warm up, followed by a whole class tactical discussion for a total of 10 minutes.

Step 3

Play or perform your physical activity for 10 minutes and assess your performance by completing Condition A of the GPAI 6. Rate your performance by placing ticks in the appropriate boxes.

If you need to refresh your memory of the different body and movement concepts, you can revisit Lesson 2.10 Body and movement concepts (page 74).

Step 4

Divide the class into two groups.

- **Group A** listens to a piece of calming/meditative music while lying still on the ground for 10 minutes.
- **Group B** listens to a piece of high-energy/upbeat music while performing an active warm up (e.g. star jumps, active stretching) for 10 minutes.

Step 5

Play or perform the same physical activity as you completed the first time, for another 10 minutes.

Step 6

Again, assess your performance using GPAI 6. Group A completes Condition B and Group B completes Condition C.

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	Condition A Standard arousal			Condition B Low arousal			Condition C High arousal		
Body and movement concept	**Worse than usual**	**Same as usual**	**Better than usual**	**Worse than usual**	**Same as usual**	**Better than usual**	**Worse than usual**	**Same as usual**	**Better than usual**
Body awareness (e.g. balance, transfer of body weight)									
Spatial awareness (e.g. use of space, direction of movement)									
Quality of movement (e.g. speed, accuracy, force and flow of movement)									
Relationships (e.g. positioning on court/field, relationship to opponent, communication)									

SOURCE 1 GPAI 6

Analysis and discussion tasks

1 **Analyse** the primary data gathered in this Skill drill by completing the following tasks.
   - **a** Which group did you participate in? How did your arousal level differ between your two performances?
   - **b** **Describe** the relationship between your arousal level and overall performance referring specifically to the data in GPAI 6.
   - **c** **Compare** your results with the results of three members of the class who participated in the opposite arousal condition to yours.
   - **d** Based on your data and the data collected by others in your class, what preliminary conclusions can you draw about the impact of arousal levels on psychological state and performance?

2 **Assess** the reliability and validity of your data by completing the following tasks.
   - **a** **Consider** the reliability of the data you have gathered. If you repeated this activity on a different day, how likely is it that you would get the same results? **Explain** your answer.
   - **b** How could the reliability of this experiment be improved?
   - **c** **Consider** the validity of the data you have gathered. Did you get the results that you were expecting? If the actual results were different to the expected results, how might you explain this?
   - **d** What measures could be put in place to increase the validity and reliability of this experiment? **Consider** variables such as measurement techniques and sample size.

3 Based on the data you have gathered, draw conclusions about the optimal level of arousal for your performance in the physical activity you are currently studying. Use secondary sources to **justify** your conclusions.

4 **Synthesise** your knowledge of arousal from Lesson 4.4 Arousal (page 220) with the data you have gathered in this activity (relating to your personal optimal arousal level) in order to devise a practical strategy to help you optimise arousal in your future performances. Record your strategy in a written response of 250 words.

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Lesson 4.6
Attention and concentration

Learning intentions and success criteria

Key ideas

- → Attention is the ability of an athlete to respond to specific internal and external stimuli during training and competition.
- → Concentration is the everyday term used to describe how a person focuses their mental energy.

Defining attention and concentration

attention a technical term used by sports psychologists to refer to the specific ability of an athlete to attend and respond to appropriate internal (e.g. thoughts or feelings) and external (e.g. the starter's gun, an opponent) stimuli during training and competition

concentration an everyday term used to describe how a person focuses their mental energy

selective attention the ability to process and react to certain stimuli selectively (when several stimuli occur simultaneously)

relevant cues essential (important) information that an athlete needs to focus on

irrelevant cues extraneous (unnecessary) information that can distract an athlete

Attention and **concentration** are two more key concepts in sport psychology. In simple terms, attention and concentration are both concepts used to describe the level of focus and attentiveness a person dedicates to a particular task or stimulus.

People often use these terms interchangeably, but when examining attention and concentration in the context of sport psychology, it is helpful to distinguish between them. In sport psychology:

- **attention** is the technical term used to refer to the specific ability of an athlete to attend and respond to appropriate internal stimuli (e.g. thoughts or feelings) and external stimuli (such as the starter's gun or an opponent) during training and competition
- **concentration** is the everyday term used to describe how effectively a person focuses their mental energy and is attentive to useful stimuli. Strong performances are often said to be the result of "good concentration" and poor performances the product of "lapses of concentration".

To maintain the highest levels of attention and concentration, players must use **selective attention**. This is where they narrow their focus to the specifics of the task required (known as **relevant cues**) and block out distractions (known as **irrelevant cues**). For example, during play a soccer goalkeeper will focus on relevant cues (such as the position of the ball, the speed of its approach and the location of other players on the field) and ignore irrelevant cues (e.g. a bird flying overhead, taunts from opponents, cheers from the crowd).



SOURCE 1 Successful athletes use selective attention to block out distractions and focus closely on the task at hand.

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Achieving and maintaining optimum attention and concentration

Sport psychologists generally agree that achieving optimum performance is dependent on an athlete focusing on the right thing at the right time. Many theories have been developed to explain the relationship between attention and performance, but the most popular and widely accepted theory is known as Nideffer's attentional model.

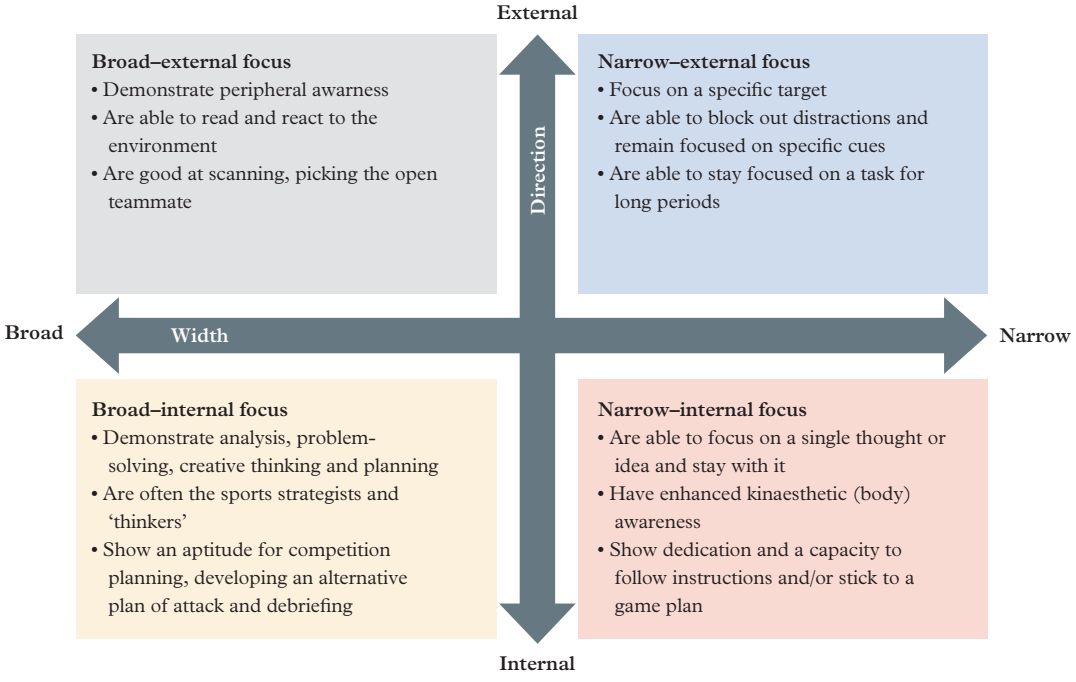
Nideffer's attentional model

Nideffer's attentional model (see Source 2) was developed in 1981 by US sport psychologist Robert Nideffer. It helps to define and explain attention and concentration behaviours in athletes by proposing that attention exists in two dimensions:

- Width relates to the *amount* of information or number of cues an athlete perceives. These cues exist on a continuum from narrow focus (i.e. a single cue) through to broad focus (i.e. many cues).
- Direction relates to the *source* of stimuli that an athlete perceives. These sources also exist on a continuum from internal (e.g. an athlete's own thoughts and feelings) through to external (e.g. an opponent, the wider environment).

Source 2 shows the attentional model's four distinct types of attentional focus:

- broad–external – athletes with this focus are often referred to as "aware"; for example, a volleyball setter who scans the defence before setting up the play
- broad–internal – athletes with this focus are often referred to as "strategic"; for example, a golfer carefully considering shot selection prior to addressing the ball
- narrow–external – athletes with this focus are often referred to as "focused"; for example, a tennis player focusing on their toss as they begin to serve
- narrow–internal – athletes with this focus often referred to as "systematic"; for example, a basketball player reviewing their self-talk prior to taking a free throw.



SOURCE 2 Nideffer's attentional model has four distinct types of attentional focus, with a number of characteristics common to each type.

Retrieve it!

How many stages are there on the arousal continuum? Check back to Lesson 4.4 Arousal (page 220) to see if you retrieved the information correctly.

Study tip

Keeping a video log of your performance can be a great way to assess your levels of attention and concentration. Store video clips of your performance in a folder on your computer and add either a voiceover or a short written analysis of each one as you go. Look beyond physical performance; for example, note changes in your attention and concentration. Make a note of any links between strategies you have been implementing off court (such as mental rehearsal and meditation) and changes in performance on court.

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Theory in action Improving concentration

Paying attention to the right things at the right time is one of the most important skills an athlete can possess. All athletes recognise that they can have difficulties concentrating for the duration of a performance or at specific times. Difficulty paying attention to useful stimuli is usually due to distractions. Lapses in concentration prevent athletes from paying attention to appropriate cues. This is often because athletes become distracted by thoughts, emotions and other events. These distractions can be both internal and external. The Australian Sports Commission (previously Sport Australia) has outlined strategies for overcoming these distractors.



SOURCE 3 The Australian Sports Commission (formerly Sport Australia) has recommended strategies for improving concentration.

Internal distractors (thoughts, worries and concerns)

- Living in the past – worrying about what just happened (especially mistakes).
- Living in the future – thinking about results, outcomes and consequences.
- Self-talk – especially when it is negative.
- Arousal levels and anxiety – high arousal and anxiety can narrow your attentional field (that is, tunnel vision) and decrease environmental scanning. Alternatively, low arousal can cause a broadening in your attentional field and a focus on inappropriate cues.
- Fatigue – focus requires effort, so if you are feeling fatigued it can sometimes be difficult to find the energy required to maintain your focus.

External distractors

- Visual distractors – crowd, competitors, scoreboards, cameras, etc.
- Auditory distractors – talking, laughing, traffic, mobile phones, etc.
- Sensory distractors – problematic equipment (e.g. a loose grip), etc.
- Gamesmanship – sledging, trash talking.

Strategies for improving concentration

Attention control and concentration are skills that can be improved and worked on just like a physical skill. There are a number of sport and non-sport related strategies and exercises that can be used to assist you in enhancing your attention and concentration skills. These are:

- simulation training – identify the types of distractions that are present during competition and systematically incorporate and learn to manage these distractions in training
- cue words – identify some key words/phrases that remind you what you need to concentrate on
- positive self-talk – repeat positive self-statements/affirmations (for example, "I am feeling fit and strong", "I am ready to go", "I can do this")
- switching on and off – identify appropriate points during training or competition at which to "switch on" (i.e. direct attention and energy to the task at hand) and "switch off" (i.e. allow thoughts/attention to shift to a non-performance focus)
- "parking" thoughts – try "parking" your distracting thoughts, which involves putting them aside until a later time, typically by using a rational self-talk instruction or form of imagery that places the troublesome thought in a secure and non-distracting place until after the performance
- staying in the "here and now" – the only time frame that you have any control over is the present and therefore the importance of being present-focused cannot be overstated.

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Sledging is a practice used by some cricket players to distract opponents and interfere with their concentration. This practice is further explored in "Theory in action: Sledging: a true test of concentration".

Theory in action Sledging: a true test of concentration

Cricket players are well known for their controversial use of sledging during matches. Sledging is a practice whereby athletes use trash talk to distract their opponents and break their concentration.

A batter in cricket is required to face a hard leather ball – sometimes travelling at speeds over 140 km/h – while also considering the placement of other players on the field, their grip on the bat and the tally on the scoreboard. A good batter will also try to detect cues in the bowler's grip prior to them releasing the ball, so they can predict the type of delivery they are about to face.

To achieve this broad–external focus, the batter must be fully attentive. However, between balls, it is common for the bowler, wicketkeeper and slip fielders to "sledge" (i.e. make derogatory comments to) the batter, in the hope that the batter's focus will shift to irrelevant cues and they will be put off their game.

When interviewed on the topic of sledging, one cricketer said: "As a bowler, if you see a guy that is in form and in a routine, you almost want to say more to him to try and upset his rhythm … It's all about trying to draw the batter outside of their own little bubble and give them something else to think about."

Experienced cricket players must adopt strategies to overcome the distraction of sledging and maintain appropriate attention at all times. It only takes one moment of lapsed concentration for a costly error to be made.



SOURCE 4 Cricketers commonly use sledging to increase tension and affect the attention and concentration of their opponents.

Check your learning 4.6

Check your learning 4.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. In the context of sport psychology, how is "attention" distinct from "concentration"?

- **A** Attention refers to mental effort, while concentration is the physical effort exerted during training.
- **B** Attention is the ability to focus on relevant stimuli, while concentration involves avoiding distractions.
- **C** Concentration involves analysing game strategies, while attention is the ability to stay physically alert.
- **D** Attention refers to motivation levels, while concentration is related to emotional control during competition.

2 An athlete who is said to be "systematic" has which type of focus?

- **A** Broad–external
- **B** Broad–internal
- **C** Narrow–external
- **D** Narrow–internal

3 Read "Theory in action: Sledging: a true test of concentration". **Describe** the potential impact of sledging on an athlete's attention.

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4 **Summarise** the two dimensions of attention and explain the difference between them.

Analytical processes

5 Download the blank template of Nideffer's attentional model. Using Source 2 (page 229) as a guide, **classify** each of the sports and coaching skills in the table below into the most appropriate quadrant.

Knowledge utilisation

6 **Evaluate** your ability to maintain appropriate levels of attention and concentration in your selected physical activity this term. Your evaluation should include examples and make specific reference to Nideffer's attentional model.

Template: Nideffer's attentional model

Sports skills	Coaching skills
Tackling in football Putting in golf Psyching up for the game Rebounding in basketball (when the ball has hit the rim) Listening to instructions	Developing a game plan Helping an athlete correct an error Listening to a player Deciding how to respond to an official's bad call Delivering a speech Analysing your competence as a coach

Lesson 4.7
Team dynamics and cohesion

Learning intentions and success criteria

Key ideas

- → Team dynamics describes the relationships between all the different members of a group.
- → Team cohesion is the extent to which individual members of a team can work together as a unified whole.
- → There are four distinct stages teams go through to reach cohesion: forming, storming, norming and performing.

team dynamics the relationships between all the different members of a group (who are working together to achieve a common goal)

cohesion (in sport) the extent to which individual members of a team can work together and function as a single unified (i.e. united) whole

Defining team dynamics and cohesion

Team dynamics and **cohesion** are key concepts in sport psychology. Both terms are used to describe the individual relationships between members of a group, as well as their ability to work together.

It is common to hear these terms used interchangeably in conversation; however, when examining team dynamics and cohesion in the context of sport psychology, they have different meanings. In sport psychology:

- team dynamics is a term used to describe the relationships between all the different members of a group (who are working together to achieve a common goal)
- team cohesion is used to describe the extent to which individual members of a team can work together and function as a single, unified (i.e. united) whole.

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Strong team dynamics and cohesion are the key elements that transform a group of individual athletes into a high-performing and successful team.



SOURCE 1 Strong team dynamics and cohesion can enable a group of skilled individual athletes to rise to the top of their field as a unified team.

Achieving and maintaining optimum team dynamics and cohesion

It is not difficult to think of a successful sporting team, but it can be challenging to work out exactly why certain teams are more successful than others. One way in which coaches and sport psychologists try to understand this is by examining team dynamics and cohesion. Over the years, many theories have attempted to explain the link between team dynamics, cohesion and performance. One of the most popular and widely accepted is known as Tuckman's stages of group development.

Retrieve it!

Self-confidence is one of three factors often used to describe an athlete's overall confidence. What are the two other factors? Check back to Lesson 4.3 Confidence (page 216) to see if you retrieved the information correctly.

Tuckman's stages of group development

Tuckman's stages of group development were first developed in 1965 by US psychologist Dr Bruce Tuckman. He proposed that there were four distinct stages that teams go through to achieve cohesion (i.e. function together effectively) and deliver high quality results:

- **Stage 1:** Forming
- **Stage 2:** Storming
- **Stage 3:** Norming
- **Stage 4:** Performing.

Stage 1 – Forming

In the forming stage, a group of individuals come together for the first time and begin to get to know each other. Coaches and athletes begin to think about establishing:

- **group roles** – the formal and informal positions that each individual on the team holds. Formal roles include positions of authority (such as captain and vice-captain) and playing positions (such as fullback, prop and hooker in rugby). Role ambiguity can occur when someone is not clear what is expected of them, and role conflict can occur when there is competition for the same role or when jobs within roles overlap. These occurrences can affect team performance as they distract from the common goal. Informal roles include positions that develop over time based on the individual personalities of the players (such as "the joker", "the morale booster", "the problem solver", "the good listener" and "the Zen master").
- **group norms** – the rules and expectations set out for all members of the team to follow. Group norms include expectations and rules relating to things such as training commitments, equipment requirements, dress codes and ethical conduct.
- **group goals** – the vision or aims of a team for their time together (i.e. the season). Goals should be shared by the entire group and can be related to outcomes (e.g. team ranking at the end of the season) or performance (such as mastering a particular team strategy or completing a team challenge).

group roles the formal and informal positions that each individual on the team is assigned or adopts

group norms the rules and expectations set out for all members of the team to follow

group goals the vision or aims of a team for their time together (i.e. the season)

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Stage 2 – Storming

In the storming stage, the team begins to work, train, play and compete together. Team members compete with each other for status and acceptance of their ideas. Conflict between team members is common, but roles can become clearer as a result, and norms can be refined to suit the needs of the group. Good resolutions to conflict can strengthen team cohesion. Coaches and athletes work to develop:

- **social cohesion** – the degree to which team members like each other and interact together
- **task cohesion** – the ability to identify closely with the group's goals and to experience success in achieving those goals.

social cohesion the degree to which team members like each other and interact together

task cohesion the ability to identify closely with the group's goals and to experience success in achieving those goals

social support the feeling that one is cared for, has access to assistance if needed and is part of a strong social network

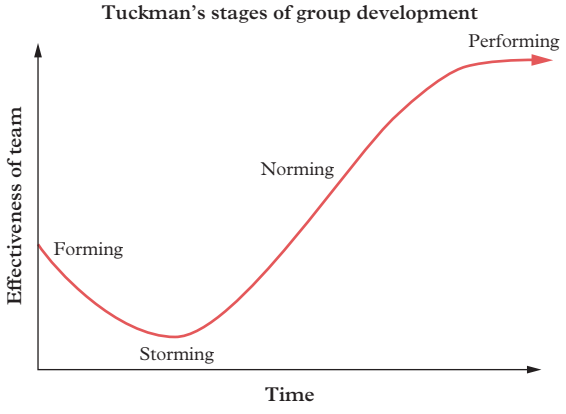
Stage 3 – Norming

In the norming stage, the team is more settled and there is a greater acceptance of individual positions within the group. There is also wider acceptance of the rules and expectations being placed on the group. Rather than competing against each other for status and acceptance, members are able to work together towards a common goal.

Coaches and athletes work to develop **social support** – the feeling that one is cared for, has access to assistance if needed and is part of a strong social network. Team members are able to trust each other on and off the ground, which results in greater fluency and harmony in the team's performances.

Stage 4 – Performing

In the performing stage, the team is functioning at a very high level and can work effectively to achieve identified goals. Social and task cohesion are at optimum levels and performance is strong. In the face of conflict, group members can work together to find a solution (often without coaches or training staff). Team members are aware of each other's strengths and weaknesses and work well to optimise the team's performance.



SOURCE 2 As a team works together over time, they pass through Tuckman's stages of team development. The effectiveness of the team will vary according to each stage of development.

It is important to note that not every team progresses to the performing stage. Many teams stop developing at the norming stage. It is also common for teams to fluctuate between the second, third and fourth stages of team development for a number of reasons, such as:

- individual team members may start working independently
- established members may leave the team and new members may join the team
- coaching and training staff may change, leading to changes in team goals and training expectations
- unexpected issues arise that challenge the team unity.

The New Zealand All Blacks are an example of a high-functioning sports team. Their success is further explored in "Theory in action: The world's most successful sporting team".

Retrieve it!

What are Tuckman's four stages of group development? Check back to earlier this lesson to see if you retrieved the information correctly.

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Theory in action The world's most successful sporting team

According to many sporting agencies and media outlets, New Zealand's national rugby union team, the All Blacks, is the most successful international sports team of all time.

In more than a century of competition, the All Blacks have won more than three-quarters of their 637-plus matches. They were the first rugby team to win 500 Test matches, including three Rugby World Cups in 1987, 2011 and 2015. They have also won 10 of the 16 Tri-Nations trophies between Australia and South Africa, and have held the Bledisloe Cup for 20 years from 2003–2023.

So, what is the secret to their incredible success? Team dynamics and cohesion have a lot to do with it. The All Blacks team culture always puts the team before the individual, no matter how talented an individual player might be. It is this obsession with team unity that makes them an awesome winning unit.

The tantrums of overpaid stars that are a reality in many other teams are not tolerated by the All Blacks. The sense of honour and respect for previous achievements and holders of the jersey dictate the code of behaviour for new players joining the team. The team mantra is "Better people make better All Blacks" – a saying that emphasises the importance of good character both on and off the field.



SOURCE 3 For more than a century, the All Blacks have performed the haka (a traditional Māori dance) as a powerful pre-match team ritual.

Check your learning 4.7

Check your learning 4.7: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. What is a key characteristic of a cohesive sporting team?
   - **A** Intense competition among team members
   - **B** High levels of internal conflict and disagreement
   - **C** Strong interpersonal relationships and mutual trust
   - **D** Strict adherence to individual performance goals

2 Choose the correct answer. Clearly communicating the rules and expectations for members of a team is an example of establishing:
   - **A** group norms.
   - **B** group roles.
   - **C** social support.
   - **D** team cohesion.

3 In your own words, **summarise** the four stages of Tuckman's stages of group development.

4 Read "Theory in action: The world's most successful sporting team". **Identify** the reasons given for the phenomenal success of the All Blacks.

Analytical processes

5 **Analyse** the role that trust plays in developing team cohesion.

Knowledge utilisation

6 **Create** as many endings for this sentence as you can: "A cohesive team is one that ..."

7 **Evaluate** which of the following scenarios would be most likely to result in a successful team. **Justify** your response.
   - One strong leader with ultimate authority over all members of the team
   - A collection of individuals who have authority in certain sub-areas (such as defensive leader or offensive leader)

8 Consider a sporting team you have been involved with recently and identify the team's stage of group development. **Justify** your response with primary and secondary data. *(Hint:* Primary data could include anecdotes or examples from your team's experience written in the form of a journal entry.)

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SKILL DRILL

Lesson 4.8
Assess the impact of team cohesion on performance

Aim

To evaluate the impact of team cohesion on your implementation of movement strategies

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Equipment specific to one selected physical activity from either the invasion, net and court, or striking and fielding category
- Game Performance Assessment Instrument 7 (GPAI 7)
- Pen

Template: Game Performance Assessment Instrument 7 (GPAI 7)

Method

Step 1

Select a sport from the invasion, net and court, or striking and fielding categories.

Form a team with players who are familiar to you and with whom you have played before.

In one minute, decide as a group on **one** clear attacking strategy that you will implement during your game. At the end of the minute, you are no longer permitted to speak.

Step 2

Begin play and implement your attacking strategy without using any verbal or non-verbal cues.

After 10 minutes of play, stop and – as a team – fill out the Performance 1 row of GPAI 7.

Step 3

In one minute, again decide as a group on one **new** attacking strategy. At the end of the minute, take to the court or field and implement the strategy. This time, you are permitted to communicate without restrictions. After 10 minutes of play, stop and fill out the Performance 2 row of GPAI 7 as a team.

Step 4

Form a new team of players who are less familiar to you. Repeat steps 1 to 3 of this Skill drill and complete the Performance 3 and Performance 4 rows of GPAI 7.

Performance	Chosen attack strategy	Outcome of strategy (e.g. was it successful? How many goals or points were scored? What was the outcome of the game?)	Evaluation of overall team cohesion (e.g. did each team member understand their role? Did the team function effectively?)
Performance 1 Familiar team with no communication			
Performance 2 Familiar team with communication			

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Performance	Chosen attack strategy	Outcome of strategy (e.g. was it successful? How many goals or points were scored? What was the outcome of the game?)	Evaluation of overall team cohesion (e.g. did each team member understand their role? Did the team function effectively?)
Performance 3 Unfamiliar team with no communication			
Performance 4 Unfamiliar team with communication			

SOURCE 1 GPAI 7

Analysis and discussion tasks

1 **Analyse** the primary data you gathered during this Skill drill by completing the following tasks.
   - **a** **Evaluate** the effectiveness of the attack strategy across the four performances. **Discuss** what factors contributed to the success or failure of this strategy.
   - **b** **Compare** and **contrast** the level of team cohesion across the four performances. **Discuss** what factors contributed to the success or failure of your team cohesion.

2 **Analyse** the data you have gathered and **identify** the most significant factor affecting the level of team cohesion (i.e. familiarity with team members; ability to communicate with team members; a combination of these factors).

3 **Assess** the reliability and validity of your data (i.e. would the results be the same if you repeated this activity tomorrow? Is the activity measuring what it is supposed to measure? Did your results match what could be expected, given the conditions of each performance? How could you ensure your conclusions regarding team dynamics are more accurate and convincing?) **Justify** your answer.

4 Based on the data you have gathered, **draw conclusions** about the importance of team cohesion on effective implementation of attacking strategies in invasion sports.

5 **Devise** a strategy to improve team cohesion. **Justify** your response using secondary sources.



SOURCE 2 Team cohesion can enable a group of skilled individuals to succeed as a unified team.

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Lesson 4.9
Psychological techniques to optimise performance

Learning intentions and success criteria

Key ideas

- → Athletes use a variety of psychological techniques to optimise performance.
- → Psychological techniques can be used before, during and after performances.

Psychological problems in sport

Retrieve it!

According to Nideffer's attentional model, there are four distinct types of attentional focus. What are these? Check back to Lesson 4.6 Attention and concentration (page 228) to see if you retrieved the information correctly.

Even the most capable, experienced and physically able athletes may have to deal with a range of common psychological problems, such as low levels of confidence, lack of motivation, feelings of stress and anxiety, and lack of attention and concentration.

Skill and fitness aside, the main difference between a successful and unsuccessful athlete is their ability to successfully identify and resolve psychological problems as they arise. A mentally strong athlete is one who can recognise and diagnose a psychological problem, and then apply a relevant technique before too much damage is done to their performance.

Psychological techniques

Different psychological techniques can be applied at different times to help athletes overcome a range of challenges and problems and optimise performance. Regardless of when or why these techniques are required, it is recommended that chosen techniques are practised regularly outside of performance to ensure that when they are used during a performance, they are effective. There are eight broad categories of psychological techniques. Each one has an impact on a psychological concept. Psychological techniques discussed in this module are listed in the table below.

Psychological techniques	Targeted psychological concepts
Goal-setting techniques	• Motivation • Arousal • Team dynamics and cohesion • Confidence
Mental rehearsal techniques	• Confidence • Arousal • Attention and concentration
Positive self-talk techniques	• Confidence • Arousal
Self-confidence techniques	• Confidence
Pre-performance techniques	• Attention and concentration • Arousal
Relaxation and energiser techniques	• Arousal

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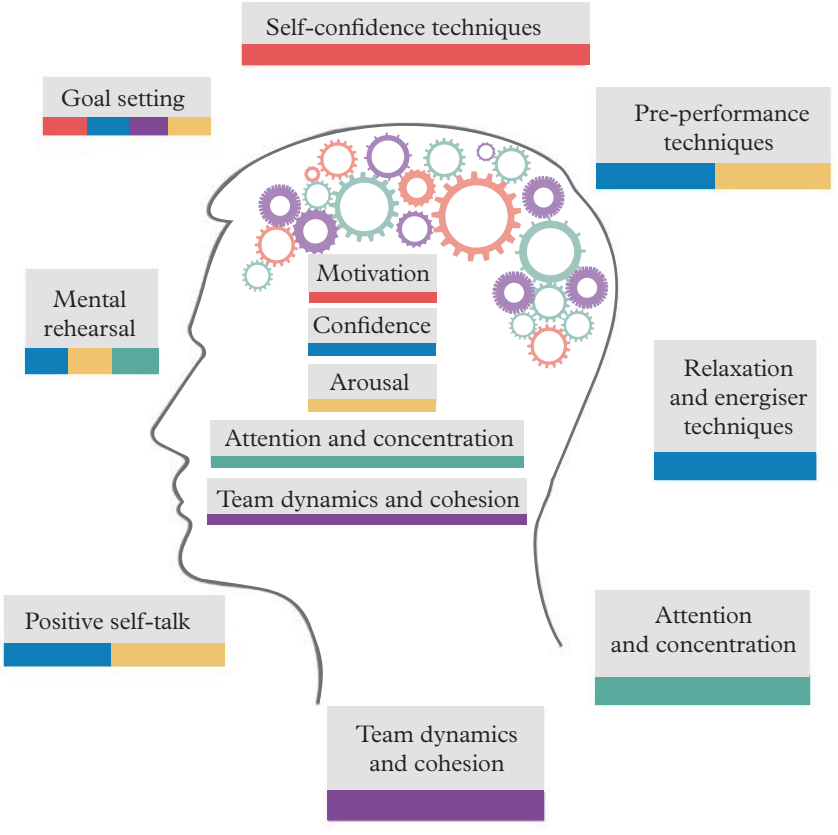
Psychological techniques	Targeted psychological concepts
Attention and concentration techniques	• Attention and concentration • Motivation
Team dynamics and cohesion techniques	• Team dynamics and cohesion

SOURCE 1 Psychological techniques such as those listed in this table can be used to manage areas of psychological need.

Developing a "sport psychology resource kit"

As you learn about each of the techniques in Source 1, you will be able to apply them to your own performances and the performances of other athletes. An awareness of the psychological concepts you learnt about earlier in this module, together with a strong understanding of the skills and techniques used to deal with them, will help you to develop a "sport psychology resource kit". This resource kit will contain a range of practical techniques and skills that you can apply in different situations and at different times to help you overcome problems and perform at your best.

While coaches should guide athletes towards the psychological techniques they think will be most beneficial, it is also important for the athlete to have some autonomy over the techniques they choose to apply. This often helps athletes maintain a level of mental strength that will keep them confident, motivated and focused throughout their performance, resulting in a better outcome.



SOURCE 2 A sport psychology resource kit contains a range of practical techniques to help you overcome problems and perform at your best.

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Check your learning 4.9

Check your learning 4.9: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Goal-setting techniques have the best potential to improve an athlete's:
   - **A** confidence.
   - **B** arousal.
   - **C** attention and concentration.
   - **D** motivation.

2 Attention and concentration can be improved with which techniques?
   - **A** Mental rehearsal, attention and concentration and pre-performance techniques
   - **B** Goal setting, attention and concentration, and relaxation and energiser techniques
   - **C** Goal setting, mental rehearsal and positive self-talk techniques
   - **D** Goal setting, team dynamics and cohesion, and self-confidence techniques

3 In your own words, **explain** what a sport psychology resource kit is.

Knowledge utilisation

4 Look at the psychological techniques listed in Source 1.
   - **a** Based on your current knowledge and understanding of each one, **evaluate** two techniques related to two different psychological concepts and **justify** why you think these would be effective in optimising your performance, based on primary and secondary data.
   - **b** As you learn more about each technique over the course of this topic, revisit your answer and extend on your thinking, as necessary

Lesson 4.10
Goal-setting techniques

Learning intentions and success criteria

Key ideas

- → Goal setting is used to identify what you want to achieve and to establish measures to track progress.
- → There are three types of goals that can be used to optimise performance: outcome goals, performance goals and process goals.
- → The SMARTER principle is a popular technique for developing realistic and achievable goals.

What is goal setting?

goal setting a technique used to identify a desired achievement and establish measures to track progress towards achieving it

Goal setting is a technique used to identify one or more things that you want to achieve and to establish measures to help you monitor and track your progress towards achieving them.

Goal setting is an ongoing psychological technique, meaning that it should be applied early on in an athlete's sporting pathway, and revisited regularly in training and performance as a source of motivation. Goals can also help an athlete achieve optimal arousal and concentration and enhance team cohesion. The achievement of goals set can also provide a confidence boost for athletes lacking self-confidence. Athletes need to develop, evaluate and revise their goals on a regular basis in order to get the best out of their performance.

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Effective goal setting

Setting goals is vital for all athletes wanting to achieve success in their sport. Athletes should analyse the types of goals they set to ensure they are maximising the benefits these goals can provide. In sport psychology, there are three main types of goals:

- **outcome goals**
- **performance goals**
- **process goals**.

Understanding the relationship between these types of goals can help athletes achieve their aim, one step at a time.



SOURCE 1 Australian Paralympian Kurt Fearnley is a three-time gold medallist who is expert at setting both personal and professional goals and working hard to achieve them.

outcome goal a type of goal that focuses on winning and losing

performance goal a type of goal that focuses on enhancing specific aspects of performance, often using statistics

process goal a type of goal that focuses on improving technique

Outcome goals

Outcome goals focus on winning and losing (i.e. the specific outcome of a performance or competition). For example, an outcome goal might be:

- to win an Olympic gold medal in basketball
- to place in the top 10 in the Brisbane Marathon
- to achieve an "accomplished and proficient" grade in your practical assessment in senior Physical Education.

Outcome goals serve to motivate athletes because an outcome is easily measurable. They can also help to reorient and refocus an athlete who is going through a challenging period as they look towards a longer-term goal. While it is natural to make winning the goal, focusing only on outcome goals can contribute to anxiety in an athlete, because these goals are not entirely within the control of the athlete. It is helpful to combine outcome goals with performance and process goals to help athletes remain "in the zone" throughout their performances.

Performance goals

Performance goals focus on a particular performance standard that an athlete is trying to achieve. Performance goals are often designed to help athletes achieve their outcome goals by breaking them down into a series of smaller, more manageable targets. They focus on various aspects of an athlete's game, often using statistics to set the goal. For example, a performance goal might be:

- to improve shot accuracy from 60 to 70 per cent
- to complete a 20-kilometre training run in under 90 minutes.

Performance goals push athletes to monitor and record their improvement over time. They also help improve arousal and motivation as an athlete can detect the achievement of these more manageable goals within their reach.

Process goals

Process goals focus on a specific technical aspect of an athlete's overall performance. They are often designed to help athletes achieve their performance goals by breaking them down

Retrieve it!

Name the eight broad psychological techniques that help athletes overcome challenges and problems and optimise performance. Check back to Lesson 4.9 Psychological techniques to optimise performance (page 238) to see if you retrieved the information correctly.

For the record!

Throughout 2009, Kurt Fearnley won wheelchair marathons in London, Paris, Seoul, Sydney, Chicago and New York. He also crawled the gruelling 96-kilometre Kokoda Track in Papua New Guinea. These incredible accomplishments would not have been possible without a strong ability to set and achieve goals.

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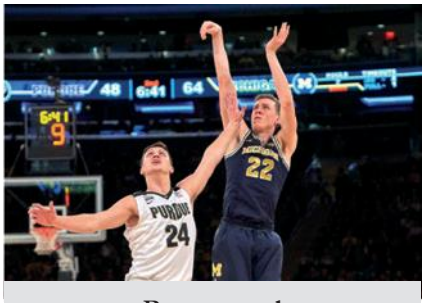
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into smaller targets that are completely under their own control. For example, a process goal might be:

- to hold the basketball shot follow through for one more second
- to train four days a week.

Process goals can help athletes with concentration. By focusing on elements of their technical performance, they can more effectively block out irrelevant cues caused by pressures experienced within a performance which might otherwise lead to anxiety.

As shown in Source 2, athletes have more control over process and performance goals than outcome goals and can feel a greater sense of accomplishment and competence as they achieve them. Increased competence results in greater self-confidence and motivation.



Process goal
To improve follow through by one second



Performance goal
To improve shot accuracy from 60% to 70%



Outcome goal
To win an Olympic gold medal in basketball

More control — **Less control**

SOURCE 2 Outcome goals, performance goals and process goals need to be combined to optimise an athlete's performance.

SMARTER principle
an acronym that athletes can use to remember all the elements required for effective goal setting – SMARTER goals are Specific, Measurable, Achievable, Relevant, Time-bound, Evaluated, Recognised and rewarded

Setting SMARTER goals

Athletes need to monitor and assess the progress of their goals over time, and one of the most popular ways to do this is by applying the **SMARTER principle**.

SMARTER is an acronym (a word formed from the initial letters of other words) that athletes can use to remember all the elements required for a goal to be effective. For example, rather than writing general goals such as "I want to get better at tennis" or "I want to play well in the game this weekend", the SMARTER principle helps to identify the specific level required to attain and then measure the goal. Source 3 describes how this principle can be used for setting goals.

Criteria	Description	Bad example	Good example
Specific	Effective goals are specific. Record as much detail about the goal as possible.	I want to get better at tennis.	I want to achieve a first serve success rate of 50%.
Measurable	Effective goals are measurable. Be clear about what success will actually look like so that you can objectively assess whether you have achieved it.	I will improve my service game by a lot.	Within 6 months I will achieve a first serve success rate of 50%.

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Criteria	Description	Bad example	Good example
Achievable	Effective goals are achievable. Think about whether your goal is appropriate for you – i.e. do you have the necessary time, money, talent, patience and/or dedication? Goals should motivate you to challenge yourself, but they must also take your other commitments into account (e.g. school, work, family).	I will be the world number 1 tennis player in 6 months.	I will be club champion in 6 months.
Relevant	Effective goals are relevant. Be clear about what you want so you can move in the right direction. Think about why you want to achieve this goal and whether it aligns with other goals you may have.	I want to win my tennis club championship because I like to win trophies.	I want to improve my first service percentage from 20% to 50% because it will help boost my confidence, put me in a better position at the beginning of each rally and prove that I am a capable player.
Time-bound	Effective goals are time-bound. Set a timeline for achieving your goals.	I will improve my service game by a lot.	By January next year I will achieve 50% of my first serves in court.
Evaluated	Effective goals are evaluated. Revisit your goals on a regular basis (every day, week or month) to ensure that you are on track. It is also important to remember that situations change. For example, if you are injured or your priorities change, then your goals may need to change too.	N/A	N/A
Recognised and rewarded	Effective goals are recognised and rewarded. Celebrate when you achieve your goals. Rewarding yourself is a good way to create a positive feeling of success, and it will inspire you to set your next goal and achieve it.	N/A	N/A

SOURCE 3 Using the SMARTER principle gives athletes the best chance of achieving their goals.

Check your learning 4.10

Check your learning 4.10: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. A performance goal:
- **A** breaks down process goals into more manageable parts.
- **B** encourages an athlete to identify a specific feature of their technical performance they wish to improve.
- **C** focuses on a long-term accomplishment the athlete wishes to achieve.
- **D** requires athletes to think of a standard within their performance they would like to achieve.

2 Choose the correct answer. Tony has set a goal to increase the effectiveness of the ball toss in his volleyball jump serve by pushing it further out in front before he begins his approach. This type of goal is:
- **A** a SMARTER goal.
- **B** an outcome goal.
- **C** a performance goal.
- **D** a process goal.

3 **Describe** the differences between outcome goals, performance goals and process goals.

4 **Identify** problems that might arise from focusing solely on outcome goals.

Analytical processes

5 **Categorise** each of the following as general goals or SMARTER goals.
- **a** Play smarter in my tennis matches.
- **b** Be more prepared for training sessions.
- **c** Increase my speed off the blocks by 0.2 seconds by the end of the season.

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d Become more accurate in passing the volleyball.

e Run an interval training session of ten 50-metre sprints at 80–90 per cent intensity with a rest/work ratio of 1:5 by week 3 of the touch football season.

Knowledge utilisation

6 Refer to Source 3 and use it to help you **create** four SMARTER goals related to your selected physical activity this term. Once you have created your goals, swap them with another student in your class to check that they meet the relevant criteria.



SOURCE 4 Goal setting creates a path for you to follow. It helps you to understand where you are right now and where you want to go to achieve optimal performance.

Lesson 4.11
Mental rehearsal techniques

Learning intentions and success criteria

Key ideas

- → Mental rehearsal is a psychological technique that includes mental rehearsal of the entire performance, visualisation of one aspect of skill execution, and internal and external perspectives of imagery.
- → Mental rehearsal techniques help athletes to develop skills, reduce anxiety, increase confidence and concentration, and optimise performance.

What is mental rehearsal?

mental rehearsal a psychological technique whereby athletes create mental pictures and movies of their performance in their minds

visualisation a mental rehearsal technique where the athlete creates still and moving images of aspects of their performance in their minds

Mental rehearsal techniques such as **visualisation** and **imagery** are used by athletes to develop skills, reduce anxiety, increase confidence and concentration, and ultimately improve performance. Numerous studies have found that a combination of both mental and physical rehearsal results in better performances than just mental or physical rehearsal. Top athletes such as Naomi Osaka (tennis), Simone Biles (gymnastics), Steph Curry (basketball) and Kelsey-Lee Barber (track and field) all include mental rehearsal as a key component of their preparation and performance.

Mental rehearsal can help athletes to convert distraction into focus, anxiety into confidence and timidness into assertiveness. Rehearsing a performance in one's mind helps to create clarity around performance expectations. It can also help athletes cope with performance pressures (such as cheering crowds and television cameras) that cannot always be replicated during training. It is believed that mental rehearsal works because imagining an action creates electrical activity in the muscles involved in the movement, even though they do not visibly move. Mental rehearsal also allows the brain to work out problems, propose

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solutions and make decisions. It also strengthens the neural connections between the brain and the muscles, which are needed to create the movement.

Mental rehearsal, visualisation and imagery are terms often used interchangeably in sport psychology. However, it is important to understand that they each have slightly different meanings in a sport psychology context. Mental rehearsal is the broad term used to represent any type of imagining of performance. Visualisation and imagery are two types of mental rehearsal, as described below.

imagery a mental rehearsal technique where the athlete creates a sensory experience related to their performance

Visualisation

Visualisation is when an athlete reproduces still and moving pictures in their mind related to an aspect of their performance. For example, an athlete might visualise themselves executing a skill within their performance with ideal technique. Many athletes include visualisation as a part of their **pre-task routines**, by imagining themselves successfully performing the action needed to produce the desired result, such as a free throw in basketball or a serve in volleyball. Visualisation like this can also occur prior to taking to the field or court.

pre-task routines actions performed by athletes immediately prior to performing a task (e.g. a serve, free kick or pitch) within a performance

Imagery

Imagery is a type of mental rehearsal where an athlete creates sensory experiences related to their performance. Imagery can be used from an external or internal perspective. Using an external perspective, the athlete views themselves from an external viewpoint, much like watching themselves on television. An internal perspective occurs when the athlete views their performance through their own eyes. This allows a full sensory experienced to be recalled. For example, a netball player can visualise themselves shooting a successful shot while they hear the sounds of their teammates, feel the vibrations on the court floor and smell the hot chips cooking in the canteen. This form of sensory imagery is considered a more effective form of mental rehearsal as it better prepares the athlete for the whole experience, reducing the impact of potential distractors.



SOURCE 1 From an internal perspective, imagery allows an athlete to not only see the performance in their mind but also feel it, hear it, smell it and taste it.

Retrieve it!

Explain the difference between amotivation, extrinsic motivation and intrinsic motivation. Check back to Lesson 4.2 Motivation (page 212) to see if you retrieved the information correctly.

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Retrieve it!

What is the difference between visualisation and imagery? Check back to earlier in this lesson to see if you retrieved the information correctly.

Mental rehearsal of the entire performance

Mental rehearsal of the entire performance occurs when an athlete finds a quiet place, free from distractions, and plays their entire performance from start to finish in their minds. This is particularly beneficial for athletes preparing for individual performance activities such as track and field or swimming events, as these types of activities are much more predictable than activities in teams or with opponents. Both visualisation and imagery can be used in this type of mental rehearsal.

Mental rehearsal is an ongoing psychological technique, meaning that it can be applied at any time. Athletes will often practise mental rehearsal in their downtime before a big performance; but it can also be useful just prior to performance and, in some cases, during performance.

The PETTLEP model

PETTLEP model a framework to help athletes get the most out of mental rehearsal and visualisation by making it as close as possible to the real situation

The **PETTLEP model** was proposed by English sport scientists Paul Holmes and David Collins in 2001. It is a framework designed to help athletes get the most out of mental rehearsal by making it functionally equivalent (i.e. as close as possible) to the real situation. PETTLEP is an acronym that athletes can use to remember all the elements required for effective mental rehearsal and visualisation, as shown in Source 2. It stands for Physical, Environment, Task, Timing, Learning, Emotion and Perspective.

Criteria	Description
Physical	Imagine the physical characteristics of your body, including your sports uniform and equipment. You could also take the same physical stance (or position) that you would during performance.
Environment	Imagine the location where the performance will take place, including the surface of the playing area and the stadium and spectators around it.
Task	Imagine the exact requirements of the task. It is important to visualise the task being completed successfully, but it must also be at a level that is equivalent to your role and skill level.
Timing	Imagine the task or performance in real time. Generally, this is more effective than imagining tasks in slow motion, but there are occasions where slow-motion imagery can assist a player wanting to perfect a more difficult, technical element.
Learning	Imagine the task or performance that best suits your level of learning. Adapt imagery to reflect your development of skills over time and any additional demands being placed on you.
Emotion	Imagine yourself feeling the same types of emotions as you would during a performance. If you generally feel anxious during a game, imagine that feeling during mental rehearsal too. However, avoid focusing too heavily on negative emotions such as panic and fear. Steer yourself towards more positive and constructive emotions instead.
Perspective	Imagine the task or performance from your own point of view. This is known as internal perspective (i.e. through your own eyes).

SOURCE 2 The PETTLEP model helps guide athletes towards more effective mental rehearsal.

For the record!

Beach volleyball players Natalie Cook and Kerri Pottharst attributed a large part of their Sydney 2000 Olympic Games gold medal win to mental rehearsal. For example, they rehearsed what they would say to people on the day of the match and they visualised key moments of the match itself, particularly the moment they would finally serve for the win.



SOURCE 3 The use of mental rehearsal during preparation and performance may have helped retired US swimmer Michael Phelps (centre) to become the most successful Olympian of all time, with a total of 28 medals, 23 of which were gold.

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Theory in action Olympic athletes harness the power of the mind's eye

Olympic athletes spend a great deal of their time training for events. However, a study conducted at the 1980 Winter Olympics, which compared the training schedules of four groups of Olympic athletes, revealed that the athletes who pictured themselves crossing the finish line first were more likely to do just that. Each group in the study was assigned a different combination of physical and mental training:

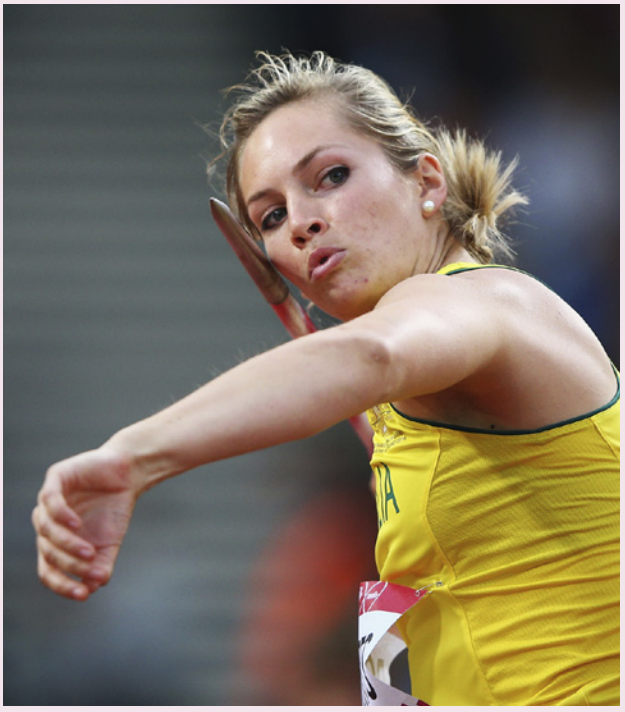
- Group one: 100 per cent physical training
- Group two: 75 per cent physical training, 25 per cent mental training
- Group three: 50 per cent physical training, 50 per cent mental training
- Group four: 25 per cent physical training, 75 per cent mental training.

The scientists found that the fourth group were the top performers during the Olympics. As a result of these findings, over the past 20 years the United States Olympic Committee has increased the number of its full-time sport psychologists from just one to 12.

What makes visualisation such a powerful technique for success?

According to Dr Srini Pillay, a US psychiatrist, brain researcher and author, "We stimulate the same brain regions when we visualise an action as we do when we actually perform that same action".

Visualisation becomes a sort of conditioning for the brain – establishing a goal, then visualising achieving that goal in detail and focusing on it over the long term. These simple techniques help the brain to know what to look out for. Without this conditioning, critical information that can help to achieve goals could end up as background noise.



SOURCE 4 Australian javelin thrower Kelsey-Lee Barber uses mental rehearsal techniques to help her prepare for competition.

Check your learning 4.11

Check your learning 4.11: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Using all senses to mentally recreate a skill within a sporting performance is called:
   - **A** imagery with an internal perspective.
   - **B** imagery with an external perspective.
   - **C** visualisation.
   - **D** mental rehearsal of an entire performance.

2 The "L" in the PETTLEP acronym stands for:
   - **A** Looking.
   - **B** Listening.
   - **C** Learning.
   - **D** Lamenting.

3 **Explain** how a quiet space can enhance mental rehearsal.

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Analytical processes

4 **Differentiate** between visualisation and imagery.

5 **Compare** and **contrast** internal and external perspectives in mental rehearsal.

6 Download the blank PETTLEP template provided and use it to plan a mental rehearsal of your performance in a sport of your choice. This can form the basis for your own mental rehearsal.

7 Read "Theory in action: Olympic athletes harness the power of the mind's eye". **Consider** why the athletes who did 25 per cent physical training and 75 per cent mental training performed better at the Olympics than those who did 100 per cent physical training.

Knowledge utilisation

8 Susie and Mei are preparing for a golf tournament. They understand the importance of mental rehearsal in their preparations.

Susie uses an external perspective and visualises herself hitting a hole-in-one on each hole. She sees the ball clearly rolling into the hole and feels excited to start the tournament.

Mei mentally rehearses her swing, watching the club move through the air to hit the ball in the "sweet spot" off the tee. She hears the crowd cheering and feels the butterflies in her stomach dissipating after her first successful shot.

a Whose mental rehearsal do you think will be more effective? **Justify** your decision using the PETTLEP model.

b What aspects of the PETTLEP model could help improve Susie's and Mei's mental rehearsal? **Propose** strategies that you believe will help to improve their technique.

Template: The PETTLEP model

SKILL DRILL

Lesson 4.12

Assess the impact of mental rehearsal on performance

Aim

To assess the impact of mental rehearsal on performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Sporting equipment specific to your selected physical activity
- Pen
- Game Performance Assessment Instrument 8 (GPAI 8)

Template: Game Performance Assessment Instrument 8 (GPAI 8)

Method

Step 1

Participate in a game of your selected physical activity for 10 minutes. If your physical activity is a performance, target or aesthetic activity, either complete the entire event or complete a crucial aspect of the event (for example, a transition in triathlon).

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Step 2

Rate your performance according to the body and movement concepts in GPAI 8. Indicate the standard of your performance for each concept in Column A (i.e. worse than usual, same as usual or better than usual).

Step 3

Find a quiet space where you can close your eyes and spend 10 minutes using the PETTLEP model (refer to Lesson 4.11 Mental rehearsal techniques (page 244)) to revisit the game from step 1, mentally rehearsing a better performance. Ensure your rehearsal considers the optimisation of the four body and movement concepts over the full 10 minutes (i.e. you will spend 10 minutes playing the whole game in your mind).

Step 4

Repeat step 1 and record your results in Column B, following the same method outlined in step 2.

My selected physical activity is: _____

	Column A Control sample (i.e. before mental rehearsal)			Column B Performance sample (i.e. after mental rehearsal)		
Body and movement concepts	Worse than usual	Same as usual	Better than usual	Worse than usual	Same as usual	Better than usual
Quality of movement						
Space awareness						
Body awareness						
Relationships						

SOURCE 1 GPAI 8

Analysis and discussion tasks

1 **Analyse** the primary data you gathered during this Skill drill. **Discuss** whether your performances were better before or after mental rehearsal. **Justify** your response by referring explicitly to your GPAI 8.

2 Based on your knowledge of mental rehearsal, which round of performances (i.e. the one before or after mental rehearsal) should have produced the best average result? **Explain** why.

3 **Identify** whether your results support your answer for question 2. If not, suggest some possible reasons why.

4 **Assess** the reliability and validity of your data. (i.e. would the results be the same if you repeated this activity tomorrow? Is the activity measuring what it is supposed to measure?) **Justify** your answer.

5 This Skill drill allowed you to **determine** the outcomes, implications and limitations of using mental rehearsal to improve your performance in an authentic environment.

a Use primary and secondary data to **determine** whether regular mental rehearsal would be a worthwhile strategy for improving your performance in your selected physical activity.

b **Consider** the mental rehearsal strategy that you used in this Skill drill. Would you modify it at all if you were to use it again? How would you optimise your implementation of this strategy for future performance enhancement? **Justify** your answer using primary and secondary data.



SOURCE 2 Mental rehearsal is a technique used to improve performance, reduce anxiety, and increase confidence and concentration.

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Lesson 4.13
Positive self-talk techniques

Learning intentions and success criteria

Key ideas

- → Positive self-talk can increase feelings of confidence and motivation, improve arousal and concentration, and optimise performance.
- → Positive self-talk techniques include positive cue words and positive emotions.

What is positive self-talk?

positive self-talk saying encouraging and motivating messages to yourself

Positive self-talk is the practice of saying encouraging and motivating messages to yourself, either silently or out loud. Positive self-talk techniques are known to increase feelings of confidence and motivation, optimise arousal and improve concentration. They can have a significant impact on athletes' performance.

Athletes most commonly use positive self-talk techniques during performance or competition. However, a number of these techniques can also be applied in an ongoing sense and/or immediately prior to performance. It is recommended that athletes practise these techniques regularly so that they can apply them effectively whenever they are required.

Effective positive self-talk techniques

self-talk words and thoughts directed towards yourself

negative self-talk saying negative comments to yourself

Self-talk consists of the words and thoughts that athletes direct towards themselves. Self-talk can be positive or negative. It is linked strongly to an athlete's core self-belief and motivation.

When self-belief is low, an athlete is more likely to engage in **negative self-talk**, with comments such as "I'm just hopeless!", "This will be a double fault" or "I'm never going to win!" They are also more likely to see strong emotions as negative threats rather than positive



SOURCE 1 Sally Pearson has often publicly spoken about the impact positive self-talk had on her career as an elite hurdler.

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challenges. However, an athlete who chooses to use positive self-talk can help to shift the negative self-beliefs they may have learned over time.

Effective positive self-talk techniques include the use of:

- positive cue words
- positive emotions.

Retrieve it!

What are the criteria of the PETTLEP model? Check back to Lesson 4.11 Mental rehearsal techniques (page 244) to see if you retrieved the information correctly.

Positive cue words

Positive cue words are one component of positive self-talk. Positive cue words are single words or short statements (see Source 2) that athletes can say to themselves to help refocus their attention and combat negative thoughts or emotions that would otherwise distract them and negatively affect their performance. Positive cue words can lift players out of low moods during competition and bring them back to the present moment. For example, a tennis player who has made two unforced errors in a row might say "Focus!" to themselves to remind themselves to stay on task and not tune into negative thoughts.

positive cue words single words or short statements to help refocus attention and combat negative thoughts or emotions

The use of positive cue words not only helps athletes to focus but also elicits positive feelings for other athletes in their team. For example, a basketball player might shout out "STTE!" (strong to the end) to encourage their teammates not to give up and to play with confidence, even when defeat looks inevitable.

Athletes can often be seen talking to themselves throughout their performance. During the televised coverage of the 2016 Rio Olympic Games, US gymnastics gold medallist Laurie Hernandez could be seen whispering to herself: "I got this."

Positive cue words should be:

- short and clear
- relevant and meaningful to the individual athlete
- repeated regularly during training so they can be instantly called upon during competition
- written out and displayed in various prominent places.

Mental state	Examples of positive cue words
Over-arousal (e.g. anxiety or panic)	• Calm down • Relax • Easy • Relax and breathe • Calm, confident, in control
Under-arousal (e.g. wakefulness or boredom)	• Go for it • Drive hard • Get in the game • Get after it
Distraction or lack of focus	• Eye on the ball • Focus • Keep it simple • Focus on every play • Stay in the game
Low confidence	• You've got this • You can do this • Ball is going in the hoop • Reach my full potential • Dig deep • Dominate

SOURCE 2 Positive cue words can motivate athletes to work hard and give them confidence to reach their potential.

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Theory in action Why do tennis players talk to themselves?

Tennis players are renowned for using a range of self-talk techniques. Singles tennis is an individual sport, and it is one of only a few sports where you can score more points than your opponent and still lose the match. There are many mind games players have to work through as they experience both wins and losses at crucial stages of each match. Unlike many other sports, tennis players are banned from receiving support and guidance from their coaches during the match. Therefore, the onus is on the players to coach themselves through the difficult periods of a match.

Makis Chamalidis, a psychologist with the French Tennis Federation, explains: "After each point, you have 20 to 25 seconds where there isn't much happening. It's quite normal to talk to yourself then. You have things to deal with, you need to analyse what happened or evacuate your frustration. There are no such breaks in other sports, or an external person like a coach."

Performance psychologist Dr Melissa Weinberg explains that while it appears that only some tennis players are self-talkers, in reality even the seemingly quiet players use self-talk – they just do it more covertly.

Roger Federer, who was known for his quiet mental strength during matches, admitted in a post-match interview at the 2017 Australian Open that he was talking to himself internally after losing a crucial fourth set against Stan Wawrinka:

"… in the fifth set … I was talking to myself in my head, saying 'Just relax, man. The comeback is so great already. Let it fly off your racquet and just see what happens.' "

Unlike Federer, other tennis players such as Andy Murray and Serena Williams talk aloud to themselves during matches. For these players, the act of speaking the words aloud is more effective. It also makes it easier for spectators to figure out what is on their mind!



SOURCE 3 Roger Federer was renowned for his composed demeanour on the court, but he admitted to using self-talk techniques to keep himself motivated.

Positive emotions

positive emotions emotions that create an uplifting effect

growth mindset a belief that one's own abilities can be developed through hard work

Positive emotions are an important aspect of an athlete's sporting experience. Joy, interest, contentment, pride and love are all positive emotions that contribute to a stronger psychological performance in sports. Positive emotions build stronger resilience and contribute to increased self-belief. The resulting positive experience further reinforces self-confidence and belief. The athlete who draws on positive emotions can rise above slumps in their performance and use a **growth mindset** to avoid succumbing to the negative emotions that naturally arise during low points in competition. With a growth mindset, an athlete sees dips in their performance as interesting challenges that they have control over. This can transform feelings of frustration or anger into excitement and hope. Experiencing sport as an enjoyable challenge is highly motivating and has a positive effect on an athlete's confidence.

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Check your learning 4.13

Check your learning 4.13: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. "Relax", "go for it" and "focus" are examples of:
   A positive emotions.
   B relevant cue words.
   C positive cue words.
   D negative self-talk.

2 **Identify** a positive cue word (or statement) that could assist an athlete in each of the following mental states:
   A over-arousal
   B under-arousal
   C distraction or lack of focus
   D low confidence.

Analytical processes

3 **Differentiate** between positive cue words and positive emotions in the context of sport psychology by making a list of key points.

4 Read "Theory in action: Why do tennis players talk to themselves?". This article mentions two methods of self-talk: internal (spoken in your head) and external (spoken aloud). Use a PMI analysis framework to identify the strengths and weaknesses of both methods (an example is provided). Use it to **determine** which method would work best for you.

Knowledge utilisation

5 Aaliyah and Lizzie are playing in their high school basketball final. Neither of them has played well in the first half of the game.

Lizzie feels defeated, and each time she misses a shot, she mutters to herself: "See? You're just hopeless at basketball!" She thinks she should probably quit the team.

Aaliyah is also upset that she is not playing well, but after missing a shot, she shouts to herself: "Come on. You can do better than that! You've got this. Focus!" Aaliyah feels she is in a slump and decides to push herself to work hard and get back in the game.

From a sport psychology perspective, **discuss** the difference between the players' reactions to their poor performance. **Justify** which athlete is more likely to experience success in the second half of the match

Lesson 4.14
Self-confidence techniques

Key ideas

→ Self-confidence techniques aim to optimise feelings of confidence during performance.

→ Self-confidence techniques involve using affirmations to address thoughts, emotions and reactions that undermine confidence and performance.

Learning intentions and success criteria

What is self-confidence?

Self-confidence is a feeling of trust in one's own abilities, qualities and judgments. Self-confidence techniques are important for athletes wanting to optimise their feelings of confidence, competence and efficacy within their physical activity. By understanding how

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Retrieve it!

What are positive cue words? Check back to Lesson 4.13 Positive self-talk techniques (page 250) to see if you retrieved the information correctly.

situational thoughts, emotions and reactions can affect self-confidence, athletes can work to overcome those that negatively affect their performance. For example, a wing attack player in netball who makes several poor passes consecutively may begin to doubt themselves and shy away from getting into position to help advance the ball up the court. By recognising that this reaction sabotages the situation, they can apply psychological techniques to bring themselves out of their negative mindset and get them back into playing at their peak performance level.

Using affirmations is one way that athletes can change their personal reactions to situations.

Affirmations

affirmations
positive statements that are directly related to an athlete's qualities, abilities or goals

Affirmations are positive statements that are directly related to an athlete's qualities, abilities or goals. They are designed to help train an athlete's brain into believing that they have the skills, abilities, attitudes and beliefs necessary to achieve whatever goal (or goals) they have set for themselves. Affirmations are used by many athletes as a self-confidence technique to increase confidence and motivation and improve performance.

Affirmations can be used at any time during or between training and performance. Athletes need to continually practise creating and using affirmations to optimise their performance.



SOURCE 1 Positive self-talk and affirmations can improve an athlete's performance.

Using affirmations effectively

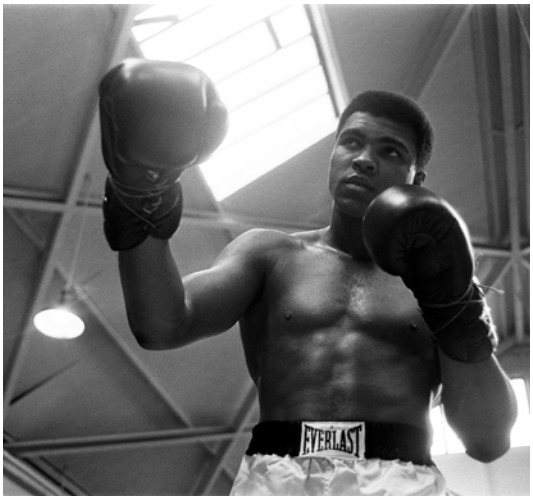
When situations arise during a performance where an athlete's confidence is undermined, they can use affirmations to remind themselves that they can be successful if they put their mind to it. In the example of the netball player who has reduced confidence after making several poor passes in a row, saying short phrases such as "mistakes happen" or "you can do this" can help adjust their mindset to a state that is more optimal for effective performance.

At times outside of performance, affirmations can also be useful to optimise self-confidence. In the lead-up to any training session or sporting event, it is common for an athlete to experience feelings of doubt and anxiety. An athlete who regularly practises affirmations will become better at countering these negative thoughts and emotions to boost their confidence.

Many sport psychologists agree that the effective affirmations have five characteristics:

- they are written as a statement of fact rather than a wish or a hope (e.g. "I am a natural-born runner.")
- they are written in the first person (e.g. "I can stay focused and strong.")
- they are written in the present tense (e.g. "I am good at taking shots under pressure.")
- they are positive (e.g. "I am a skilled player.")
- they are specific (e.g. "My serve is powerful and lands in first time.")

Some sport psychologists suggest that athletes take note of any negative thoughts that arise during training or competition and write six to ten inspirational affirmations to counter each one. These affirmations can be



SOURCE 2 Muhammad Ali was famously quoted as saying: "I am the greatest. I said that even before I knew I was." This is an example of an affirmation.

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about specific skills or about the individual generally. Athletes should say these affirmations out loud and with conviction to themselves in a mirror or to a trusted friend or trainer. Displaying notes or posters with written affirmations is also beneficial.

The most famous advocate for the use of affirmations was US professional boxer and activist Muhammad Ali. Widely acknowledged as one of the greatest athletes in history, Ali told himself "I am the greatest" so many times that even his opponents became convinced of it. Ali was also famously quoted as saying: "It's the repetition of affirmations that leads to belief. And once that belief becomes a deep conviction, things begin to happen."

Check your learning 4.14

Check your learning 4.14: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Affirmations are:
   - **A** best used sporadically to avoid over-confidence.
   - **B** a good self-confidence technique.
   - **C** best written and displayed rather than spoken.
   - **D** often written in the third person.

2 Which of the following options is an example of a well-written affirmation?
   - **A** I wish to be the greatest.
   - **B** We can win.
   - **C** I am good at taking corner kicks under pressure.
   - **D** I was good at turning over possession the last time I played.

3 **Describe** five characteristics of an effective affirmation.

Analytical processes

4 **Consider** three negative thoughts you might have about your sporting performance.
   - **a** **Describe** the negative thoughts.
   - **b** **Apply** the five characteristics of effective affirmations to create five new affirmations to counter each negative thought. Practise saying the affirmations aloud so you can redirect these negative thoughts into positive ones.

Knowledge utilisation

5 **Conduct** some online research about the life and sporting career of Muhammad Ali.
   - **a** **Assess** the role that affirmations played in the sporting and personal success of Ali.
   - **b** **Discuss** five affirmations Ali used. **Justify** which affirmation resonates with you.

Lesson 4.15
Pre-performance techniques

Key ideas

→ Pre-performance techniques are sequences of actions and/or thoughts (performed in order) that an athlete follows just prior to the performance of a task.

→ Pre-performance techniques aim to optimise performance and include routines and checklists, and mental rehearsal.

Learning intentions and success criteria

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What are pre-performance techniques?

Retrieve it!

In terms of goal setting, what are the three main types of goals? Check back to Lesson 4.10 Goal-setting techniques (page 240) to see if you retrieved the information correctly.

Pre-performance techniques are a predetermined set of actions (physical and mental) an athlete carries out prior to or during a competition or performance. In this lesson, we will look at two types of pre-performance techniques:

- pre-performance routines
- pre-performance checklists.



SOURCE 1 English rugby union player Jonny Wilkinson used a detailed pre-task routine for goal kicking. After lining the ball up, he would take four steps away from the ball, one deep breath and relax his shoulders, five steps towards the try line, clasp his hands, stare at the goal and then kick.

Pre-performance routines

pre-performance routines a sequence of actions and/or thoughts that an athlete follows just prior to performance or competition

Pre-performance routines are a type of pre-performance technique used by athletes to optimise their mental strength and help get them "in the zone". A pre-performance routine is a sequence of actions and/or thoughts (performed in a specific order) that an athlete follows just prior to a performance or competition.

Sports stars often practise pre-performance routines before they complete closed skills within their game play. For example:

- before a free throw, basketball player Michael Jordan would spin the ball, bounce it three times, focus on the rim of the hoop, spin the ball once more and then take the shot
- rugby league player Johnathan Thurston would take a predetermined number of steps backwards and then to the side; he would then focus on the goal posts and then the ball before taking a deep breath and counting his steps in as he ran up to kick the ball.

Pre-performance routines are specific to individual athletes and sports. They are designed to reduce anxiety by helping to generate feelings of certainty, familiarity and control, and improve the athlete's concentration by helping them to focus on appropriate cues.

Tips for establishing an effective pre-performance routine

- Choose actions that mimic (or are part of) the task you must complete, e.g. if your task is driving a golf ball, then the pre-performance routine might be standing two steps back and practising the swing.
- Keep the routine short, with consistent timing between each step, e.g. take 5 seconds between each practice swing and the actual task.
- Include a breathing rhythm and a cue word or phrase such as "you've got this".
- Practise and refine the routine until it becomes habitual.

Pre-performance checklists

Checklists are another type of pre-performance technique. A pre-performance checklist is a list of tasks to complete prior to competition. Checklists might include practicalities such as checking that the requisite equipment and uniform are ready, completing a warm-up that focuses on technical cues and taking part in a pre-game briefing. It could include mental preparation tasks such as mental rehearsal, positive self-talk or relaxation techniques.

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Once the items on the checklist are complete, the athlete can focus on other aspects of their pre-competition routine.

Implementing pre-performance techniques

Pre-performance routines and checklists should be devised and practised on a regular basis, both in training and in competition.

Athletes often listen to music while completing their pre-performance checklist – some always listen to the same piece of music or artist to provide consistency and familiarity, while others simply wear headphones (without music) to give them the quiet time they need to work through their checklist efficiently. Working through the checklist in the same order each time is good for helping athletes to manage nerves and stay positive ahead of performances.

Pre-performance routines can be easily skipped over in the pressure of a performance environment. However, slowing down and making the most of the time available before the performance of a closed skill to prioritise a routine is crucial for effective implementation. Australian hurdler Michelle Jenneke (see Source 2) includes dancing in her pre-competition routine. A video of her warm-up dance at the starting line of her event went viral after the 2012 World Junior Championships. As she performed well at that meet, she has prioritised including the dance routine before both training and competition ever since. Michelle explains: "I honestly don't get too nervous about the race. I am more excited than anything else – and the pre-race routine is an outlet for that, [it] gets me into the right frame of mind."

Retrieve it!

Provide two tips for establishing an effective pre-performance routine. Check back to earlier this lesson to see if you retrieved the information correctly.



SOURCE 2 Many athletes use pre-performance techniques. (A) Spanish tennis player Rafael Nadal would always have a freezing cold shower 45 minutes before each game. (B) Australian hurdler Michelle Jenneke gets into the right frame of mind by doing a dance on the starting line.

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Theory in action A case of lucky underwear

Many athletes consider rituals such as wearing their favourite underwear or carrying a lucky charm an important part of their pre-performance checklist.

Retired basketball legend Michael Jordan wore his University of North Carolina basketball shorts under his Chicago Bulls uniform in every match he played. He strongly believed that they brought him luck and contributed to his success. To hide his "lucky" shorts, he wore longer shorts over the top, which started a trend that continues today.

Similarly, tennis legend Serena Williams had several routines to which she attributed her success. She always brought her shower sandals onto court with her, tied her shoelaces in a certain way and wore the same pair of socks for the duration of a tournament. When her performance was off, she would often cite not following one of her routines as the reason.

Some research has shown that rituals provide athletes with a sense of control in an otherwise unknown environment. This can have a positive impact on an athlete's confidence. However, some psychologists dismiss this idea and warn against getting too attached to rituals and superstitions. They claim that rituals are based on luck and give athletes a false sense of confidence compared with other checklist tasks.



SOURCE 3 Michael Jordan won six NBA championships wearing the same "lucky" shorts under his uniform.

Check your learning 4.15

Check your learning 4.15: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. A pre-performance routine is:
   - **A** usually performed an hour before a performance.
   - **B** made up of six unique steps performed prior to a task.
   - **C** a spontaneous set of tasks performed prior to performance.
   - **D** a well-practised set of actions usually performed prior to closed skills.

2 **Identify** five tasks that could be included in a pre-performance checklist.

Analytical processes

3 Read "Theory in action: A case of lucky underwear", then conduct some additional research into rituals in sport. Based on your research, **reflect on** whether you think rituals are beneficial additions to checklists that can have a positive impact on an athlete's confidence or inadvisable routines that give athletes a false sense of confidence. **Compare** examples from your research in a written response of 150 words.

Knowledge utilisation

4 **Create** a pre-performance checklist you could use prior to competition in a sport you participate in. **Consider** the order of your checklist as you put it together.

5 **Create** your own pre-performance routine for a closed skill within the sport that is the focus of your study this term.

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SKILL DRILL

Lesson 4.16

Determine the impact of pre-task routines on performance

Aim

To determine the impact of a pre-task routine on performance

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Equipment specific to your selected physical activity
- Game Performance Assessment Instrument 9 (GPAI 9)
- Pen
- Data Collection Instrument 5 (DCI 5)

Template: Game Performance Assessment Instrument 9 (GPAI 9)

Template: Data Collection Instrument 5 (DCI 5)

Method

Step 1

Select a **closed** skill from your selected physical activity (e.g. a serve in tennis).

Step 2

Participate in an authentic game or performance environment for a minimum of 10 minutes.

Then, use the Condition A column of GPAI 9 to rate your confidence, anxiety and concentration levels when performing the closed skill.

Rate your overall performance of the closed skill.

Step 3

Now create a pre-task routine for the same closed skill by combining up to four elements (i.e. separate parts of the overall routine), as outlined in DCI 5. Use the details column to describe each element in your routine in as much detail as possible.

My selected physical activity is: _____

My closed skill is: _____

	Condition A – without pre-task routine			Condition B – with pre-task routine		
Psychological concept	**Worse than usual**	**Same as usual**	**Better than usual**	**Worse than usual**	**Same as usual**	**Better than usual**
Confidence						
Anxiety						
Concentration						
Overall performance						
Reflection						

SOURCE 1 GPAI 9

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Elements	Details
1. **Breathing** • Choose how many breaths you will take, as well as the rate and depth of these breaths.	
2. **Trigger words** • Choose a word or short phrase to focus your attention.	
3. **Physical action** • Create a ritualistic action to perform just prior to the task.	
4. **Temporal consistency** • Decide the length of preparation time (e.g. countdown prior to execution of skill). • Decide how long the complete pre-task routine will last.	

SOURCE 2 DCI 5

Step 4

Perform your pre-task routine for 10 minutes. Complete the routine in its entirety each time, performing each element in a set order.

Step 5

Participate in an authentic game or performance environment for 20 minutes. During the game or performance, complete your pre-task routine every time you perform the closed skill.

Step 6

Then, use Condition 2 of GPAI 9 to record the impact of your pre-task routine on your confidence, anxiety and concentration levels and overall performance of the skill.

Analysis and discussion tasks

1 **Analyse** the primary data you gathered during this Skill drill by completing the following tasks.
   - **a** Referring to your completed GPAI 9, **describe** how your pre-task routine impacted your confidence, anxiety and concentration levels during the authentic game or performance.
   - **b** Can you **identify** a relationship between confidence, anxiety, concentration and pre-task routines?

2 **Assess** the reliability and validity of your data (i.e. would the results be the same if you repeated this activity tomorrow? Is the activity measuring what it is supposed to measure? Did your results match what could be expected, given the conditions of each performance? What could you do to make your conclusions about the effectiveness of the pre-task routine more accurate?). **Justify** your answer.

3 **Identify** any differences between your results and the expected impact of the pre-task routine. Was the result what you thought it would be? If not, why do you think that is the case?

4 **Predict** what changes you may observe in your confidence, anxiety and concentration levels (and your overall performance) if you apply a pre-task routine to all closed skills in your physical activity over the coming weeks or months.

5 **Discuss** the benefits of using pre-task routines for closed skills. Are pre-task routines always necessary? How can they be used most effectively to optimise the performance of closed skills? **Justify** your response using primary and secondary data.

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Lesson 4.17
Relaxation and energiser techniques

Key ideas

- → Relaxation and energiser techniques are used to optimise arousal levels prior to performance.
- → Relaxation and energiser techniques include meditation, progressive muscle relaxation (PMR), deep breathing, music and visualisation.

Learning intentions and success criteria

What are relaxation and energiser techniques?

Relaxation and energiser techniques are often used to optimise arousal levels prior to performance. They can also contribute to better concentration, motivation and confidence. These techniques can be adapted to suit the individual needs of athletes and the situation in which they find themselves.

Relaxation and energiser techniques are most commonly used immediately prior to performance or competition. However, a number of these techniques can also be applied in an ongoing sense and/or during performance. It is recommended that athletes practise these techniques regularly so that they can apply them effectively whenever they are required.

relaxation and energiser techniques a range of different techniques aimed at optimising athletes' arousal levels

Effective relaxation and energiser techniques

Effective relaxation and energiser techniques include:

- meditation
- progressive muscle relaxation (PMR)
- deep breathing
- music
- visualisation.

Retrieve it!

What are two types of pre-performance techniques? Check back to Lesson 4.15 Pre-performance techniques (page 255) to see if you retrieved the information correctly.

Meditation

Meditation is the practice of focusing the mind to achieve clarity and a sense of calm by reducing "noise" or stimulation to the brain. Meditation allows you to turn attention away from distracting thoughts and focus on the present moment. It can involve focusing on breath or bodily sensations, or a word, phrase or image.

Athletes can use meditation to prevent the build-up of pre-competition anxiety. Meditation can also help athletes gain greater control of their emotions and focus during performance. For example, a softball pitcher may experience a natural increase in arousal before a crucial pitch. If the pitcher practised effective meditation beforehand, their strengthened mind–body connection will enable them to resist the heightened external and internal distractions and remain connected to the task in the present. This will, in turn, allow them to stay more relaxed as a performer.

meditation the practice of focusing attention on a single point of reference to create calmness and clarity

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To be most effective, meditation should initially be practised:

- in a quiet environment
- for 10–30 minutes, two to three times a day initially
- with a focus on breathing
- with a clear mind (i.e. without holding onto distracting thoughts).

Progressive muscle relaxation (PMR)

progressive muscle relaxation (PMR) a stress-relief technique that involves the systematic tensing and relaxing of particular muscle groups in the body

Progressive muscle relaxation (PMR) is a popular relaxation technique used by athletes. It involves the systematic tensing and releasing of muscles, which is beneficial to athletes both before and after a sporting performance. PMR can reduce respiration, blood pressure, muscle tension and negative thoughts. An athlete who engages in PMR regularly can manage anxiety better and their performance is therefore optimised.

To be effective, it is recommended that athletes spend 10 minutes engaging in PMR in the quiet of their home before and after competitions, at least two to three times each week. Athletes lie on the floor and progressively tense and then relax particular muscle groups. Starting with the arms, the athlete can make a fist and tighten the arm muscles for approximately 5 seconds and then relax for 30 seconds. Repeating this several times will help athletes become more familiar with the sensations and feedback from the muscles. The same can be done for the neck, face, shoulders and upper back and then the lower back and abdominals, as well as the legs and hips. To finish, athletes tense their whole body and then relax completely.

With practice, athletes will be able to relax the muscles without tensing them first; sometimes a cue word is enough to produce the feeling of relaxation. This technique is particularly useful for neck and shoulder tension, tension headaches and tight jaw muscles.



SOURCE 1 Practising PMR prior to a performance can induce feelings of relaxed energy.

Deep breathing

Deep breathing is the action of taking long, slow, deep breaths to induce relaxation. It can be used before and during performances to manage arousal levels and increase concentration. Deep breathing is an important relaxation technique that is often performed in conjunction with meditation and PMR, but it is also effective on its own. When breathing is performed in a deep rhythmic pattern (often referred to as diaphragmatic breathing), the "primitive" parts of the brain that control the fight or flight response are given a signal that the threat of danger has passed. Deep breathing is often used during stressful or high-pressure moments during performance, but it should be practised outside of performance during controlled environments to perfect technique.

There are several steps to practise deep breathing outside of a performance.

- Sit or lie in a relaxed position with bent knees.
- Relax your shoulders.
- Place your dominant hand just below your navel and your other hand just above it.
- Breathe in deeply through your nose, filling the area under your dominant hand with air first, then the area under your other hand (lower rib cage) and finally the upper portion of your lungs.
- Exhale slowly, squeezing your belly, pushing the air out.
- Focus on each inhalation and exhalation.
- Repeat for 10 minutes.

For the record!

Phil Jackson, former NBA coach of the Chicago Bulls and the Los Angeles Lakers, used to invite all his players into a meditation circle before important playoff games to help players focus on the task and ensure they were mentally present. Over his nine seasons as coach of the Chicago Bulls, Chicago won the NBA championships six times.

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During performance, an athlete might use deep breathing to manage their emotions or refocus themselves as needed. They may only have time to take one or two quick, deep breaths, but when more time is available they may use specific breathing patterns, such as those in Source 2.

Technique	Method	Effect
4–7–8	• Inhale deeply for 4 seconds • Hold breath for 7 seconds • Exhale for 8 seconds	Manage arousal
6–2–8	• Inhale deeply for 6 seconds • Hold breath for 2 seconds • Exhale for 8 seconds	Increases concentration
Measured breathing	• Customised to the athlete • Inhale and exhale for the same count (e.g. five in and five out) • No breath holding	Increases relaxation and concentration

SOURCE 2 Breathing techniques that athletes can use during performance to manage specific psychological needs

For the record!

Haile Gebrselassie, a retired long-distance runner and Olympic gold medallist, often requested that the 1990s hit "Scatman" (with a BPM of around 135) be played during his events. Gebrselassie says: "I did many records with the 'Scatman' song. If you watch back some of my world records you can hear 'Scatman' in the background. The rhythm was perfect for running."

Music

Music is a powerful tool for both increasing and decreasing athletes' arousal levels before training or competition. The effect of music differs from athlete to athlete.

Prior to performance, it is more common for athletes to listen to music with a fast beat – this type of music generally increases arousal levels. However, some athletes respond well to relaxation music (for example, nature sounds such as whales or water) or the mellow tunes of their favourite artist prior to performance.

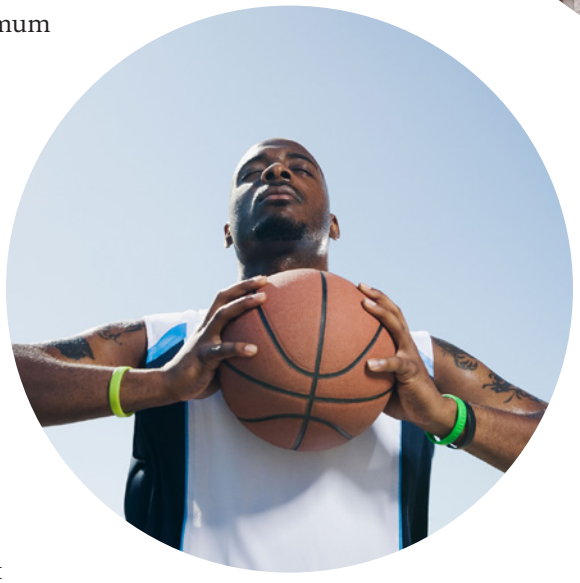
The Brunel Music Rating Inventory was created by sport psychologist Costas Karageorghis to help athletes choose the ideal music to listen to as part of their pre-performance routine. One of the most important elements of Karageorghis's research was that a song's tempo (i.e. speed) should be between 120 and 140 beats per minute (BPM) for optimum arousal. That pace coincides with the range of most commercial dance music and rock songs.



SOURCE 3 Athletes use relaxation and energiser techniques such as deep breathing and listening to music to prepare for performances.

Visualisation

Visualisation is another technique used to increase energy levels in athletes. A type of mental rehearsal (see Lesson 4.11 Mental rehearsal techniques, page 244), visualisation uses mental imagery to create powerful events in an athlete's mind. This can "trick" the body into activating the hormone control centres of the brain, and the subsequent release of adrenaline can kick-start arousal. It is recommended that athletes repeat the images over and over again to flood the mind with the powerful arousal emotions.



SOURCE 4 Visualisation creates powerful events in an athlete's mind. A basketball player might visualise the sweetest point they ever scored and the subsequent celebration of this basket.

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Check your learning 4.17

Check your learning 4.17: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Meditation is effective in helping athletes to control their anxiety during a high-pressure game because it:
   - **A** allows them to control unwanted thoughts that threaten performance.
   - **B** makes them learn the steps to their routines more efficiently.
   - **C** energises and gees them up for performance.
   - **D** puts them into a low state of arousal.

2 The breathing technique recommended to manage arousal levels is the:
   - **A** 4–7–8 technique.
   - **B** 6–2–8 technique.
   - **C** measured breathing technique.
   - **D** Costas Karageorghis technique.

Analytical processes

3 Research PMR and deep breathing techniques. **Reflect on** which technique would have the greatest impact on optimising your arousal levels prior to performance.

4 **Compare** and **contrast** the types of music that increase athletes' arousal levels and the types of music that decrease arousal levels.

Knowledge utilisation

5 "Music with a tempo of 120 to 140 BPM will optimise arousal levels for all athletes."

6 Do you agree or disagree with this statement? **Justify** your response, using examples.

7 **Devise** a relaxation and energiser strategy to optimise your performance. **Justify** the elements of your strategy, referring to primary and secondary data.

Lesson 4.18
Attention and concentration techniques

Learning intentions and success criteria

Key ideas

→ Attention and concentration techniques aim to improve athletes' focus during their performance.

→ Selective attention, using trigger words, performance segmenting, pre-performance routines and within-competition routines are psychological techniques designed to improve attention and concentration within performance.

Retrieve it!

Which relaxation technique involves the systematic tensing and releasing of muscles? Check back to Lesson 4.17 Relaxation and energiser techniques (page 261) to see if you retrieved the information correctly.

What are attention and concentration techniques?

Attention and concentration techniques are designed to increase the focus and motivation of athletes. Such techniques include:

- selective attention using trigger words
- performance segmenting

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- pre-performance routines
- within-competition routines.

We will now look at each of these in detail.

Selective attention using trigger words

As discussed in Lesson 4.6 Attention and concentration (page 228), selective attention is the process of attending to relevant cues within the specific task at hand. To tune out irrelevant cues and stay focused, athletes can use tools such as trigger words. A trigger word is a pre-determined word, usually related to the demands of the sport. An athlete can use trigger words such as "focus" or "breathe" to bring themselves back to the task when they find their mind or performance declining.

Performance segmenting

Performance segmenting is the process of breaking up extended periods of training or competition into smaller, more manageable periods of time (known as segments). Each segment should be short enough for the athlete to totally focus on what needs to be done during that period. Performance segmenting is designed to help athletes stay motivated, and to focus their attention and concentration.

performance segmenting the process of breaking up a performance into more manageable periods in one's mind

A sporting event that takes place over a long period of time can be overwhelming for the players or athletes taking part in it – think of a marathon runner at the start of an event or a cricket player at the start of a run chase. If an athlete performs below expectations in the early stages of an event, feelings of panic and anxiety can set in and influence the outcome of the entire event. Effective performance segmenting aims to prevent this from happening. By dividing an event up into segments, athletes can narrow their focus and fully concentrate on the demands of that smaller period of play or activity.

There are no set rules on how short or long each segment should be, as this will depend on the individual and the sport or physical activity. The marathon runner might break the event into 10-kilometre sections, while the cricket player embarking on an Ashes series will probably think of one game at a time. They may even break it down further into days, innings or sessions.

For the record!

Australian cricket player Steve Smith has been a successful performance segmenter since his early days playing the sport. His junior coaches and teammates claim that he would regularly steer his team to victory by "winning" one over at a time. After each over, he would yell out from the crease: "What's our run rate now?"

Pre-performance routines

Pre-performance routines were discussed in detail in Lesson 4.15 Pre-performance techniques (page 255). Pre-performance routines are pre-determined and practised thoughts, movements and actions performed in a specific sequence prior to performance. Research has shown that the use of pre-performance routines (also known as pre-shot or pre-serve routines) increases concentration by decreasing both internal and external distractions, such as negative thoughts or crowd noise, and increasing focus on task-specific cues. Practising these routines so that they can be performed systematically and with consistency is important to optimise the effectiveness of this psychological technique.

Within-competition routines

Athletes might also use actions and mental reminders to keep themselves focused within extended periods of competition. A soccer player, for example, must engage in 90+ minutes of high-intensity gameplay. A lapse in concentration at any point during the match can result in a goal being conceded, and ultimately can mean the difference between winning and losing.

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A within-competition routine might involve the athlete taking a moment during a stoppage of play to take deep breaths or check in with their body by slapping their thighs or looking towards the coach for encouragement. Within-competition routines can be continually used throughout the match to ensure focus and motivation is maintained.

Check your learning 4.18

Check your learning 4.18: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Saying "In the hoop" to yourself or out loud prior to taking a free throw in basketball is known as:
   - **A** performance segmenting.
   - **B** using a trigger word.
   - **C** using a pre-performance routine.
   - **D** using a within-competition routine.

Analytical processes

2 The phrase "play one hole at a time" describes the concept of performance segmenting in golf. **Consider** the activity you are currently studying and **identify** the opportunities for performance segmenting.

3 Australian cricketer Steve Smith is a master of performance segmenting. Conduct some online research to identify two other Australian sporting identities that use performance segmenting. **Compare** the data you have collected and **analyse** how it has helped these athletes to optimise their performance. Provide one or more credible sources to support your answer.

Knowledge utilisation

4 **Devise** a detailed personal psychological strategy to optimise your attention and concentration. Refer to primary and secondary data to **justify** your strategy.

Lesson 4.19
Team dynamics and cohesion techniques

Learning intentions and success criteria

Key ideas

→ Team dynamics and cohesion techniques help the individual members of a team develop strong relationships, establish clear roles and expectations, and maintain high levels of communication so that they can work together.

→ Leadership, communication, norms, rules and discipline are all techniques to develop team dynamics and cohesion.

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What are team dynamics and cohesion techniques?



SOURCE 1 Team dynamics and cohesion techniques help individual members of a team work together as a unified whole.

Team dynamics and cohesion techniques include a range of different strategies and skills designed to help the individual members of a team:

- develop strong relationships
- establish clear roles and expressions
- maintain high levels of communication
- so that they can work together and function as a unified whole.

Team dynamics and cohesion techniques should be applied continuously during training and performance.

In Lesson 4.7 Team dynamics and cohesion (page 232), we discussed Tuckman's stages of group development – a theory designed to explain the stages that teams go through to achieve cohesion. At each stage of team development, there are important strategies athletes need to work through to optimise the cohesion of their team. A good coach plays a significant role in implementing and facilitating these strategies. It is crucial, especially in the forming and storming stages, that the coach is open and available to hearing and meeting the needs of the individuals in the team. To ensure all members are motivated and driven, a coach must ensure that each individual is having their need for autonomy, competence and relatedness met (as discussed in Lesson 4.2 Motivation, page 212). This will enable each athlete to contribute more and better accept their teammates' contributions.

Retrieve it!

In sport psychology, what are affirmations? Check back to Lesson 4.14 Self-confidence techniques (page 253) to see if you retrieved the information correctly.

Techniques for improving team dynamics and cohesion

There are many different aspects to team dynamics and cohesion, and therefore many different strategies and techniques for improving the cohesion of teams. It is helpful to organise individual techniques into five broad categories based on their purpose. These are:

- techniques for establishing group goals and vision
- techniques for establishing group roles (including leadership)
- techniques for establishing group norms (including rules and discipline)
- techniques for building team identity
- techniques for improving communication.

Techniques for establishing group goals and vision

When everyone shares the same goals and vision, it not only fosters support and harmony within the group but also motivates individuals within the team to work hard for the good of the team. Goals should be:

- made in consultation with the whole team
- pertain to things other than just outcomes
- guided by the SMARTER principles (see Lesson 4.10, "Setting SMARTER goals", page 242)
- written down and reviewed regularly.

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Vision statements are short sentences or collections of words that capture the essence of the team's group goals. Vision statements should be:

- short
- motivating
- memorable
- related to the team goals
- unique to the team.



SOURCE 2 Rowing is an example of a team sport that requires a lot of team cohesion and cooperation.

Techniques for establishing group roles (including leadership)

When every player is aware of their role and the roles of others, they feel a greater sense of competence and relatedness to their teammates. In establishing group roles, it is important that:

- they are clearly communicated during the forming stage of team development, including identifying leaders and people with the authority to make decisions on behalf of the group
- they are made in consultation with the team
- each role has a description
- they are revised, as required.

Techniques for establishing group norms (including rules and discipline)

Group norms are rules, expectations and disciplinary guidelines set out for all members of the team to follow. Group norms should be:

- established by the coach (sometimes in consultation with some or all members of the team)
- communicated in full
- tailored to the goals and needs of the team
- revised when issues inevitably arise.

It is important that rules are established to ensure individuals within teams are clear about what is expected of them. Making the expectations of team members explicit lessens the potential for emotional stress. Players are often required to sign an agreement to uphold the team rules.

Rules may address the following issues:

- punctuality for games and training
- the dress code for games and training
- social media use
- antisocial behaviours in and out of the sporting arena.

Discipline for breaches of the rules should also be clearly communicated to the team.

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Techniques for building team identity

Building a shared team identity is a useful strategy for improving team cohesion. There are many ways in which to build team identity, including:

- creating a team name and logo
- creating a team song and mascot
- creating unique team rituals (e.g. special hand slaps during breaks in play, team chants, and pre- and post-match routines such as a warm-up and cool-down).

All these individual elements combine to help create bonds and feelings of belonging and shared identity within the group.

For the record!

The Australian rugby union team mascot is called Wally. Team tradition requires the youngest member of the squad to protect and care for Wally while on tour. They must place Wally on the sideline during Tests (facing the way the team is running), take Wally to all functions and ensure Wally is protected from pranks!



Techniques for improving communication

Communication is a key factor in creating harmony. A team needs an environment in which all members are encouraged to contribute their ideas and have their opinions and suggestions listened to. If communication is not effective, team officials might create a system for communication.

Check your learning 4.19

Check your learning 4.19: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Team dynamics and cohesion can be developed by focusing on:
   - **A** good communication.
   - **B** establishing clear roles.
   - **C** developing strong relationships.
   - **D** all of the above.

2 **Explain** why a shared team identity is important. **Describe** some common strategies used to build team identity.

Analytical processes

3 Think of your Physical Education class as a team. **Reflect on** the development of your team since the start of the year.
   - **a** **Identify** Tuckman's stages of group development in relation to your team and discuss the reasons for your answer.
   - **b** **Identify** any problems you have encountered as a group.
   - **c** **Consider** which of the team-building strategies suggested here that you have and have not adopted.

4 **Reflect on** a time when you were part of an unsuccessful or dysfunctional team.
   - **a** In your view, what made the team unsuccessful or dysfunctional?
   - **b** What strategies or techniques could have been applied to improve team cohesion?

Knowledge utilisation

5 **Justify** the importance of actively maintaining effective communication within a sporting team.

6 **Discuss** who should have the greatest say when establishing group norms – the coach or the players. Give reasons for your response.

7 Use primary and secondary data to **justify** a team cohesion strategy such as establishing clear team roles and leadership.

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Lesson 4.20
Assessment support – Internal assessment: Project – folio

Overview of internal assessment 1: Project – folio

As part of your assessment for Unit 2 of the QCE Physical Education syllabus, you will be required to complete a Project – folio. The Project – folio is a complex task with many components.

This section of the module is designed to support you as you complete your own Project – folio (see Practice assessment task, page 278). It includes practical tips and advice to ensure that what you produce meets the criteria set in the instrument-specific marking guide (ISMG). Detailed information on how to structure, create and present your Project – folio is provided in Lesson 1.3 Tips for success on the Project – folio (page 8). In addition to this, Lesson 1.4 Skill drill: Planning, creating and presenting a Project – folio (page 9) provides a number of useful tips and instructions to help you.

The Project – folio is made up of two sections. We will model one possible approach to completing the task, as follows.

- **Section 1 – Presentation**: a multimodal task presented as an mp4 video up to 11 minutes
- **Section 2 – Demonstrating and applying**: supporting visual evidence presented as an mp4 video up to 3 minutes

Section 1 – Presentation

Your presentation will be the main part of your Project – folio. It is a multimodal task, and in this approach, we have chosen to produce an mp4 video up to 11 minutes in length. Do not exceed the 11-minute time limit as any content included after 11 minutes will not be counted in the awarding of your grade. Your multimodal presentation must consist of at least two modes (visual, written or spoken). One way you might meet this requirement is to make a slideshow with embedded videos, images and text. You could then use a program such as Screencastify to produce a voiceover whereby you explain the different elements on your slides and tell your story from beginning to end.

Section 1 will include the following tasks:

- analysing primary and secondary data
- devising and justifying a sport psychology strategy
- evaluating the effectiveness of the strategy
- justifying the maintenance and modification of the strategy.

These tasks are detailed below. For each task, we have provided an example of what this might look like in action for a student completing their Project – folio.

Retrieve it!

What are the five broad categories of techniques for improving team dynamics and cohesion? Check back to Lesson 4.19 Team dynamics and cohesion techniques (page 266) to see if you retrieved the information correctly.

Task 1 – Analysing primary and secondary data

The first part of your presentation requires you to analyse primary and secondary data, looking for relationships between:

- the demands of the specialised movement sequences for one movement strategy

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- the impact of psychological concepts such as motivation, confidence, arousal, attention, concentration, and team dynamics and cohesion (as applicable) on personal or team performance
- application of the relevant psychological techniques.

To do this, you will need to:

- gather secondary data about the demands of the specialised movement sequences for one movement strategy (model of effective technique)
- collect video footage of your performance of specialised movement sequences for a movement strategy from your selected physical activity to demonstrate the aspects of your performance that do or do not meet these demands
- analyse how psychological concepts have affected your performance in these videos; completing Skill drills and creating Game Performance Assessment Instruments (GPAIs) to collect data about your confidence, motivation, arousal and so on will provide you with additional information you can use to connect to your analysis of the demands of the movement strategy
- experiment with different psychological techniques and collect data about their impact on your performance throughout the unit, which will enable you to discuss these results in relation to the first two dot points.

To assist you with this process, GPAI 10 has been provided for you in Source 1. A digital version of this GPAI is available. You can customise GPAI 10 to suit your individual needs.

Once you have gathered all this information, you will be ready to write your analysis. You must ensure you refer explicitly to relevant primary data and support your findings with secondary data. This section will form the basis of your justification of the development of your sport psychology strategy.

How did my psychological state affect optimal performance in my selected physical activity?

On a scale of 1–5, rate the impact of your psychological state on your ability to perform optimally as follows:
1 – was very detrimental to optimal performance
2 – was detrimental to optimal performance
3 – had little positive or negative impact on optimal performance
4 – was supportive of optimal performance
5 – was very supportive of optimal performance.
To get your average rating, add your scores from sessions 1 to 3 and divide by 3 (the number of sessions).

	Session 1 rating (1–5)	Session 2 rating (1–5)	Session 3 rating (1–5)	Average rating	Comment
Confidence	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5		
Motivation	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5		
Arousal	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5		
Attention and confidence	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5		
Team dynamics and cohesion	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5		

SOURCE 1 GPAI 10

Template: Game Performance Assessment Instrument 10 (GPAI 10)

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Example



Penny uses drills and authentic game environments to improve her physical and mental performance as a small forward in basketball in Unit 2 of her Physical Education course. She begins her data collection process by obtaining video footage of herself performing the specialised movement sequences of a jump shot for the movement strategy of "Advance team play and scoring". Penny has noticed that she has some success with her outside shooting but goes through periods of inconsistency, which has affected her confidence. She would like to improve her shooting consistency.

By analysing her primary data (including video footage and GPAIs) and secondary data about basketball shooting and sport psychology concepts of confidence, arousal, attention and concentration, Penny determines that successful basketball shooters gain confidence by narrowing their focus and practising shots from areas on the court they are most likely to shoot from in their position. They also refine their technique by ensuring their feet are slightly turned away from their dominant arm to align the arm with their eyes, increasing power and accuracy. It takes a concerted effort to concentrate on these technical points, and this is something that Penny acknowledges she has not been doing.

Penny can see from journal entries that her arousal levels during gameplay are always very high, and she is easily distracted by her opponents and teammates and does not think about her technique. She notes from looking at her GPAIs that whenever she has incorporated positive self-talk and attention and concentration techniques before shooting in her class games, her concentration improves, and she has more success in her shooting consistency. This increases her feelings of confidence and improves her overall performance.

Penny uses the information she has gathered in her analysis to devise (and justify the development of) a sport psychology strategy.

Task 2 – Devising and justifying a motor learning strategy

Once you have determined the most significant relationships between the movement strategy, psychological concepts impacting performance and applied psychological techniques, you should have enough data to devise a sport psychology strategy to optimise your performance of your selected movement strategy. This strategy should consist of the psychological techniques you could use to address any areas of psychological concern in your performance (according to your primary and secondary data). You will need to consider when, how and how often you will implement your strategy. You will also need to synthesise (put separate facts together) the primary data collected in your analysis with relevant secondary data to justify the development of your strategy.

Upon devising your strategy, it is recommended that you implement the strategy during class time over the course of one to two weeks and collect primary data about the impact of your strategy on your identified areas of psychological concern and overall performance of the movement strategy.

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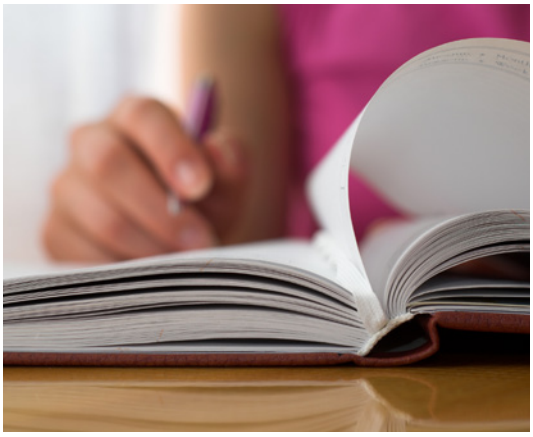
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Example

Through the analysis of her shooting performance, Penny decides to develop a sport psychology strategy to improve her confidence, arousal, attention and concentration to better meet the demands of jump shooting in gameplay. She refers to her primary and secondary data to determine that her strategy should use psychological techniques such as positive cue words and trigger words to improve her shooting performance. She decides exactly which phrases she will use and when she will practise using them before and during her Physical Education lessons.

Penny implements her strategy for two weeks, collecting a range of data (e.g. through video footage and GPAIs) on the changes she notices in her shooting performance during that time.

Task 3 – Evaluating the effectiveness of the strategy



Once you have implemented your devised strategy for two to three weeks and collected data on your performance, you are required to evaluate the effectiveness of your strategy. To do this, it is important to appraise:

- the outcomes and limitations of the psychological techniques you applied in your strategy
- the outcomes and limitations of the impact of your strategy on your identified areas of psychological concern (e.g. confidence, motivation, arousal, attention, concentration, team dynamics).

In other words, you will need to discuss what did and did not work. Referring to primary and secondary data here will enable you to justify the parts of your strategy that you recommend keeping and those you should modify. This part will be outlined in more detail next.

Example

Penny reviews all the footage, journal entries and GPAIs recorded when implementing her strategy and uses the information to evaluate the effectiveness of the strategy by appraising the outcomes and limitations. She concludes that using trigger words helped her to stay focused on technical points and improved her performance of advancing team play and scoring using jump shots.

She noted that while positive cue words were enjoyable to say, they did not make as much difference to her performance as trigger words, and she struggled to implement both types during gameplay. She also noted that her arousal levels were largely unchanged throughout the implementation of her strategy. She conducts some further research to support her findings, synthesising her primary data with the secondary data to draw conclusions.

Penny uses these evaluations and their accompanying data to form the basis of her recommendations moving forward.

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Task 4 – Justifying the maintenance and modification of the strategy

The final task in Section 1 of your Project – folio requires you to make recommendations for parts of your strategy you should maintain and parts you should modify or change. To do this properly, you will need to use evidence from primary and secondary data. It is also recommended that you explain your modifications by detailing what you should do differently and why.

Tip: This does not need to be its own section within your folio. You can speak about your recommendations as you evaluate their effectiveness. That is, you can recommend maintenance of the psychological techniques that had a positive effect on your performance as you explain these benefits and recommend modification of the aspects that did not have such a benefit when you appraise these limitations.

Example

Based on her evaluations, Penny decides that some elements of her strategy helped her to improve her shooting (such as the use of trigger words) and these should be maintained. Some elements were not as beneficial at this stage, such as positive cue words, and therefore should be modified. She is able to support her recommendations with primary data presented in her evaluation of the strategy synthesised with secondary data from textbooks, websites and journal articles.

Section 2 – Demonstrating and Applying

The second section of your Project – folio requires you to collect video footage of your practical performance in your selected physical activity as evidence of your demonstrating and applying ability. Specifically, your video will be up to 3 minutes in length and will need to show evidence of your demonstration of two movement strategies from two principles of play. Do not exceed the 3-minute time limit as any content included after 3 minutes will not be counted in the awarding of your grade.

Demonstration footage must show you applying these strategies in authentic performance environments, i.e. showing performance within gameplay. While it is a highlights reel of your best performances, to be considered effective, your footage must show the full picture of your performance rather than repeated little snippets within rallies or gameplay.

Finally, your video must include demonstration of quality of movement concepts (speed, accuracy, force, flow and so on) and one other body and movement concept such as body awareness, space awareness or relationships. These body and movement concepts are discussed in detail earlier in this course (see Module 2 Motor learning, page 28).

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MODULE 4

Lesson 4.21
Review: Sport psychology

Summary

4.1
- Sport psychology is a field of science that studies how an athlete's mental processes influence their participation and performance in sport and physical activity.
- Sport psychology aims to assist athletes to improve performance and achieve optimum mental health.

4.2
- Motivation refers to the drive we have to behave in a particular way to achieve our goals.
- There are two types of motivation: intrinsic and extrinsic.

4.3
- Confidence is the belief that a person can have faith in (or rely on) themselves, someone or something.
- Internal factors affecting an athlete's overall level of confidence include: self-confidence, self-belief and self-efficacy.

4.4
- Arousal is a feeling of mental and physical alertness or excitement.
- There are several key stages on the arousal continuum, which include relaxed drowsiness, joy and exhilaration, and panic and rage.

4.6
- Attention is the ability of an athlete to respond to specific internal and external stimuli during training and competition.
- Concentration is the everyday term used to describe how a person focuses their mental energy.

4.7
- Team dynamics describes the relationships between all the different members of a group.
- Team cohesion is the extent to which individual members of a team can work together as a unified whole.
- There are four distinct stages teams go through to reach cohesion: forming, storming, norming and performing.

4.9
- Athletes use a variety of psychological techniques to optimise performance.
- Psychological techniques can be used before, during and after performances.

4.10
- Goal setting is used to identify what you want to achieve and to establish measures to track progress.
- There are three types of goals that can be used to optimise performance: outcome goals, performance goals and process goals.
- The SMARTER principle is a popular technique for developing realistic and achievable goals.

4.11
- Mental rehearsal is a psychological technique that includes mental rehearsal of the entire performance, visualisation of one aspect of skill execution, and internal and external perspectives of imagery.
- Mental rehearsal techniques help athletes to develop skills, reduce anxiety, increase confidence and concentration, and optimise performance.

4.13
- Positive self-talk can increase feelings of confidence and motivation, improve arousal and concentration, and optimise performance.
- Positive self-talk techniques include positive cue words and positive emotions.

4.14
- Self-confidence techniques aim to optimise feelings of confidence during performance.
- Self-confidence techniques involve using affirmations to address thoughts, emotions and reactions that undermine confidence and performance.

4.15
- Pre-performance techniques are sequences of actions and/or thoughts (performed in order) that an athlete follows just prior to the performance of a task.
- Pre-performance techniques aim to optimise performance and include routines and checklists, and mental rehearsal.

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4.17
- Relaxation and energiser techniques are used to optimise arousal levels prior to performance.
- Relaxation and energiser techniques include meditation, progressive muscle relaxation (PMR), deep breathing, music and visualisation.

4.18
- Attention and concentration techniques aim to improve athletes' focus during their performance.
- Selective attention, using trigger words, performance segmenting, pre-performance routines and within-competition routines are psychological techniques designed to improve attention and concentration within performance.

4.19
- Team dynamics and cohesion techniques help the individual members of a team develop strong relationships, establish clear roles and expectations, and maintain high levels of communication so that they can work together.
- Leadership, communication, norms, rules and discipline are all techniques to develop team dynamics and cohesion.

Revision notes: Module 4

Module 4 summary

Review questions 4.21 Exam-style revision questions and tasks

Section A

- Ten multiple-choice questions

Question 1

The main objective of sport psychology is:

A to positively affect an opponent's performance.
B to increase the chance of optimum performance.
C to assist athletes to achieve optimum mental health and improve performance.
D to assist athletes to achieve optimum mental health and guarantee optimum performance.

Question 2

Motivation is:

A a general desire, need or want that drives a person to behave in a particular way.
B a belief that a person can have faith in (or rely on) themselves, someone or something.
C the level of focus and attentiveness a person dedicates to a task or stimulus.
D the relationships between members of a group of people (who are working together to achieve a common goal).

Question 3

Arousal is:

A a general desire, need or want that drives a person to behave in a particular way.
B a belief that a person can have faith in (or rely on) themselves, someone or something.
C the level of focus and attentiveness a person dedicates to a task or stimulus.
D the relationships between members of a group of people (who are working together to achieve a common goal).

Question 4

Which of the following cannot be categorised as a type of goal?

A Outcome
B Performance
C Achievement
D Process

Question 5

Extrinsic motivation is:

A a type of motivation driven by internal factors.
B a type of motivation driven by external factors.
C a type of amotivation.
D at the lower end of the motivation continuum.

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Question 6

In addition to an athlete feeling that they can rely on other people or other things, their confidence is made up of which three factors?

A Self-confidence, self-belief and self-respect
B Self-confidence, self-belief and self-efficacy
C Self-belief, self-efficacy and self-esteem
D Self-belief, self-efficacy and resilience

Question 7

Progressive muscle relaxation (PMR) is a popular technique used by athletes to:

A reduce respiration, core body temperature, perspiration and negative thoughts.
B reduce respiration, core body temperature, perspiration and positive thoughts.
C reduce respiration, blood pressure, muscle tension and core body temperature.
D reduce respiration, blood pressure, muscle tension and negative thoughts.

Question 8

According to Nideffer's Attentional Model, attention exists in two dimensions:

A direction and width.
B length and width.
C intrinsic and extrinsic.
D broad and narrow.

Question 9

_____ is the strategy that allows an athlete to maintain concentration and focus by breaking up a performance into manageable sections.

A Body movement segmenting
B Performance segmenting
C Progressive muscle relaxation
D Pre-task routines

Question 10

According to Tuckman's stages of group development, group norms should be developed during the _____ stage.

A forming
B storming
C norming
D performing

Section B

- Two short-response questions
- One extended written response question

Question 11 (13 marks)

Goal setting is a technique used to help athletes identify things they want to achieve and establish measures to monitor and track progress.

a Identify the three main types of goals and compare each one using examples to support your answer.
b The SMARTER principle is often used to help athletes generate effective goals. Write a goal that incorporates aspects included in the SMARTER principle.

Question 12 (4 marks)

During a match, a tennis player can be heard saying, "I love taking shots under pressure."

a Identify what psychological technique is being used here.
b Explain how this psychological technique is used by athletes to increase confidence and motivation and, ultimately, improve performance.

Question 13 (14 marks)

At the 2018 Commonwealth Games on the Gold Coast, Australian javelin thrower Kathryn Mitchell won her first gold medal. Mitchell had failed to earn a medal in three previous Commonwealth Games and the 2016 Rio Olympic Games.

After performing a throw of over 68 metres on her first attempt at the 2018 Commonwealth Games – the longest distance to be thrown by a woman in the sport in more than 5 years – Mitchell had this to say about her preparation:

> "I have worked a lot this season not to focus too much on results and more on the process. It has worked and it's a little bit unbelievable. If I put all distances out of my mind, I knew I could throw the Australian record eventually but said to myself, 'Just allow it to happen and it will come.' "

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Reflecting on her thoughts during the event, Mitchell said:

> "I just tried to concentrate on what I was doing, and I did that on the first throw. Then it was awfully distracting for me for the next three throws as I was trying to get calm again. It took quite a while to get the adrenalin down again because I need to be so relaxed and calm when I throw, so that was a challenge. Once I relaxed again I threw another 68."

Evaluate how Kathryn Mitchell's preparation for the 2018 Commonwealth Games affected her performance. In your response, refer to the stimulus provided and comment on the application of sport psychology concepts such as confidence, motivation, arousal, attention and concentration.



SOURCE 1 Australian javelin thrower Kathryn Mitchell

Practice assessment task

Subject	Physical Education
Instrument number	
Technique	Project – folio
Unit	2 Sport psychology and equity in physical activity
Topic	1 Sport psychology in physical activity

Conditions	
Duration	5 hours
Mode	Multimodal – at least two modes (visual, written, spoken)
Length	Up to 11 minutes
Individual / Group	Individual
Other	Examples of presentations include: • a pre-recorded presentation submitted digitally • a presentation conducted in front of an audience (class or teacher) • a digital portfolio of video, images and diagrams with annotations or commentary • a multimedia movie or slideshow that may combine images, video, sound, text and a narrative voice.

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Context

Throughout this topic, you have analysed your performance to identify areas of psychological concern within your selected physical activity. You have been applying and evaluating the effectiveness of various psychological techniques for optimising performance, including goal setting, mental rehearsal, positive self-talk, self-confidence techniques, pre-performance techniques, relaxation and energiser techniques, and attention and concentration techniques. Primary data was collected to evaluate the effectiveness of sport psychology techniques at optimising your performance.

Task

FOLIO:

For your selected physical activity, devise and justify a sport psychology strategy to optimise your performance of specialised movement sequences for one movement strategy. To devise your strategy, you must investigate the psychological techniques that have the greatest capacity to improve your areas of psychological need. Appraise the outcomes and limitations of the psychological techniques and the impact on your areas of need. Justify the maintenance and modification of your strategy using primary and secondary data to support your recommendations to optimise your performance within your selected physical activity.

SUPPORTING EVIDENCE:

Supply up to 3 minutes of visual evidence of your performance in your physical activity. Specifically, your footage must demonstrate quality of movement criteria and criteria from one other body and movement concept through your performance of specialised movement sequences and two movement strategies from two different principles of play.

To complete this task, you must

FOLIO:

- Analyse primary data and secondary data to ascertain the most significant relationships between the:
  - demands of the specialised movement sequences for one movement strategy
  - impact of motivation, confidence, arousal, attention, concentration and team dynamics (as applicable) on personal or team performance of the specialised movement sequences for one movement strategy
  - application of the psychological techniques when performing specialised movement sequences for one movement strategy.
- Synthesise the most significant relationships to devise a sport psychology strategy to optimise performance for one movement strategy.
- Justify the development of the sport psychology strategy for one movement strategy to optimise performance, using evidence from primary data and secondary data.
- Evaluate the effectiveness of the sport psychology strategy by appraising the outcome and limitations of the:
  - applied psychological techniques
  - impact on motivation, confidence, arousal, attention, concentration and team dynamics (as applicable).
- Justify the modification and maintenance of the sport psychology strategy for one movement strategy to optimise performance, using evidence from primary data and secondary data.
- Make decisions about and use language, conventions and mode-appropriate features to communicate information about the strategies to a technical audience.

SUPPORTING EVIDENCE:

- Perform in your selected physical activity authentic environments to:
  - demonstrate specialised movement sequences and two movement strategies from two different principles of play
  - apply the quality of movement body and movement concept and one other body and movement concept to specialised movement sequences two movement strategies.

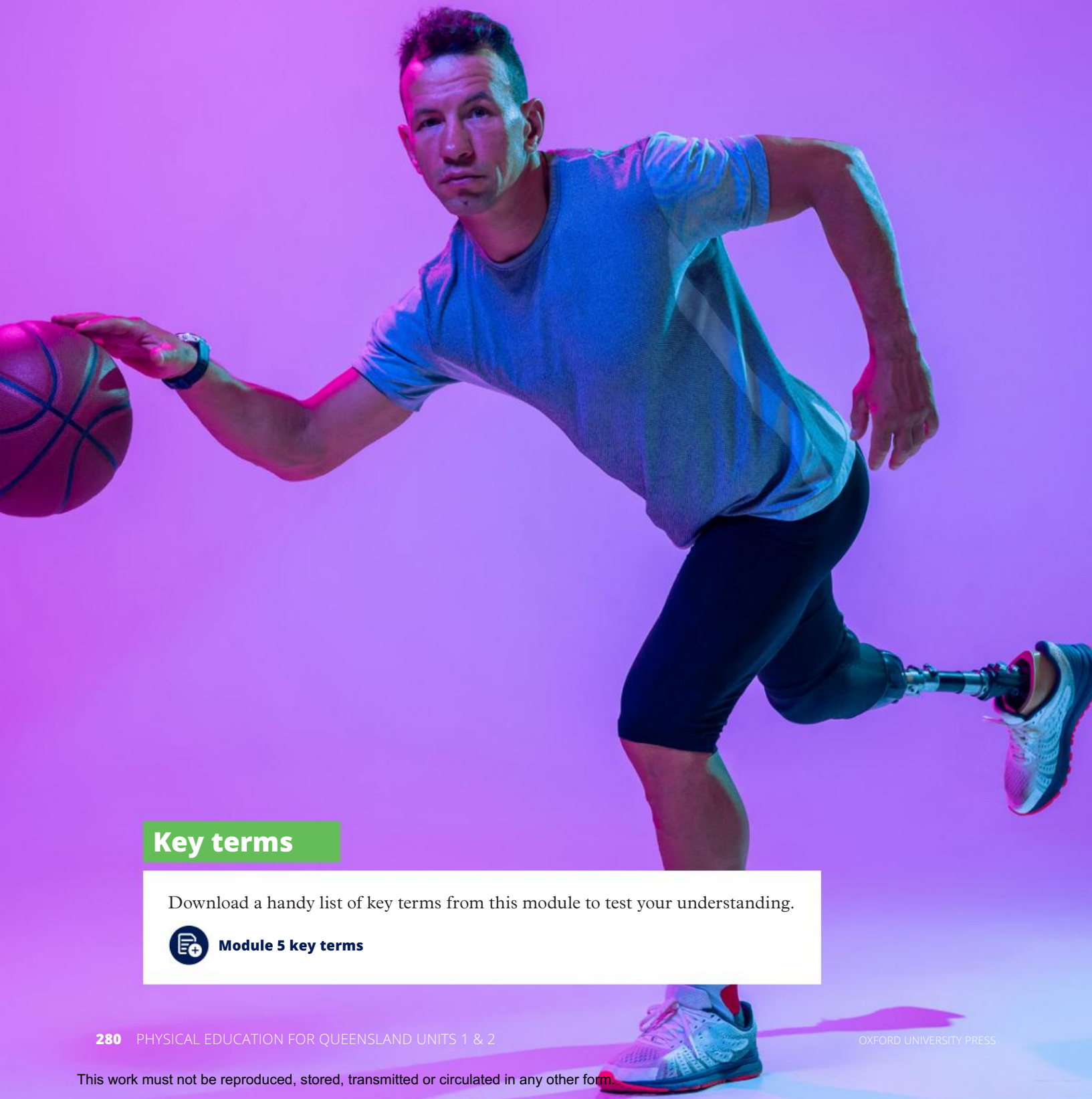
A detailed instrument-specific marking guide (ISMG) for this task is available for teachers to download.

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MODULE 5

Equity – Barriers and enablers



Key terms

Download a handy list of key terms from this module to test your understanding.

Module 5 key terms

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Subject matter outcomes covered in Module 5

The following table lists all the subject matter dot points you are required to cover in **Unit 2 – Topic 2** of the Physical Education General Senior Syllabus. It also shows you exactly where that subject matter is provided in this course.

Unit 2 – Topic 2: Equity – barriers and enablers

In Unit 2 – Topic 2, students engage in learning about equity in physical activity, and explore barriers and enablers to gather data about the influence on equity.

Subject matter	Lesson/s
• Recognise and explain that equity is concerned with giving value to, and celebrating, personal, social and cultural differences in society.	Lesson 5.1 Introduction to equity in physical activity (page 284)
• Recognise and explain that access includes the opportunity to participate in physical activity.	
• Identify and explore how equity and access interact and impact engagement in physical activity.	
• Recognise and explain that barriers are personal, social, cultural and environmental factors that limit access to personal, social and community resources.	
• Recognise and explain that enablers are personal, social, cultural and environmental factors that increase access to personal, social and community resources.	
• Analyse and synthesise primary data and secondary data about access, equity and engagement in physical activity contexts.	Lesson 5.2 Skill drill: Implement an equity strategy in your PE class (page 290) Lesson 5.14 Skill drill: Investigate the impact of the social construction of gender (page 323) Lesson 5.16 Skill drill: Analyse the role of social factors on access (page 330)
• Identify relationships between personal, social, cultural and environmental factors, including: – personal factors, e.g. enabling choice of activities to suit personal preference; acknowledging personal attitudes, values and beliefs – social factors, e.g. grouping and team selection, performance environment modifications, manipulation of rules and constraints in physical activity – cultural factors, e.g. community promotion and engagement related to physical activity, media and marketing strategies, rules, policies and procedures, risk assessment within a school context – environmental factors, e.g. active travel, planning of walkways and cycleways, design of green public spaces.	
• Identify and explore information about personal factors acting as barriers and enablers for self or others to influence equity and access, including: – motivation.	Lesson 5.3 Personal factors that influence equity and access (page 292) Lesson 5.4 Personal factors that influence equity and access: Motivation (page 293)
• Identify and explore information about personal factors acting as barriers and enablers for self or others to influence equity and access, including: – confidence.	Lesson 5.5 Personal factors that influence equity and access: Confidence (page 296)
• Identify and explore information about personal factors acting as barriers and enablers for self or others to influence equity and access, including: – personality traits, e.g. enjoyment, temperament or preference, self-esteem and self-concept.	Lesson 5.6 Personal factors that influence equity and access: Personality traits (page 299)

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Subject matter	Lesson/s
• Identify and explore information about personal factors acting as barriers and enablers for self or others to influence equity and access, including: – personal ability.	Lesson 5.7 Personal factors that influence equity and access: Personal ability (page 302)
• Identify and explore information about personal factors acting as barriers and enablers for self or others to influence equity and access, including: – genetic disposition.	Lesson 5.8 Personal factors that influence equity and access: Genetic disposition (page 305)
• Identify and explore information about personal factors acting as barriers and enablers for self or others to influence equity and access, including: – gender.	Lesson 5.9 Personal factors that influence equity and access: Gender (page 308)
• Identify and explore information about personal factors acting as barriers and enablers for self or others to influence equity and access, including: – previous experiences of physical activity.	Lesson 5.10 Personal factors that influence equity and access: Previous experiences of physical activity (page 311)
• Identify and explore information about social factors acting as barriers and enablers for self or others to influence equity and access, including: – agents of socialisation	Lesson 5.11 Social factors that influence equity and access (page 313) Lesson 5.12 Social factors that influence equity and access: Agents of socialisation (page 314)
• Identify and explore information about social factors acting as barriers and enablers for self or others to influence equity and access, including: – siblings, peers, parents, teachers and coaches.	Lesson 5.12 Social factors that influence equity and access: Agents of socialisation (page 314)
• Identify and explore information about social factors acting as barriers and enablers for self or others to influence equity and access, including: – the social construction of gender.	Lesson 5.13 Social factors that influence equity and access: The social construction of gender (page 320)
• Identify and explore information about social factors acting as barriers and enablers for self or others to influence equity and access, including: – diversity.	Lesson 5.15 Social factors that influence equity and access: Diversity (page 325)
• Identify and explore information about social factors acting as barriers and enablers for self or others to influence equity and access, including: – physical activity preferences.	Lesson 5.17 Social factors that influence equity and access: Physical activity preferences (page 332)
• Identify and explore information about cultural factors acting as barriers and enablers to influence equity and access, including: – demographic, generational and cultural change.	Lesson 5.18 Cultural factors that influence equity and access (page 334) Lesson 5.19 Cultural factors that influence equity and access: Demographic, generational and cultural change (page 335)
• Identify and explore information about cultural factors acting as barriers and enablers to influence equity and access, including: – the role of government funding.	Lesson 5.20 Cultural factors that influence equity and access: Government funding (page 341)
• Identify and explore information about cultural factors acting as barriers and enablers to influence equity and access, including: – mass media promotion and marketing of physical activity.	Lesson 5.21 Cultural factors that influence equity and access: Mass media promotion and marketing of physical activity (page 344)
• Identify and explore information about cultural factors acting as barriers and enablers to influence equity and access, including: – institutional rules, policies and procedures.	Lesson 5.22 Cultural factors that influence equity and access: Institutional rules, policies and procedures (page 349)

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Subject matter	Lesson/s
• Identify and explore information about environmental factors acting as barriers and enablers to influence equity and access, including built and natural environments, green space.	Lesson 5.23 Environmental factors that influence equity and access (page 354) Lesson 5.24 Environmental factors that influence equity and access: Built and natural environments (page 355) Lesson 5.25 Environmental factors that influence equity and access: Green space (page 357)
• Investigate the emerging megatrends in Australia of "being physically active", including: – personalised sport for health and fitness	Lesson 5.26 Emerging megatrends in physical activity in Australia (page 359)
• Investigate the emerging megatrends in Australia of "being physically active", including: – the rise of lifestyle sports.	
• Investigate the emerging megatrends in Australia of "being physically active", including: – demographic, generational and cultural change.	
• Investigate the emerging megatrends in Australia of "being physically active", including: – the attainment of health and community objectives via physical activity.	
• Identify and explore how the emerging megatrends may interact as barriers or enablers to influence personal, social, cultural and environmental factors related to engagement in physical activity.	
• Gather primary data about the influence of equity and access concepts and principles, including personal, social, cultural and environmental factors acting as barriers and enablers, on engagement in physical activity.	Lesson 5.2 Skill drill: Implement an equity strategy in your PE class (page 290) Lesson 5.14 Skill drill: Investigate the impact of the social construction of gender (page 323) Lesson 5.16 Skill drill: Analyse the role of social factors on access (page 330)
• Use secondary data to analyse how equity and access concepts and principles influence engagement in physical activity.	Module 5
• Analyse primary data and secondary data to identify relationships between the equity strategies and engagement in a physical activity contexts	Lesson 5.2 Skill drill: Implement an equity strategy in your PE class (page 290) Lesson 5.14 Skill drill: Investigate the impact of the social construction of gender (page 323) Lesson 5.16 Skill drill: Analyse the role of social factors on access (page 330) Lesson 5.28 Review: Equity – barriers and enablers Practice assessment task (page 370)
• Devise equity strategies to influence personal, social, cultural and environmental factors in a physical activity context, e.g. event or tournament, come-and-try session or group participation activity.	
• Justify the development of the equity strategies using evidence from primary data and secondary data.	
• Implement equity strategies to gather primary data about the outcomes and limitations of decisions.	
• Reflect on primary data and secondary data to evaluate the effectiveness of the equity strategies to achieve a determined outcome.	
• Make decisions to maintain or modify the equity strategies to optimise engagement in physical activity contexts.	
• Justify maintenance or modification of the equity strategies using evidence from primary data and secondary data.	

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Lesson 5.1
Introduction to equity in physical activity

Learning intentions and success criteria

Key ideas

- → Equity is a concept that relates to fairness and justice in the way all people are treated. It means striving for fairness and justice by treating people differently (based on their individual needs and personal differences).
- → Access is the opportunity a person is given to participate.
- → Barriers are factors that decrease access to the resources people need for sport and physical activity.
- → Enablers are factors that increase access to the resources people need for sport and physical activity.

The concept of equity

equity a concept that relates to fairness and justice in the way all people are treated; equity means striving for fairness and justice by treating people differently (based on their individual needs and personal differences)

In simple terms, **equity** is a concept that relates to fairness and justice in the way all people are treated. Equity means acknowledging that all people are different and taking these individual differences into account when allocating resources and providing opportunities for them.

When it comes to sport and physical activity, equity is more than just treating people fairly and acknowledging their differences. It involves celebrating personal, social and cultural differences in all aspects of sport – from the athletes themselves through to spectators, coaches, training staff and management. Respecting these differences means keeping an open mind about the kinds of rules, values, beliefs and behaviours that govern different sports and not regarding these as superior to the rules, values, beliefs and behaviours of people from other groups, communities or countries.

Achieving equity in sport is not always as simple as giving people access to the same resources (such as a ball to play soccer or access to a swimming pool to go swimming). Instead, equity requires you to consider a person's personal differences, experiences and circumstances and to support them (possibly in very different ways) to reach the same outcome. Having access to a swimming pool, for example, is not adequate for a person who has never learnt to swim, fears water or is unable to wear traditional swimming attire.

equality a concept that relates to being equal in terms of status, rights or opportunities; equality means striving for fairness and justice by treating people the same (regardless of their personal differences)

In everyday conversation, it is very common to hear the word "equity" being used interchangeably with terms such as **equality**, equal opportunity and social inclusion. While all these concepts might share some common characteristics, they are different in many ways.

One of the best ways to clearly understand the concept of equity is to explore the similarities and differences between equity and equality. As shown in Source 1:

- equality is about **sameness** – this means striving for fairness and justice by treating everyone the same. In Source 1, equality is achieved by giving each person the same bicycle.
- equity is about **fairness** – this means striving for fairness and justice by treating people differently (based on their individual needs and personal differences). In Source 1, equity is achieved giving each person a different bicycle (designed to meet their specific needs).

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In this module, we will focus on the concept of equity rather than equality. We will also explore the idea of inequity, which is where the needs of an individual have not been met; this is also known as an equity issue. In this module, when an equity issue exists, we will refer to it as an equity dilemma.



SOURCE 1 Equity aims to achieve fairness and justice in the way all people are treated by acknowledging their individual needs and personal differences. One of the best ways to clearly understand the concept of equity is to compare it with the concept of equality.

The concept of access

Access is central to the concept of equity. In the context of sport and physical activity, access is important in ensuring individuals have the opportunity to:

- use something (e.g. a piece of sporting equipment or sporting facilities)
- participate in something (e.g. take part in a game, become a member of a club or sporting team).

It is important at this point to understand the difference between participation and engagement. Participation is the simple act of taking part in something, such as showing up for practice. Engagement, on the other hand, goes beyond just being physically present. It involves a deeper level of involvement, interest and connection. While access enables participation, the interaction between equity and access is what enables engagement.

For individuals to enjoy the full range of benefits available to them through sports, it is important that they not only participate but also engage positively. When participants are not able to engage positively in sport and physical activity, this is an **equity dilemma**.

access the opportunity a person is given to make use of something or take part in something; in a sporting context, access refers to the ways in which different institutions (e.g. schools, sporting clubs, organisations and governments) make sure that all people have the same opportunities to participate in sports and activities of their choice

equity dilemma a situation that devalues or diminishes personal, social and cultural differences in society, especially as they relate to physical activity

Factors that act as barriers and enablers

There are a whole range of factors that influence people's access and engagement in sport and physical activity. These include:

- personal factors (such as motivation, confidence, personality traits, personal ability, genetic disposition, gender, previous experiences of physical activity)
- social factors (such as agents of socialisation, social construction of gender, diversity, physical activity preferences)

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- cultural factors (such as demographic, generational and cultural change; government funding; mass media promotion and marketing of physical activity; and institutional rules, policies and procedures)
- environmental factors (such as built and natural environments and green space).

barriers factors that decrease access to resources; barriers discourage or prevent a person from participating in a sport or physical activity (e.g. poor health, high cost of equipment, lack of motivation)

All these factors are commonly grouped into two categories according to whether they increase or limit access:

- **barriers** – factors that limit access to physical activity and associated benefits. For example, height is a genetic factor that can act as a barrier to playing organised sports such as basketball, which has many benefits, such as socialising.
- **enablers** – factors that increase access to physical activity and associated benefits. For example, confidence is a personal factor that can act as an enabler to high-risk sports such as horse racing, which has the benefit of released endorphins and associated good feelings.





SOURCE 2 A person's height may act as an enabler in the sports of horse racing and basketball.

enablers factors that increase access to resources; enablers encourage or support a person to participate in a sport or physical activity (e.g. closeness to sporting facilities, encouragement from parents and teachers, having friends on the team)

The benefits of engagement with physical activity

Sport is considered by many to be an essential part of the national identity of Australians. It often unites us as a country and provides resources for individuals to maintain good health and to thrive in their everyday lives. There are three categories of such resources.

- **Personal resources:** the tools and abilities you have within yourself, such as your skills, knowledge, talents and even your physical and mental health. You can draw on these things to navigate life's challenges and reach your goals.
- **Social resources:** the connections and support you get from the people around you, including family, friends, teammates, mentors and coaches. These people can offer emotional support, practical help, advice and even new opportunities.
- **Community resources:** the services and programs available in your local area, which include schools, recreational facilities, sporting clubs, programs and services, and affiliated organisations. These resources can provide you with education and training, financial and health care assistance, pathways to further opportunities or simply a place to connect with others.

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Individuals can access these resources through engagement in physical activity. When barriers prevent an individual from gaining access to physical activity, they miss out on the opportunity to access many beneficial resources. This is an issue of equity, or an equity dilemma.

Personal	Social	Community
• Skills • Knowledge • Talents • Physical health • Mental heath	• Family • Friends • Teammates • Mentors • Coaches	• Schools • Recreational facilities • Sporting clubs • Programs and services • Affiliated organisations

SOURCE 3 Examples of personal, social and community resources for equity and access in the context of physical activity and sport

Equity and access in physical activity

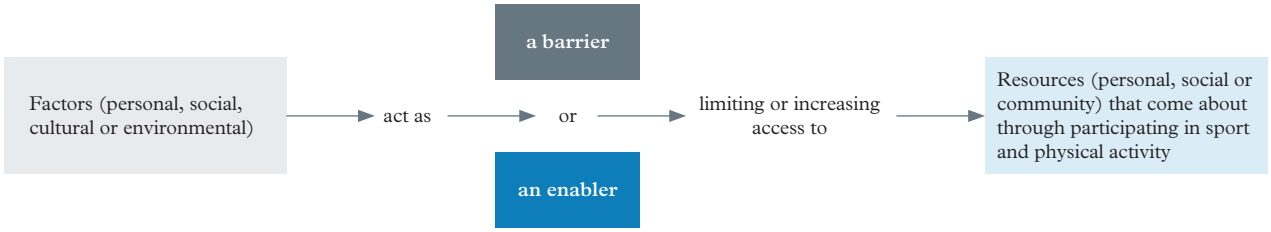
So far in this lesson, we have explored key concepts individually. Source 4 brings these concepts together and provides an example of each to illustrate the concepts in action.

Concept	Example
We understand that the benefits of physical activity are vast. Access is about individuals having the opportunity to enter the pathway to these benefits. That is, to allow them the chance to participate in physical activity so that these benefits may be possible.	Imagine a group of friends going to the beach for a day of swimming and fun. If all group members have permission to go, the means to be transported to the beach, and it is not closed due to an event or unforeseen circumstances or risk, it can be said that they have access to this activity.
Equity is about ensuring the pathway for individuals to enjoy these benefits is fair. It involves the acknowledgment of individual needs and differences and the removal of any challenges or obstacles.	The group possess a range of skill and comfort levels in open water. An equitable scenario involves all friends feeling like there is nothing stopping them from joining in and enjoying the activity. For instance, they have comfortable and preferred attire, the weaker swimmers are suitably supported by friends or aided by equipment, and the group agrees to stay close enough to the shore so that everyone feels safe.
In physical activity, equity and access work together to create engagement. This means actively enjoying the experience and getting the most out of the sport or physical activity.	Equitable access for all members of this group means that they are enjoying all elements of this activity. Equity and access is enhanced by the active supervision of lifeguards and designated safe swimming areas.
Several factors can influence access and engagement by acting as either barriers or enablers. These factors are categorised as personal, social, cultural and environmental.	Enabling factors (enablers) for the swimmers include confidence (personal), encouraging friends (social), affordable public transport (cultural) and a clean, unpolluted beach (environmental). Limiting factors (barriers) for the swimmers could have included a negative past experience of beach swimming (personal), nervous parents (social), recent media stories of shark attacks (cultural) and dangerous beach conditions (environmental).
By understanding these factors and removing barriers, or knowing how to increase the influence of enabling factors, we can create a more equitable environment where participants can unlock the resources available through participation in sports and physical activity. As we have learned, these resources are organised into three categories: personal, social and community resources.	Through all of the enabling factors above, many resources can be unlocked for these swimmers that will not only optimise their positive engagement now but also in the future. The available resources for these swimmers now include an increased knowledge of effective beach swimming techniques (personal), friends as positive mentors (social) and the possibility for more formalised programs, such as Nippers or Little Lifesavers (community).

SOURCE 4 The concepts of equity and access in physical activity

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SOURCE 5 Personal, social, cultural and environmental factors act as barriers or enablers to personal, social and community resources.

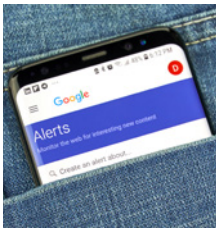
Retrieve it!

Use a sporting example to explain the difference between equity and equality. Check back earlier in this lesson to see if you retrieved the information correctly.

Study tip

Equity in sport and physical activity is a controversial subject that is often in the news. Setting up automatic alerts – via Google Alerts – is a great way of keeping up to date with current stories and developments.

To set up an automatic alert, just enter the keywords you want to search for (e.g. equity in sport; access to sport) and type in your email address. You will receive regular updates on anything you're interested in. Best of all, it is free!





SOURCE 6 The burkini – a type of swimsuit designed to cover the whole body except for the face, hands and feet – is an example of an enabler for Muslim women who adhere to the religious requirement to dress modestly in public. It was designed to remove a barrier to equity and access for Muslim women wishing to swim at the beach and in public swimming pools.

Weblink: Google Alerts

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Check your learning 5.1

Check your learning 5.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Equity can best be defined as:
   - **A** treating everyone exactly the same, regardless of their individual needs or circumstances.
   - **B** giving everyone the same resources so that they can succeed.
   - **C** judging people based on their personal opinions and beliefs.
   - **D** treating people differently (based on their individual needs and personal differences).

2 Choose the correct answer. The influence of friends, family members or the wider community to improve a person's access to physical activity are classified as:
   - **A** personal factors.
   - **B** social factors.
   - **C** cultural factors.
   - **D** environmental factors.

3 **Explain** the relationship between access and equity.

4 **Explain** how a barrier for one person might be an enabler for another, and vice versa.

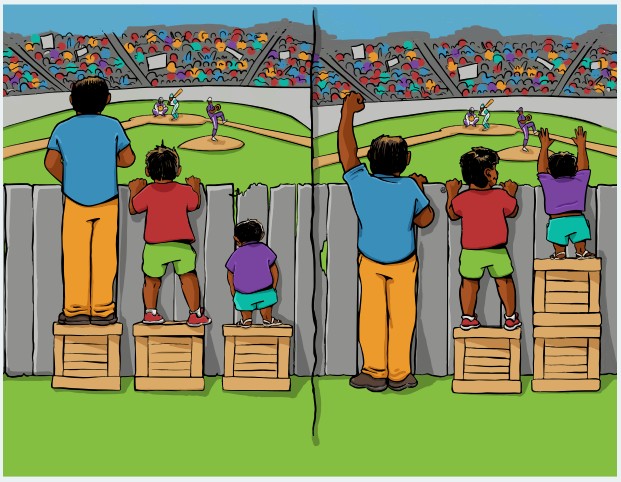
Analytical processes

5 **Analyse** Source 7. **Explain** how it demonstrates the differences between equity and equality.

Knowledge utilisation

6 "When we celebrate diversity, all members of society are included and valued." **Assess** the degree to which your school's sports program supports this statement in a written response of 150 words.

7 **Use** the Australian Sports Commission, Clearinghouse for Sport or AusPlay websites (links are provided) to find five data points (facts, statistics or pieces of information) that highlight Australians' relationship with sport and physical actvity.



SOURCE 7 The terms "equality" (as demonstrated on the left) and "equity" (as demonstrated on the right) are often used interchangeably, but they are not the same thing.

Weblink: Australian Sports Commission

Weblink: Clearinghouse for Sport

Weblink: AusPlay

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SKILL DRILL

Lesson 5.2
Implement an equity strategy in your PE class

Aim

To implement an equity strategy and consider its outcomes, implications and limitations

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks

Equipment

- Football
- Bibs
- Game Performance Assessment Instrument 11 (GPAI 11)
- Pen

Template: Game Performance Assessment Instrument 11 (GPAI 11)

Method

Step 1

Your teacher will divide the class into two teams and you will play a short game of touch football. Experienced and inexperienced players will be spread across the two teams

Before play begins, all students who feel that they are experienced (i.e. competent) in touch football should identify themselves and wear a bib.

Students who feel inexperienced (i.e. unfamiliar or unsure) about playing touch football should identify themselves and not wear a bib.

Step 2

Play for 10 minutes.

Step 3

Complete the Condition 1 column on GPAI 11. In each row, rank your performance engagement on a scale of 1 to 4 (1 being very low and 4 being high). As you complete this column, discuss the equity of the game with your team (i.e. did each team member have equal possession of the ball in the rucking and transition phase? Did each team member have equal possession of the ball in the attacking zone?). Note your observations in the general comments section on GPAI 11.

Step 4

Now play for another 10 minutes, implementing the following equity strategy:

All inexperienced players are immune from being touched when they are within 10 metres of the try line (i.e. in the attacking zone).

Step 5

Complete Column 2 of GPAI 11. As you complete this column, discuss the equity of the game with your team. Note your observations in the general comments section of GPAI 11.

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	Condition 1 Experienced				Condition 1 Inexperienced				Condition 2 Experienced				Condition 2 Inexperienced			
Participation (time on the field)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Ball possession in the rucking and transition phase	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Ball possession in the attacking zone (within 10 metres of try line)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Overall performance (success when handling the ball)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
General comments:																

SOURCE 1 GPAI 11

Analysis and discussion tasks

1 **Analyse** the differences for your class between the regular and modified game (i.e. when the equity strategy was in play).
   - **a** Was there a difference in ball possession? **Explain** your answer, making explicit reference to GPAI 11 and the discussions with your team during the games.
   - **b** Was there a difference in performance? **Explain** your answer using examples from the games.

2 **Reflect on** the equity strategy to draw conclusions about whether the game was truly equitable. **Explore** the outcomes and limitations of the equity strategy. In forming your conclusion, **consider** the following definitions:
   - equity: striving for fairness and justice by recognising people's individual needs and personal differences
   - equality: the same rights, resources, conditions and opportunities available to all
   - social inclusion: access to the resources, opportunities and capabilities to learn, work, engage and have a voice.

3 The aim of this Skill drill is to achieve equity through modifying just one rule, but achieving equity is very complex. Suggest modifications to the exercise in a 250-word response, using secondary sources to substantiate your claims.



SOURCE 2 In this Skill drill, players of varying experience reflect on an equity strategy that is implemented halfway through the game

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Lesson 5.3
Personal factors that influence equity and access

Learning intentions and success criteria

Key ideas

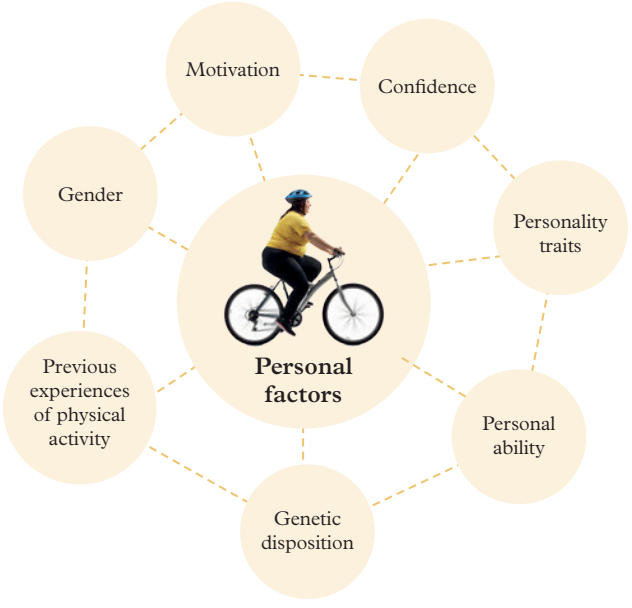
→ Personal factors are a range of influences at an individual level that act as both barriers and enablers to equity and access in sport and physical activity.

What personal factors act as barriers and enablers?

personal factors a range of influences at an individual level that can act as barriers or enablers to participation in sport and physical activities (e.g. age, personality traits, personal ability, gender, past experiences)

There are many **personal factors** that act as barriers and enablers to equity and access in sport and physical activity. Personal factors include a whole range of influences at an individual level (e.g. a person's likes and dislikes, personality type, thoughts, feelings and past experiences). Some of the most important personal factors that influence access include:

- **motivation** – the drive or willingness a person has to do something
- **confidence** – the belief a person has in their own abilities
- **personality traits** – the range of personal qualities and characteristics that a person possesses, such as enjoyment, temperament or preference, self-esteem and self-concept
- **personal ability** – the level of talent, skill or proficiency a person has
- **genetic disposition** – the range of biological qualities and characteristics that a person possesses (that make them more or less suited to a particular activity)
- **gender** – the state of being male or female (more typically used with reference to social and cultural differences rather than biological ones)
- **previous experiences of physical activity** – the level of exposure and practice that an individual has had with a particular activity.



In the lessons that follow, we will look at each of these factors in detail and examine how they act as barriers and enablers to sport and physical activities and, therefore, affect access to personal, social and community resources for different people. Although we will be learning about each factor separately, it is important to keep in mind that – in reality – these personal factors are acting on us (i.e. affecting our decisions and behaviours) simultaneously. They also affect each other; for example, a person's perception that they are not talented at a particular physical activity can lower their confidence and reduce their motivation to try. Not only that, but also social, cultural and environmental factors all contribute to the personal factors we experience.

SOURCE 1 A range of different personal factors play a role in an individual's access to the available personal, social and community resources found in sport and physical activity participation.

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Lesson 5.4
Personal factors that influence equity and access: Motivation

Key ideas

→ Motivation refers to the drive we have to behave in a particular way to achieve our goals.

→ Motivation is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

Learning intentions and success criteria

What is motivation?

Motivation is the drive or willingness a person has that causes them to act or behave in a particular way. It is one of the key personal factors affecting equity and access in sport and physical activity. The level of motivation to perform a particular task varies from person to person depending on the situation and priorities. As discussed in detail in Lesson 4.2 Motivation (page 212), one theory used for understanding what motivates people to participate in sport and physical activity is **self-determination theory (SDT)**. According to SDT, an individual's motivation sits on a continuum (see Source 1) from **amotivation**, through **extrinsic motivation** to **intrinsic motivation**:

- When self-determination sits at the low end of the continuum, a person displays a total absence of motivation, known as amotivation.
- Moving through extrinsic motivation, self-determination increases as the athlete gets past externally controlled forms of motivation and begins to internalise and integrate the external factors motivating their participation and performance.
- At the other end of the continuum, a person displays a high level of self-determined motivation driven mainly by internal factors (such as personal satisfaction and enjoyment) – known as intrinsic motivation.

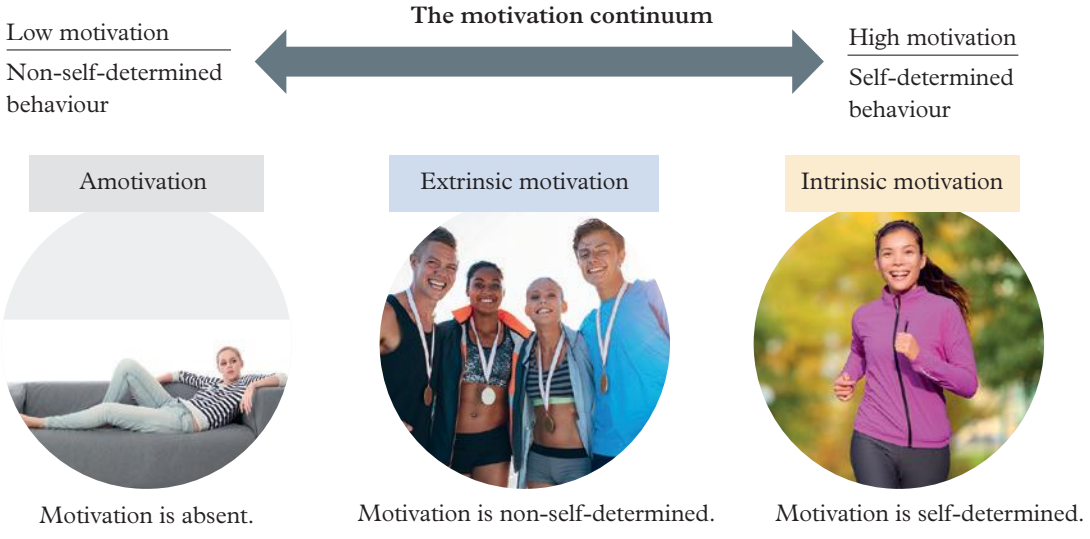
motivation a desire, need or want that causes a person to behave in a particular way

self-determination theory (SDT) a theoretical framework used to analyse human behaviour and explain what motivates people

amotivation the total absence of motivation

extrinsic motivation a type of motivation driven by external factors (i.e. factors that come from outside a person) such as money and fame

intrinsic motivation a type of motivation driven by internal factors (i.e. factors that come from inside a person) such as fun, enjoyment and personal satisfaction



SOURCE 1 According to self-determination theory, an individual's motivation sits on a continuum from amotivation to intrinsic motivation based on how self-determined the motivation is.

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Motivation as a barrier and enabler

Motivation plays a significant role in people's decisions to participate in sport and physical activity. As shown in Source 1, some people have no desire at all to participate in physical activity, while others are highly motivated to engage in a wide range of different sports and make it the focus of their daily lives.

People who are self-driven to participate in physical activity sit at the intrinsic end of the continuum. Intrinsic motivation acts as a significant enabler to participation for these people – they have a strong intrinsic drive to be physically active because they enjoy it and gain personal satisfaction from it. The motivation they have to participate is therefore an enabler that increases their access to resources such as the personal resource of fitness.

People who lack all motivation to participate in physical activity are said to be "amotivated". Amotivation acts as a significant barrier to participation – these people see no point in participating and do not see any potential value in it. They may participate in physical activity on the odd occasion, but generally this will be motivated by an external factor (e.g. a compulsory event at school or work), and engagement is limited. The lack of motivation they experience acts as a significant barrier to an individual's ability to access personal, social and community resources. For example, having low motivation affects an individual's access to the personal resource of fitness, the social resource of mentors/coaches, and the community resource of programs and services. This could have a negative impact on their ability to function effectively and is, therefore, an equity dilemma.

People in the middle of the motivation continuum represent the largest group. They sit somewhere in between amotivation and intrinsic motivation when it comes to their engagement with sport and physical activity. These people are generally motivated to participate in physical activity, but the source of that motivation varies based on a number of external factors. Some motivations, such as winning trophies, are more externally controlled than others, such as playing for fitness. This type of motivation can act as both a barrier and an enabler. External factors such as trophies, praise or punishment (from coaches and parents) can be strong extrinsic motivators for certain people initially, but they are not enough to sustain a person's motivation levels over longer periods of time.

Very few individuals remain at the same point on the continuum over time. Instead, most people move up and down the continuum based on a range of factors. For example, people who are intrinsically motivated can lose motivation at times. Social factors such as family or friendship breakdowns can influence motivation, as can environmental factors. For example, being at the beach and observing a large number of people walking or running along the beach can act as a source of motivation for some. Studies have shown a correlation between a drop in motivation to participate in physical activity rates and major life changes (such as starting a new job, periods of serious illness, graduating from high school or university, or moving to a new house). Being aware of this pattern can help individuals to put plans in place to maintain their motivation levels throughout times of change.

For the record!

In 2023, Josef Šálek from the Czech Republic performed the longest abdominal plank ever recorded. At a gruelling 9 hours, 38 minutes and 47 seconds, that effort would have required considerable motivation!

Retrieve it!

Name as many personal factors acting as barriers and enablers to equity and access in physical activity that you can think of. Check back to Lesson 5.3 Personal factors that influence equity and access (page 292) to see if you retrieved the information correctly.



SOURCE 2 Dylan Alcott is a former Australian wheelchair tennis and basketball player, radio host and motivational speaker. He competed successfully at an elite level by combining a range of extrinsic and intrinsic motivating factors.

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Check your learning 5.4

Check your learning 5.4: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which of the following factors would be considered an extrinsic motivator for physical activity?
   - **A** Enjoyment of the game
   - **B** The desire to master a skill
   - **C** Wanting to feel fitter
   - **D** Wanting to maintain a "streak" on an app

2 Choose the correct answer. Someone who is "amotivated":
   - **A** lacks all motivation to participate in physical activity.
   - **B** experiences difficulty engaging in physical activity due to physical limitations.
   - **C** prioritises other activities over physical activity.
   - **D** exercises less than they should.

3 **Define** motivation and **explain** how it can act both as a barrier and an enabler to accessing personal resources in sport and physical activity.

Analytical processes

Use the following scenarios to answer questions 4–6.

- Claudia is a 15-year-old girl who loves to participate in all kinds of physical activities, from rugby league to dance and swimming. She loves competing against her friends and has won the sports award at her school for the past two years. However, Claudia is concerned that her extracurricular activities are affecting her studies and her chance to win an academic scholarship.
- Salim is a 15-year-old boy who enjoys gaming and watching eSports. He particularly enjoys the team camaraderie he experiences when playing computer games. Salim thinks he would enjoy participating in team sports but is reluctant to try out because he has been teased in the past for being "nerdy".

4 **Compare** the personal factors that might be influencing Claudia and Salim's equity and access in sport by copying and completing this table:

Individual	Personal factors influencing their motivation
Claudia	
Salim	

5 **Analyse** the information provided and decide where Claudia and Salim would be positioned on the motivation continuum. **Justify** your decisions.

6 **Identify** two strategies that might increase Salim's motivation to participate in sport.

Knowledge utilisation

7 **Construct** an argument to support the idea that excessive praise from parents and coaches can be a barrier and therefore an equity dilemma for young athletes hoping to form a lifelong love of sport and physical activity. Use examples to illustrate your point of view.





SOURCE 3 A number of personal factors influence Claudia and Salim's participation in sport.

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Lesson 5.5
Personal factors that influence equity and access: Confidence

Learning intentions and success criteria

Key ideas

- → Confidence is the belief that a person can have faith in (or rely on) themselves, someone or something.
- → Confidence is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

What is confidence?

confidence the belief that that an individual can have faith in (or rely on) themselves, someone or something

Confidence is one of the key personal factors acting as a barrier or enabler to equity and access in sport and physical activity. When we talk about confidence in a sporting context, we are generally referring to three elements:

- **self-confidence** – an athlete's conviction that they have the skills, abilities and talent to succeed
- **self-belief** – an athlete's trust in their ability to succeed, regardless of past performances and experiences
- **self-efficacy** – an athlete's belief that they have the ability to perform a task.

These concepts are discussed in detail in Lesson 4.3 Confidence (page 216) and each one contributes to an athlete's overall level of confidence.

Many athletes express their confidence through their actions in public – how they walk, talk and act in front of others before, during and after a game. However, their inner dialogue – the thoughts and discussions they have inside their heads about their ability to perform well and succeed – is often a more accurate indicator of their true confidence. This internal dialogue forms a set of personal attitudes commonly referred to as a **mindset** and it is a good indicator of how confidence can act as a barrier and enabler to sport and physical activity.

mindset an established set of attitudes that determines how a person may interpret a situation and respond to it

Mindset and confidence

The application of theories about mindset has become increasingly popular in sporting contexts over the past few years – particularly as a way of understanding and developing the motivation and confidence of athletes. US psychologist Carol Dweck is known for her research into the psychology of mindset. According to her studies, individuals can have one of two basic mindsets. These include:

- a **fixed mindset** – a mental state in which the individual believes that their abilities (e.g. intelligence and talent) are set (i.e. fixed), without any room for change or development
- a **growth mindset** – a mental state in which the individual believes that their abilities (e.g. intelligence and talent) can be changed and developed (i.e. grown) over time.

A fixed mindset is more than likely to act as a barrier to participation in sport and physical activity. A person who does not have the talent or skills to succeed in a particular sport may never join in, because they believe they will not be able to develop these skills. Likewise, a

fixed mindset a mental state in which the individual believes that their abilities (e.g. intelligence and talent) are set (i.e. fixed), without any room for change or development

growth mindset a belief that one's own abilities can be developed through hard work

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person who is struggling to perform well in a sport they are already playing is more likely to give up, because they believe they will never improve.

A growth mindset is more than likely to act as an enabler to participation in sport and physical activity. A person who does not have the talent or skills to succeed in a particular sport will probably join in anyway, because they believe they will be able to develop these skills over time with hard work.

Source 1 provides some examples of the different ways in which people with fixed and growth mindsets may respond in similar situations.

Common responses	Fixed mindset	Growth mindset
Common responses to challenges	"I will avoid signing up for that new activity/sport in case I look stupid." "I would rather stick to things I am good at."	"OK, I will give that new activity/sport a go!" "I'm going to take a risk and step outside my comfort zone."
Common responses to obstacles	"I'm out – this is too hard."	"This is just a bump in the road." "I'm not going to let this stop me."
Common attitudes towards effort	"You're either good at it or you're not. Effort is pointless." "Only unskilled players need to put effort in."	"Effort is required for growth." "If I apply myself, I will get better."
Common responses to criticism	"I'm no good at this. There's no point in continuing." "The coach/teacher doesn't like me. I am not playing if I am under their instruction."	"I can learn from this and improve." "This criticism isn't a personal attack; it is designed to help me."

SOURCE 1 Fixed mindsets and growth mindsets result in very different patterns of thought.

Retrieve it!

Describe the relationship between equity and access. Check back to Lesson 5.1 Introduction to equity in physical activity (page 284) to see if you retrieved the information correctly.

Confidence as a barrier and enabler

Confidence plays a significant role in people's equity and access in sport and physical activity. How much confidence we have in relation to a particular sport or physical activity can be a barrier to an individual's ability to access personal, social and community resources. For example, having low confidence affects an individual's access to the personal resource of mental health, the social resource of new connections and the community resource of sporting clubs. This could have a negative impact on their ability to experience positive engagement and is, therefore, an equity dilemma.

People who take up a new sport (or participate in a physical activity for the first time) need to confront and overcome many challenges. Facing these challenges with a growth mindset can boost confidence and act as an enabler. Facing these challenges with a fixed mindset can erode confidence and act as a barrier.

It is also important to recognise that external factors (i.e. those outside individual's mindset) can also affect confidence. For example, a confident and competent athlete may be teased and humiliated by peers, teachers or coaches. This ultimately damages their confidence and acts as a barrier to participation. In contrast, an athlete who lacks confidence and skill may be positively praised for their efforts and made to feel part of a team. This ultimately boosts their confidence and can act as an enabler to participation.



SOURCE 2 The level of confidence we have in our own abilities can act as a barrier or an enabler to participation in sport and physical activity.

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In the news

Breaking through barriers

Dr Patrick Keelan, psychologist, blog post

As a psychologist and former competitive runner, I've long been fascinated by the psychology behind great feats in the sport of track and field. One of the most notable such accomplishments occurred before I was born. This was the breaking of the four-minute mile barrier by Roger Bannister of Great Britain in 1954 who went on to have a career as a neurologist and was knighted in 1975. He died in 2018 at the age of 88.

As impressed as I am by his historic athletic achievement, as a psychologist I am even more fascinated by the role of psychology leading up to the landmark run, as well as its impact on the events which followed. Leading up to the iconic run, the consensus among experts was that it was impossible for a human to run a mile in less than four minutes. Once Bannister broke through with his epic 3:59.4 clocking on a track in Oxford, England, that belief was shattered. This resulted in a flood of runners breaking the barrier—1,497 in total as of 2018 including American Steve Scott having done so more than any other runner at 137 times. The mile record has been lowered over the years to 3:43.13, a standard set by Hicham El Guerrouj of Morocco in 1999.

Beliefs leading to breakthroughs

The big challenge for Bannister was believing that he could run a sub-four minute mile when almost everyone else believed it could not be done. This belief, which went against the grain, led Bannister to do the work in training and in his landmark race which allowed him to make history.

…

How to foster beliefs which lead to breakthroughs

Bannister was able to foster the beliefs which led to his athletic breakthrough by thinking thoughts which engendered self-confidence. He reminded himself that despite others believing nobody could run a mile faster than in four minutes, he had the talent, effort level and training plan to accomplish the feat.

…

Source: drpatrickkeelan.com



SOURCE 3 Roger Bannister crossing the finish line to break the 4-minute mile barrier, in a time of 3 minutes 59.4 seconds.

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Check your learning 5.5

Check your learning 5.5: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Self-efficacy is defined as:
   - **A** an athlete's belief that they have the ability to perform a task.
   - **B** an athlete's trust in their ability to succeed, regardless of past performances and experiences.
   - **C** an athlete's conviction that they have the skills, abilities and talent to succeed.
   - **D** the effect an athlete has on their opponent.

2 Choose the correct answer. An athlete who thinks, "I'm no good at this. There's no point in continuing" displays which type of mindset?
   - **A** Neurotic
   - **B** Defensive
   - **C** Fixed
   - **D** Growth

3 **Define** confidence and **explain** how it can act both as a barrier and an enabler to participation in sport and physical activity.

Analytical processes

4 Refer to Source 1 and **determine** whether you possess a fixed mindset or a growth mindset when it comes to sport and physical activity. Provide examples from your selected physical activity to justify your decision.

Knowledge utilisation

5 Refer to "In the news" about Roger Bannister. **Conduct** research to find another example of an athlete that had the self-confidence to do something that was considered impossible in their sport.

Lesson 5.6
Personal factors that influence equity and access: Personality traits

Key ideas

→ Personality traits are psychological qualities and characteristics that determine our patterns of thinking, feeling and behaving.

→ Personality traits are personal factors that can act as a barrier or enabler to equity and access in sport and physical activity.

Learning intentions and success criteria

What are personality traits?

Personality traits are psychological qualities and characteristics that determine our patterns of thinking, feeling and behaving. There are hundreds, if not thousands, of different personality traits commonly displayed by human beings in different combinations. Some of these traits are commonly considered to be positive, while others are considered negative.

personality traits psychological qualities and characteristics that determine our patterns of thinking, feeling and behaving

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Most people display a combination of both positive and negative personality traits. A small selection of each of these traits is shown in Source 1.

It is also important to note that people display different personality traits in different ways (e.g. at different times and in different situations). Some personality traits are more dominant than others, which means that a person may display a particular trait much more often than another. However, this does not mean that they cannot also display traits that are less dominant. For example, a person who often displays the traits of bossiness and forcefulness in certain situations (such as at work or during sport) may also display the traits of shyness and indecision in other situations (such as at home with family or with friends).

The five-factor model of personality

The five-factor model of personality proposed by US psychologist John M Digman in 1990 is a useful way of thinking about the relationship between personality traits and participation in physical activity. According to this model, an individual's personality is broadly made up of "the big five" personality traits. These "big" traits are broad dimensions into which the thousands of individual personality traits (such as those shown in Source 1) can be organised. The model is a helpful tool for classifying personality traits and making predictions about how people with different personality types will act in certain situations. The five big personality traits are:

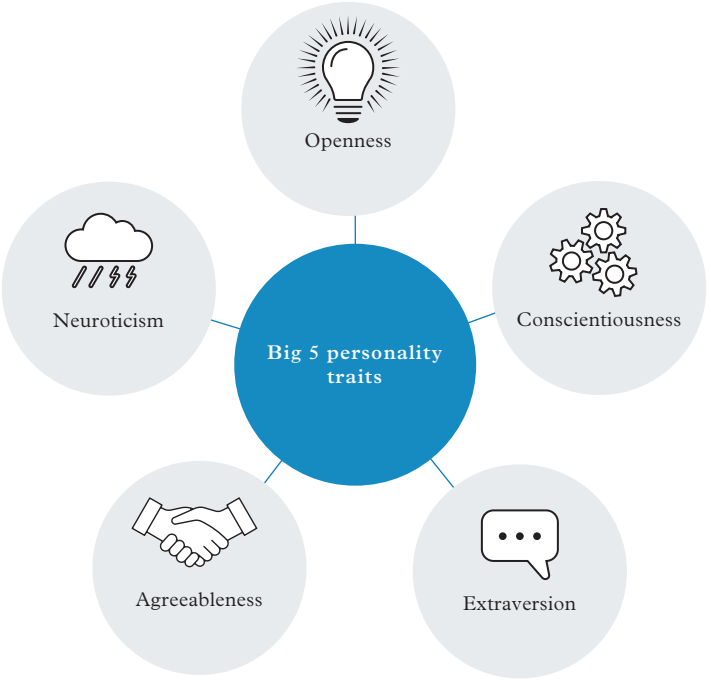
- **openness** – the tendency of a person to be open to new experiences and try new things
- **conscientiousness** – the tendency of a person to work hard and be dependable
- **extraversion** – the tendency of a person to be outgoing and socially confident
- **agreeableness** – the tendency of a person to cooperate and get along with others
- **neuroticism** – the tendency of a person to experience unpleasant feelings (e.g. anxiety, worry, fear, anger, frustration, jealousy, guilt, depression).

By applying the five-factor model of personality, we can get a better idea of how likely certain people are to participate in sport and physical activity and the types of sports they might be best suited to.

Study tip

A good way to remember the five-factor model of personality is to use the mnemonic (memory trick) "OCEAN":

- **O**penness
- **C**onscientiousness
- **E**xtraversion
- **A**greeableness
- **N**euroticism.



SOURCE 1 The five-factor personality model can be used to predict how individuals might engage with sport and physical activity.

Retrieve it!

Describe how confidence can act as a barrier to accessing sports and physical activity. Check back to Lesson 5.5 Personal factors that influence equity and access: Confidence (page 296) to see if you retrieved the information correctly.

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Personality traits as a barrier and enabler

Particular personality traits may make some people more suited to high-adrenaline, contact sports that are played in teams, such as rugby league and water polo.

These personality traits (such as being energetic, team-spirited and forceful) act as enablers to equity and access in those sports. Other personality traits may make some people more suited to individual sports that require more patience and precision, such as archery, lawn bowls or golf. Again, these personality traits (such as calmness, independence and being a strategic thinker) act as enablers to equity and access in those sports.

Despite this, there are also some personality traits commonly shared by athletes. These traits increase the likelihood that those athletes will start participating in a sport or physical activity in the first place and continue that participation in all kinds of sports and physical activities. For example, many successful athletes share personality traits such as enthusiasm, determination and resilience. Such traits enable athletes to overcome challenges and setbacks within their sporting performances and during their careers, and can unlock personal, social and community resources. For example, the trait of resilience can support a sportsperson to persist and eventually access the community resource of representative level competitions.

Study tip

Journal entries are an effective way to personalise your learning and increase your understanding of key concepts.

Consider how you would score on the five-factor personality model and write a journal entry that details how your personality traits have affected your engagement with sport and physical activity.

This journal may help inform your equity strategy for assessment.



SOURCE 2 Personality traits are psychological characteristics that make us who we are. They can also make us more or less suited to particular sports. For example, a person who is calm, strategic and independent may be more suited to a sport such as lawn bowls, while a person who is energetic, team-spirited and forceful may be more suited to a sport such as rugby.

Check your learning 5.6

Check your learning 5.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Neuroticism, one of the "big five" personality traits, is:

- **A** a personality trait characterised by a strong desire for social interaction and stimulation.
- **B** a tendency to be highly organised, detail-oriented, and focused on achieving goals.
- **C** the tendency of a person to experience unpleasant feelings.
- **D** a heightened sense of creativity and a willingness to explore new experiences.

2 Choose the correct answer. In addition to neuroticism, the other four big personality traits are:

- **A** optimism, courage, efficiency and adventurousness.
- **B** open-mindedness, consideration, enigmatic and assertiveness.
- **C** organisation, confidence, empathy and adaptability.
- **D** openness, conscientiousness, extraversion and agreeableness.

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3 **Define** the term "personality trait".

4 **Identify** three personality traits that are commonly displayed by most successful athletes, regardless of the sports they play.

Knowledge utilisation

5 **Argue** which two big personality traits are most important for players on a successful team.

6 Go online and complete the five-factor personality test. A link to the test is provided.

- **a** **Decide** whether you think the results are an accurate reflection of your personality. Provide possible reasons for this.
- **b** **Compare** and **contrast** your scores (i.e. high or low) for each of the personality traits listed in the five-factor model of personality traits with one other student in your class.
- **c** **Discuss** whether your results (and the results of other students in your class) are useful for predicting the types of sports and physical activity you are suited to. Provide reasons for your point of view.
- **d** **Assess** the reliability and validity of an online test such as this and suggest how these factors could be improved.

Weblink: Five-factor personality test

Lesson 5.7
Personal factors that influence equity and access: Personal ability

Learning intentions and success criteria

Key ideas

- → Personal ability describes the qualities and skills a person uses to complete a task or achieve a goal.
- → Personal ability is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

What is personal ability?

personal ability a term used to describe the combination of inherited qualities and learned skills a person uses to complete a task or achieve a goal

Personal ability is a term used to describe the qualities and skills a person uses to complete a task or achieve a goal. Personal ability is a product of both nature and nurture. In other words, it is a combination of both inherited qualities (what some may call natural talent) and learned skills (developed through training and coaching).

Personal ability is another personal factor that can act as a barrier or enabler to equity and access in physical activity. Every sport and physical activity has its own set of unique

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requirements and demands. As a result, certain sports are more suited to athletes with specific kinds of personal abilities. For example, some sports, such as rugby league and gymnastics, require large amounts of speed, strength and flexibility. For an athlete to compete successfully in these sports, they need to have certain inherited physical qualities (such as muscular power and agility), combined with a range of learnt skills such as motor skills (i.e. specific techniques and movement sequences relevant to a particular sport) and timing skills (i.e. the ability to implement the right skills at the right time). Then there are also the psychological and personality traits that are needed for success. Examples of some common qualities and skills are provided in Source 1.

Examples of inherited qualities (i.e. natural talent)	Examples of learnt skills (i.e. training and coaching)
Flexibility Balance Muscular power Body shape and size Coordination	Ball-handling skills Tactics and strategies knowledge Technical ability Implementation ability (e.g. timing)

SOURCE 1 "Personal ability" is a term used to describe the combination of inherited qualities and learnt skills a person uses to complete a task or achieve a goal. Personal ability is a product of both nature and nurture.

When the requirements for success in an activity match a person's physical competence, their personal ability is said to enable them to engage positively and access resources. For example, the feeling of success can build an individual's self-confidence, a personal resource. By contrast, when the demands of an activity exceed a person's physical competence, their personal ability can be a barrier to accessing these benefits.

Personal ability as a barrier and enabler

Personal ability can have a significant impact on equity and access in sport and physical activity. Generally, high levels of personal ability become an enabler to participation, while low levels of personal ability become a barrier.

It is important to acknowledge the role that *perception* of personal ability plays as a barrier or enabler to participation and engagement in some sports. For example, the perceptions formed by coaches and selectors about an athlete's personal ability directly influence their decisions about whether to pick that athlete for their team or program. Similarly, an athlete's own perception of their personal ability can exert a strong influence on their decision to take up or keep participating in a sport. Indeed, many studies have shown that a perceived lack of personal ability is a major cause of dropout in children's sport. When children think that they cannot do something, they often stop trying, to avoid embarrassment or humiliation. This can be an equity dilemma when it limits their access to the physical and mental health benefits of physical activity as well as the associated social and community resources.



SOURCE 2 When the requirements for success in an activity match a person's physical competence, their personal ability is said to enable their participation.

Retrieve it!

Define the term "barrier" in relation to equity in sports and physical activity. Check back to Lesson 5.1 Introduction to equity in physical activity (page 284) to see if you retrieved the information correctly.

For the record!

A 2020 study by Vella *et al.* published by the *BMJ Open Sport and Exercise Medicine Journal* found that "approximately 30% of all Australian youth sport participants dropped out of organised sports within a 2-year period". It would be reasonable to assume that personal factors such as perceived lack of personal ability played a role in the decision of these people to no longer play sport.

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SOURCE 3 Personal ability combines inherited qualities (e.g. muscle strength) and learnt skills (e.g. technique) required to perform skills such as the Maltese cross.

Check your learning 5.7

Check your learning 5.7: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Personal ability is a term used to describe:
   - **A** the combination of inherited qualities and learned skills a person uses to complete a task or achieve a goal.
   - **B** the degree of motivation an individual has to access physical activity and sport.
   - **C** the level of equipment and resources an individual has access to.
   - **D** the opinions and judgments of coaches and spectators.

2 An example of an inherited quality is:
   - **A** tactics.
   - **B** coordination.
   - **C** strategies.
   - **D** knowledge.

3 **Explain** how personal ability can act both as a barrier and an enabler to influence equity and access in sport and physical activity.

Analytical processes

4 **Identify** a situation in which you think a perception about personal ability has affected a person's engagement with a particular sport or physical activity.
   - **a** Was the perception held by the person themselves or by another person (e.g. coach, teacher, selector)?
   - **b** Did the perception act as a barrier or an enabler to participation? **Justify** your answer.

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Lesson 5.8
Personal factors that influence equity and access: Genetic disposition

Key ideas

→ Genetic disposition describes the physical and psychological characteristics that every person inherits from their biological parents.Genetic disposition is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

Learning intentions and success criteria

What is genetic disposition?

Genetic disposition is a term used to describe the physical and psychological characteristics that every person inherits from their biological parents (and the degree to which those characteristics make them think or act in particular ways).

genetic disposition the physical and psychological characteristics that every person inherits from their biological parents

Many of our physical and psychological characteristics – such as our height, weight, body type, eye and hair colour, and certain personality traits – are usually determined by the genes we inherit from our biological parents. These are the physical and mental qualities that each person is born with. Although it is possible to change or limit the effects of some of these characteristics (e.g. weight and muscle tone) through training and diet, certain characteristics (e.g. height and limb length) are fixed.

Genetic disposition as a barrier and enabler

Genetic disposition is one of the most significant factors influencing equity and access in sport and physical activity. The biological characteristics we inherit make us more or less suited to particular sports and physical activities and act as both barriers and enablers to participation and positive engagement.

For example, naturally tall people are generally well suited to sports such as basketball, volleyball or Australian football due to the natural advantages that height offers to succeed in these sports. Their height acts as an enabler to participating in these sports and accessing resources, such as further skill development. On the other hand, tall people are often less suited to sports such as weightlifting or gymnastics due to the natural disadvantages caused by their height, which then acts as a barrier to participation in these sports. In both examples, the opposite is true for shorter people. The Theory in action further explores how genetic disposition is used to identify potential success in particular sports.

Retrieve it!

Explain the self-determination theory. Check back to Lesson 5.4 Personal factors that influence equity and access: Motivation (page 293) to see if you retrieved the information correctly.

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Theory in action Using body shape to identify talent

An athlete's body shape is one indicator of potential success in particular sports. The Australian Sports Commission is the organisation responsible for managing and administering sport in Australia. It has long used a range of techniques and programs to identify sporting potential. Such programs use a series of physical tests and measurements to help determine what sport a person may be best suited to.

Somatotype as an indicator of success

somatotype a term used to help describe and classify human body shape and physique type

ectomorph a body type that is leaner, longer and narrower with a low tendency to build muscle and store body fat

mesomorph a body type that is lean and muscular

endomorph a body type that is stockier, wider and shorter with a high tendency to build muscle and store body fat

One genetic indicator of a person's potential for success in a particular sport and physical activity is known as a **somatotype**. It was developed as a system for classifying human physical types (from earlier theories) by a US psychologist William Sheldon in 1954. According to this theory of somatotypes, there are three body types:

- **ectomorph** people who are naturally leaner, longer and narrower with a low tendency to build muscle and store body fat
- **mesomorph** people who are naturally more muscular, athletic and lean and commonly described as being of medium build
- **endomorph** people who are naturally stockier, wider and shorter with a high tendency to build muscle and store body fat.

Subsequent researchers developed Sheldon's work further in an attempt to pair particular Olympic sports and events with particular somatotypes.

Sports scientists working within talent identification programs also study how the changing nature of sport affects the type of physical build most suited to each activity. This allows them to identify the best talent for future competitions. In 2022, the Queensland Government launched the "You for 2032" talent identification program for the 2032 Brisbane Olympic Games, inviting tens of thousands of young Queenslanders to be targeted for specialised coaching in a rigorous two-year testing program. By the program's completion, approximately 50 000 potential athletes between the ages of 13 and 23 will have had their height, pace, strength and potential assessed and the top 400 athletes offered specialised coaching at the Queensland Academy of Sport.



SOURCE 1 Skinfold tests such as the one being carried out here at the Australian Institute of Sport (AIS) are sometimes used to help determine a person's somatotype.

Although talent identification programs cannot predict with certainty whether an athlete will become successful, they do offer a good initial indication of the potential for success, and help coaches and athletes make more informed decisions. While some testing programs that identify future talent by genetic-based selection have been successful to date, criticism still exists about the possibility of some exceptionally skilled athletes getting overlooked because they do not meet the set criteria.

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SOURCE 2 US psychologist William Sheldon proposed that three body types exist: endomorph, mesomorph and ectomorph.

Check your learning 5.8

Check your learning 5.8: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which somatotype describes people who are naturally leaner, longer and narrower with a low tendency to build muscle and store body fat?
   - **A** Atomorph
   - **B** Ectomorph
   - **C** Endomorph
   - **D** Mesomorph

2 Which skills does the "You for 2032" talent identification program assess?
   - **A** Height
   - **B** Pace
   - **C** Strength
   - **D** All of the above

3 **Define** genetic disposition and **explain** how it can act both as a barrier and an enabler to equity and access in sport and physical activity.

4 **Identify** two examples of genetic disposition that would act as:
   - **a** a barrier to engagement in your selected physical activity this term
   - **b** an enabler to engagement in your selected physical activity this term.

Knowledge utilisation

5 Research talent identification programs similar to the "You for 2032" program. **Devise** an argument for and against such programs citing potential problems, limitations and benefits.

6 Use the information provided together with additional information gathered through research to **determine** your personal somatotype. Does your somatotype act as a barrier or an enabler to your engagement in your selected physical activity (or any other sports or physical activities you participate in outside of school)? **Justify** your response and provide examples to support your position.

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Lesson 5.9
Personal factors that influence equity and access: Gender

Learning intentions and success criteria

Key ideas

- → Gender refers to the state of being male or female. It usually refers to social and cultural differences between men and women.
- → Gender is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

What is gender?

gender the combined product of a person's biological characteristics (i.e. their sex) along with their social and cultural roles and identities that are formed in response to their environment (through interactions with family, friends, teachers and coaches, religious institutions, the media and so on)

sex the biological and physical characteristics of males and females (i.e. their genitalia and genetic differences); either of the two main categories, male and female, into which humans and most other living things are divided on the basis of their reproductive functions

Gender is a term used to refer to the state of being male or female. It is more commonly used to refer to the social and cultural differences between men and women, but it can also be used to refer to the biological differences. In many situations, the terms "gender" and "**sex**" are used interchangeably even though there are clear differences between them. To avoid confusion, we will explain how they are used throughout this topic:

- **gender** is used to describe the combined product of a person's biological characteristics (i.e. their sex) together with their social and cultural roles and identities that are formed in response to their environment (through interactions with family, friends, teachers and coaches, religious institutions, the media and so on)
- **sex** is used to describe the biological and physical characteristics of males and females (i.e. their genitalia and genetic differences).

Gender – and in particular the social construction of gender – is a complex social phenomenon and will be explained in greater detail in Lesson 5.13 Social factors that influence equity and access: The social construction of gender (page 320). Here, we will consider the role of gender and sex as a barrier and enabler to equity and access in sport and physical activity.

Gender as a barrier and enabler

stereotype a widely held but fixed and oversimplified image or idea of a particular type of person or thing

Gender and sex both play significant roles in influencing people's engagement in sport and physical activity. In the past, many sports tended to be classified as either "male/masculine" or "female/feminine". Today, many **stereotypes** about gender have now been discredited. More sports are regarded as "gender neutral" and appropriate for both men and women. Despite these improvements, stereotypes persist in some sports. The perceptions created by these stereotypes can act as an instant barrier for men who are interested in playing a sport that is still widely associated with women – such as cheerleading – and for women who are interested in playing a sport that is still widely associated with men, such as boxing.

In contrast, many advances have been made to address these barriers and improve access for both men and women. As outlined in Source 2, a series of key milestones over the past five to 10 years have given women's sport in Australia growing momentum. These include the launch and rise of professional women's leagues, instances of achieving pay parity, individuals and teams having on-field success, increased government investment, increased media coverage and a growing push for female representation in leadership and governance.

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These factors combined are acting as an enabler to ensure that all athletes – regardless of their gender or sex – have the same opportunities to access personal, social and community resources that come about through engaging with sport and physical activity.



2017
The AFL Women's (AFLW) league launched, offering a professional platform for female Australian Rules footballers, inspiring a generation and challenging gender barriers in a traditionally male-dominated sport.

2017
2018
2019
2020
2021
2022
2023



2018
Cricket Australia achieved pay parity for its male and female players, a significant step towards equal recognition and opportunity.



2023
The Matildas' remarkable run in the FIFA Women's World Cup, reaching the semifinals and capturing national attention, fuelled public interest and support for women's soccer.

2023
The Australian government unveiled the 'Play Our Way' program, a $200 million investment aiming to increase accessibility, participation, and visibility of women's sport across the country.

SOURCE 2 Significant milestones in women's sport in the past 10 years

Gender gap in participation rates

Despite the breakdown in many stereotypes relating to gender and sport, a noticeable but narrowing gap still exists between participation rates for girls and women, and boys and men. Data published by the **Australian Sports Commission** in 2021–2022 showed that 49 per cent of men aged 15+ participated in sport-related activity at least once a week compared to 32 per cent of girls aged 15+ (see Source 4). Furthermore, women also continue to be under-represented in positions of leadership and management when it comes to sport. According to Clearinghouse for Sport (2023), women represent only 22 per cent of CEOs across 65 organisations funded by the Australian Sports Commission.



SOURCE 1 In recent years, the rise of national women's leagues in several key sports has acted as an inspiration and an enabler for girls' participation in sport-related physical activity. One such example is the Women's Big Bash League (WBBL) in cricket.

Retrieve it!

Describe the impact of personal ability on access to sports and physical activity. Check back to Lesson 5.7 Personal factors that influence equity and access: Personal ability (page 302) to see if you retrieved the information correctly.

For the record!

According to international finance firm Deloitte, women's sport is forecast to break a record and exceed US$1.28 billion in global revenues in 2024. This figure surpasses Deloitte's previous valuation three years ago by at least 300 per cent.

Australian Sports Commission (ASC) a government agency in Australia responsible for providing strategic leadership and allocating funding for sporting activities at a national level. The ASC delivers the AusPlay survey, a large national survey updated every 6 months, tracking Australians' sporting behaviours

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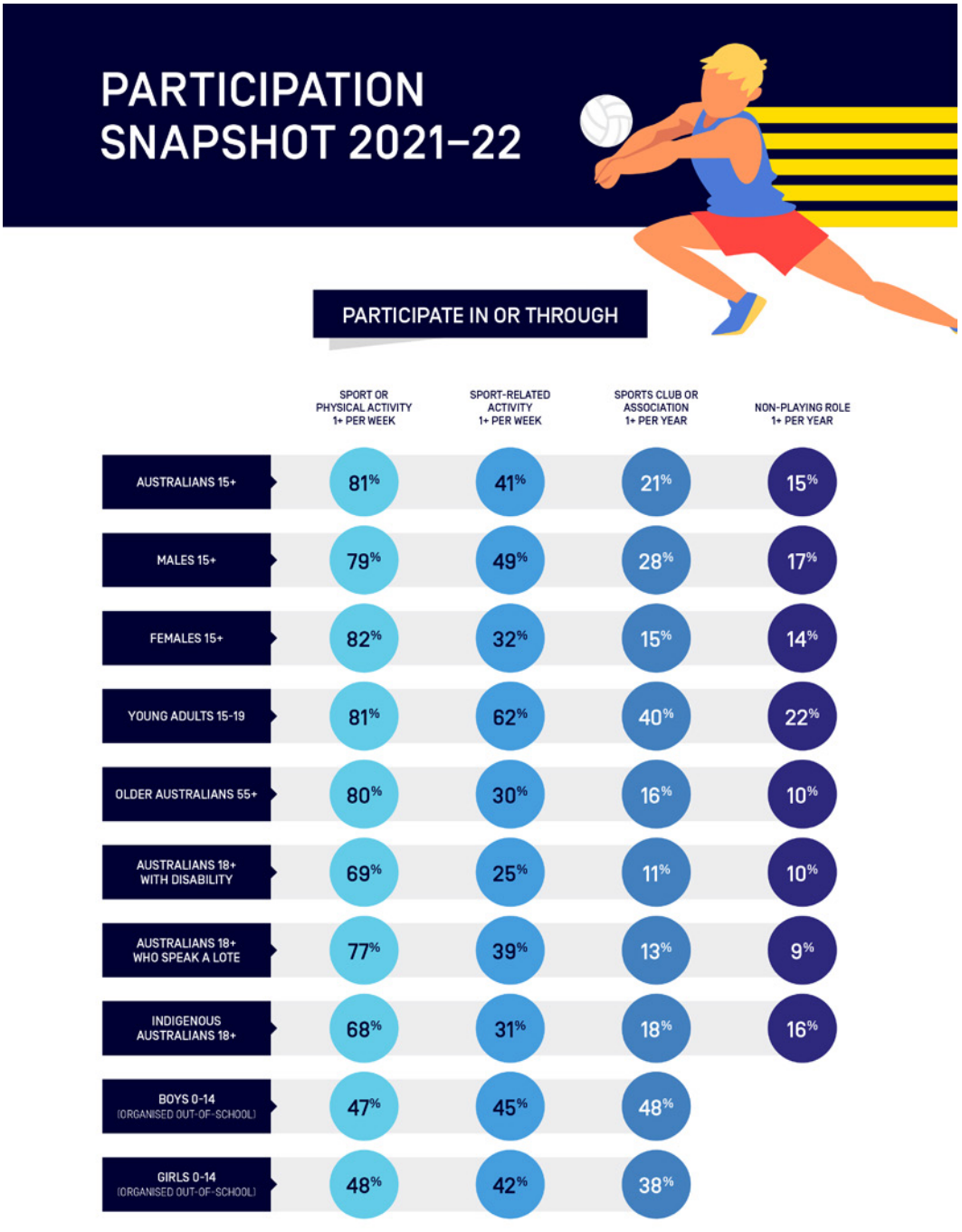


SOURCE 3 WISPAA (Women Participating and Leading in Sport) is an organisation that advocates for women's access to participation and leadership in sport. This image was voted runner-up in the 2023 Women in Sport Photo Action Awards. Initiatives such as this raise the profile of women in sport.

On the other hand, females are much more likely to take part in non-sport-related activities, such as gym, fitness and walking, than men. In fact, when it comes to overall weekly physical activity, women have a higher participation rate than men (see Source 4).

Campaigns encouraging more men and women to be active, especially through sport-related physical activity, are welcomed and encouraged at many levels of government. This also includes campaigns that generally raise the profile of women's sport (see Source 3). Such research provides an opportunity for sporting clubs and government agencies to better understand the motivations of both sexes and increase their access to the many resources available through physical activity and sport.

These statistics indicate that there is still work to be done to remove barriers and create enablers for men and women to engage in more sport and physical activity. Examining the role that gender and sex play in accounting for differences in participation rates is one way to address inequity in sport.



SOURCE 4 According to 2021–2022 data in an AusPlay report, participation rates were relatively similar for boys and girls, and men and women. The most noticeable change in participation rates were in formal sport-related activities in adulthood.

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Check your learning 5.9

Check your learning 5.9: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Based on the AusPlay data in Source 4, which was the largest group of Australians to take part in sport-related activity more than once a week?
   - **A** Australians aged 15+
   - **B** Girls aged 0–14
   - **C** Males aged 15+
   - **D** Young adults aged 15–19

2 **Describe** how gender and sex can act as both barriers and enablers to equity and access in sport and physical activity.

Analytical processes

3 **Reflect on** a number of sports and physical activities that you believe are still regarded as "masculine", "feminine" or "gender neutral". Consider some possible reasons why this kind of gender stereotyping still exists in society and suggest what could be done to address these stereotypes.

Knowledge utilisation

4 Interestingly, participation rates increased for women during the COVID-19 pandemic but have since returned to pre-pandemic levels. Suggest plausible reasons for this and **discuss** how this might indicate certain barriers to women's participation in non-organised physical activity.

5 **Conduct** research to find an example of a strategy that has been successfully implemented at a community level to successfully increase girls' or women's participation in sport-related physical activity.

Lesson 5.10

Personal factors that influence equity and access: Previous experiences of physical activity

Key ideas

→ Previous experiences of physical activity are the memories we have of participating in certain sports and physical activities in the past.

→ These experiences are personal factors that can act as barriers or enablers to equity and access in sport and physical activity.

Learning intentions and success criteria

Retrieve it!

Describe the difference between gender and sex. Check back to Lesson 5.9 Personal factors that influence equity and access: Gender (page 308) to see if you retrieved the information correctly.

What are previous physical activity experiences?

Previous experiences of physical activity are the memories we have of participating in certain sports and physical activities in the past. These experiences can act as significant barriers and enablers to equity and access in sport and physical activity later in life.

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Previous experiences as barriers and enablers

People's attitudes to sport and physical activity are generally formed in the early years of their lives when their minds are impressionable, and their bodies are still developing. Positive experiences of physical activity at a young age (such as enjoyment, winning or success) tend to act as an enabler for them to access the potential resources available through engaging in sport and physical activity, while negative past experiences (such as boredom, serious injury or failure) tend to act as a barrier, limiting their future access to such things (see Source 1).

For these reasons, care should be taken to ensure that the exposure of children to physical activity is safe, nurturing and positive. First experiences of school and community-based organised sport have the power to form attitudes towards sport – both positive and negative – that can last for many years or even a lifetime.



SOURCE 1 Previous experiences of physical activity are the memories we have of participating in certain sports and physical activities in the past. In general, positive experiences at a young age tend to enable future access to personal, social and community resources available through participation, while negative past experiences tend to be a barrier to these things.

Check your learning 5.10

Check your learning 5.10: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. An example of previous experience in sport acting as an enabler includes:
   - **A** sustained injuries over time.
   - **B** pressure to perform.
   - **C** exclusion from a team.
   - **D** crowd support.

2 **Explain** how previous experiences of physical activity can act both as a barrier and an enabler to equity and access in sport and physical activity.

Analytical processes

3 **Reflect on** your personal experiences of sport and physical activity from your early childhood. **Compare** one positive experience and one negative experience, and **consider** the ways in which these acted as enablers or barriers to your future access to personal, social and community resources.

Knowledge utilisation

4 **Identify** an example of a negative experience that could prevent an individual from re-engaging with that sport. **Devise** a strategy to help the individual overcome this barrier.

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Lesson 5.11
Social factors that influence equity and access

Key ideas

→ Social factors are a range of influences at a social level that act as both barriers and enablers to equity and access in sport and physical activity.

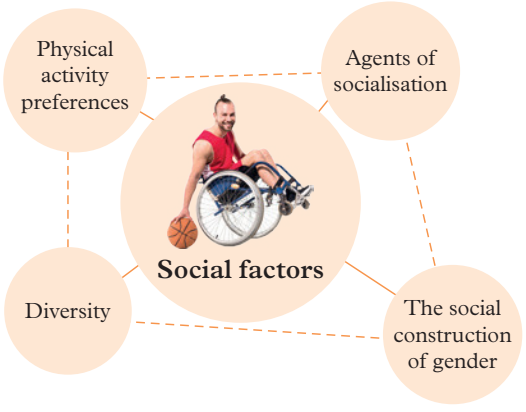
Learning intentions and success criteria

What social factors act as barriers and enablers?

There are many **social factors** that act as barriers and enablers to equity and access in sport and physical activity. Social factors include a whole range of influences at a social level (e.g. your relationships with your friends, family, community and broader society). Some of the most important social factors that influence access include:

- **agents of socialisation** – the people in our lives who teach us how to act and behave in a society, including our family, friends, teachers and coaches
- **the social construction of gender** – the ways in which men and women in a society are expected to act and the types of behaviours that are typically considered to be feminine or masculine
- **diversity** – the ways in which people in a society differ (in terms of race, ethnicity, religious beliefs, socio-economic status, language, physical and mental ability, geographical location, gender and/or sexual orientation)
- **physical activity preferences** – the types of sports and physical activities that a person likes to engage in (i.e. prefers) over other types of sports and physical activities in relation to others in their community.

In the lessons that follow, we will look at each of these factors in detail and examine how they act as barriers and enablers to equity and access in sport and physical activity for different people. Although we will be learning about each factor separately, it is important to keep in mind that, in reality, these social factors are acting on us (i.e. affecting our decisions and behaviours) simultaneously. They also affect each other; for example, the social construction of gender can influence the way adults parent their children, and parents can influence physical activity preferences. Not only that, but also we are almost always influenced by a combination of other factors at the personal, cultural and environmental levels.



SOURCE 1 A range of different social factors play a role in an individual's access to the available personal, social and community resources found in sport and physical activity participation.

social factors a range of influences at a social level that can act as barriers or enablers to participation in sport and physical activities (e.g. influences at the community level such as the opinions of friends, parents, teachers and coaches, social expectations, gender roles, levels of diversity in the community)

Study tip

Social learning can influence your academic life as well as your sporting one. Working with a partner when doing your schoolwork can help to keep you motivated and broaden your scope to be creative and innovative in your thinking.

Retrieve it!

Name three psychological concepts that can affect performance. Check back to Lesson 4.1 Introduction to sport psychology (page 208) to see if you retrieved the information correctly.

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Lesson 5.12
Social factors that influence equity and access: Agents of socialisation

Learning intentions and success criteria

Key ideas

- → Agents of socialisation are the people in our lives who teach us how to act and behave in a society, including our family, friends, teachers and coaches.
- → Agents of socialisation are social factors that can act as a barrier or enabler to equity and access in sport and physical activity.

What is socialisation?

socialisation the process of learning to behave in a way that is acceptable to other people in the society in which we live

agents of socialisation the people in our lives from whom we learn the types of behaviours that are expected of us in society (e.g. parents and guardians, siblings, friends, teachers and coaches)

norm a standard or pattern of behaviour that is typical or expected

Socialisation is the process of learning to behave in a way that is acceptable to the society in which we live. As humans, we all begin to learn the types of behaviours expected of us from a very early age from the people around us. Initially we learn directly from our parents or guardians, siblings (brothers and sisters), relatives and close family friends. Later in life, we learn from our friends, teachers and other people in the community (such as coaches, religious leaders and other people with whom we are in regular contact). Because all these people have a direct influence on the way we are socialised, they are referred to as **agents of socialisation**. They teach us the values, attitudes and **norms** specific to the social groups of which we are a part. Agents of socialisation are one of the key social factors affecting equity and access in sport and physical activity. In this lesson we will learn about the ways in which they act as barriers and enablers to accessing personal, social and community resources.

In addition to the direct agents of socialisation mentioned above, there are a number of other indirect agents of socialisation. These include the books we read (and the authors who write them), the television shows and movies we watch (and the actors who star in them), the news we consume and the people we follow on social media. We continually learn and grow from all these agents of socialisation, but in this lesson we will focus on direct agents of socialisation. Indirect agents of socialisation will be discussed in more detail in Lesson 5.21 Cultural factors that influence equity and access: Mass media promotion and marketing of physical activity (page 344). The direct agents of socialisation include:

- parents and siblings
- friends/peers
- teachers
- coaches.

Social cognitive theory and socialisation

There are many theories that seek to explain how humans learn – and become socialised – through their relationships with others. One such theory – known as social cognitive theory – was developed in 1986 by Canadian-born US psychologist Albert Bandura. The theory proposes that humans learn behaviours by observing, watching and absorbing other people's social interactions and experiences.

From birth, we watch those around us, taking in overt (obvious) and covert (subtle) messages about the world in which we live. We observe people modelling particular behaviours and attitudes, and store that information. Consider the way parents teach their

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child manners, reminding them to say "please" and "thank you". This would be considered an overt message of socialisation. The parent who always helps others and shows kindness to everyone they interact with sends a more covert message to the child about the way to engage in society. The kinds of attitudes and behaviours we observe are many and varied. They include ways of behaving towards people of different genders, ethnicities and ages, to name but a few. We later make decisions about which of those behaviours or attitudes are appropriate for us to imitate or reproduce, based on our observations of their consequences and the extent to which we identify with the people we have observed.



SOURCE 1 From a young age humans begin to learn behaviour from the people around them. These people include parents and siblings, friends, teachers and coaches. They are referred to as agents of socialisation.

Agents of socialisation as barriers and enablers: Parents and siblings

Parents and siblings have the earliest and most significant influence on an individual's attitude towards physical activity. Parents can pass on attitudes and values relating to physical activity in general, or for specific sports and physical activities. Either way, these influences can have a lifelong impact on an individual's choices and behaviours.

Sometimes a parent's influence can be a direct enabler (for example, a parent can make physical activity choices on their child's behalf by signing them up for a competitive or recreational sport). In this example, the parent is increasing the child's access to the community resource of a club or organisation. In other cases, a parent's influence can be an indirect enabler, such as when the parent models positive behaviours for the child by participating in regular physical activity. Furthermore, the type of sport a parent is involved in will also be an influencing factor for the child's sport participation and sporting values (for example, parents who play touch football regularly will naturally encourage their children to develop a preference for this sport).

Parents can also act as barriers to equity and access. Some parents may actively discourage or restrict their child's access to opportunities for a number of reasons (such as out of fear they may get hurt or be teased, or due to negative past experiences of their own). More commonly, a parent has other interests (such as music) and/or priorities (financial or time-based), which means that access to sport is not available to their children.

Parents can also act as barriers to participation when they engage in negative behaviour in front of their children (for example, yelling abuse from the sidelines, acting aggressively towards coaches and other parents). This type of behaviour has become such a concern in the community in recent years that initiatives to combat it have emerged at an institutional, governance and societal level. Some sporting organisations have created "parent handbooks" and now ask parents to sign codes of conduct when their child is selected in a team. National media campaigns have also been launched. The "Let Kids Be Kids" initiative by Sport Integrity Australia, the Australian Sports Commission and the Australian Human Rights Commission is designed to combat abusive or negative parent behaviour at sporting games (see Source 2). It uses sport stars to advocate for good behaviour. The "Positive or It's Pointless" campaign is another such initiative run throughout Queensland that aims to teach parents about positive sideline etiquette.

Parents and siblings who are overly critical of their child's performance and set unrealistic expectations at home or in private can also act as a barrier to positive engagement.

Retrieve it!

Define the term "socialisation". Check back to earlier in this lesson to see if you retrieved the information correctly.

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SOURCE 2 Recent media campaigns have been designed to combat abusive or negative parent behaviour at sporting games because this can be a serious barrier to continued participation.

The influence of siblings is also significant in determining a child's sporting choices. It is common for younger children to be interested in the same sports and activities as their older siblings. Parents often encourage this, as having two children choosing the same sport can be more convenient and offer cost savings. This can be a barrier for some younger siblings who may not end up pursuing the sport they would prefer. In some cases, siblings can also be a negative influence. For example, when there is a clear difference in ability between siblings, the less-able sibling can feel inadequate. This has been known to discourage young athletes from trying their hardest or continuing in the sport. "Theory in action: Agents of socialisation as barriers and enablers of physical activity" further explores how parents and peers act as enablers of physical activity.

In the news

How parents' sideline behaviour at sporting events affects kids

by Rhiannon Bowman, *Education Matters* magazine, 13 February 2024

Researchers behind a new study from the University of South Australia have found a link between parents' sideline conduct and athletes' behaviour.

When parents behaved well – applauding good play, encouraging players, and enjoying the game – their child was more likely to project positive behaviour. But the more a parent behaved poorly – being overly critical, second guessing the referee, or yelling abuse – this was related to greater antisocial behaviours in their child.

…

The study assessed the perceptions of 67 Australian youth athletes (aged 12–17 years) participating in team-based sports. Athletes were asked to report their parents' positive and negative sideline behaviour, as well as reflect on their own sporting behaviours.

Specifically, the study assessed five negative behaviours. It found that:

- 32% of participants reported never seeing any negative behaviours from their parents.
- 69% reported some form of negative behaviour from their parents (even if rarely).
- 18% said their parents sometimes or often said bad things about the way they played.
- 17% said their parents sometimes to very often yelled at the referee during the game after a bad call was made.

University of South Australia's Dr Alyson Crozier said parents' sideline actions can predict children's on-field sports behaviours.

"Most parents are role models for their children, with children looking to their parents to learn about acceptable behaviour. So, it's natural for them to copy the behaviours they observe," Dr Crozier said.

…

"Encouragingly, most players in this study reported frequent positive parent behaviours, and negative parent behaviours as rare."

…

"Children get far more enjoyment from playing sport when a parent is present, encouraging, and supportive. Such behaviours also help build a child's self-esteem, and improve their life skills and wellbeing.

"Yet poor parent behaviours can reduce a player's confidence and damage their emotional and physiological wellbeing. In some cases, they can even lead to a child withdrawing from a sport altogether."

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Theory in action Agents of socialisation as barriers and enablers of physical activity

Siblings Ella and Liam Green from Siena Catholic College on the Sunshine Coast reflect on the ways in which agents of socialisation have acted as barriers and enablers of physical activity.

Ella Green, 17 years old

"Both of my parents were very athletic growing up and continue to follow sports today, so when they heard that I wanted to take on competitive running they were ecstatic. My parents supported me financially. Most importantly, my parents emotionally supported me; always making the time to come and watch me train and compete, rain, hail or shine. When training became a challenge, or my performance dipped, the support from my parents was crucial to helping me keep sight of my goals. When I reflect on my athletics experiences – my opportunities to participate at a regional, state and national level – my parents are a part of those wonderful memories."

Liam Green, 15 years old

"In Term 1 of Year 7, we were told to select a Wednesday afternoon sport option for the semester and I chose rugby league. I had never played a contact sport before and wanted to try it out, so after a bit of convincing and pleading with my mum I tried out for the team and was successful.

"I played on the wing and in the first game I scored two tries and was instantly hooked, even though the tries were nothing to do with skill – they were more about speed and size, as I was taller than the average for boys of my age. After that game, all my friends wanted me to play rugby union for school and club. At the time, my sister was involved with multiple sports, mainly athletics, and we couldn't make it to many of the games so that meant I couldn't play. However, a few years later I was finally able to sign up and I am now playing in the U/16 rugby union team. All the boys from my school that were playing for the University Club aren't playing now, because they want to concentrate on their studies, but I'm grateful to them for their encouragement in Year 7 because I may never have given rugby union a go otherwise. Now it's a sport that I have come to love and will continue to play for as long as possible."



SOURCE 3 The support from Ella Green's parents has been a strong enabler for her participation and success in athletics.



SOURCE 4 Liam Green was enticed into the game of rugby union by his friends. Peer influence, when positive, can act as a strong enabler.

Agents of socialisation as barriers and enablers: Friends

After parents and siblings, friends are generally the most influential agents of socialisation in a person's life. Research shows that as children get older, the influence of parents and siblings decreases and the influence of close friends becomes more important. As a result, they can act as significant barriers and enablers to equity and access in sport.

Many children and adolescents report that the desire to "fit in" and "belong" plays an important role in their decisions to engage in sport. The same young people have a tendency to make decisions about sports based on what is considered socially acceptable (i.e. "cool") among their peer group. Teenagers may also drop a sport they have participated

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in throughout their childhood if it is deemed socially unacceptable (i.e. "uncool") by their friends. Research shows that as children get older and approach adolescence, their participation rates in sport-related physical activity decreases. This is especially common among females.

Friends can also influence the type of behaviour displayed on the sports field. Negative influences can exist within teams, and the desire to fit in can cause adolescents to tolerate or even take part in antisocial behaviour (such as bullying or teasing others). While bullying and victimisation from teammates can be serious barriers for some young athletes, peers who demonstrate strong leadership qualities and strong ethics can have a positive influence on teammates' behaviour and act as enablers for others to enter the sport and access the many personal, social and community resources available.

Agents of socialisation as barriers and enablers: Teachers

For many adolescents, school provides their only exposure to recreational or competitive physical activity. While a school's curriculum plays a role in shaping attitudes to physical activity, it is the teachers at the school who will ultimately influence the opportunities provided to the students. As such they can act as significant barriers and enablers to equity and access in sport and physical activity.

Retrieve it!

Describe two examples of genetic disposition enablers that allow access to physical activity. Check back to Lesson 5.8 Personal factors that influence equity and access: Genetic disposition (page 305) to see if you retrieved the information correctly.

Different teachers will place different emphases on what they see as the most important outcome of physical activity. Some view winning competitions as the most important aspect of sport and physical activity, while others believe that developing social skills and working as a team are more important goals. Some teachers might focus on sporting ability to help students achieve their personal, physical, mental and social goals.

When teachers have a passion for sport, they use their expertise, enthusiasm and commitment to give students positive experiences in that sport. In other words, they can act as strong enablers, increasing their students' access to the available resources. For example, a teacher with a passion for volleyball is more likely to enter teams into volleyball competitions (a community resource) and provide expert coaching in that area (a social resource). This may be at the expense of other sports, so limiting students' choices, or it might complement other sports already offered at the school.

Teachers have the opportunity to motivate students, teach physical and social skills, and provide new experiences that can lead to a lifelong relationship with sport and physical activity. However, some teachers may not provide positive experiences for all students, because the values and individual physical needs of these students differ. Unless teachers can find ways to tailor their instruction to suit these individual needs, some students can have negative experiences of sport. Likewise, if a teacher only provides limited opportunities to participate in a range of sports – choosing instead to teach only a few sports with which they are comfortable – then this may act as a barrier to those students who do not like those sports.



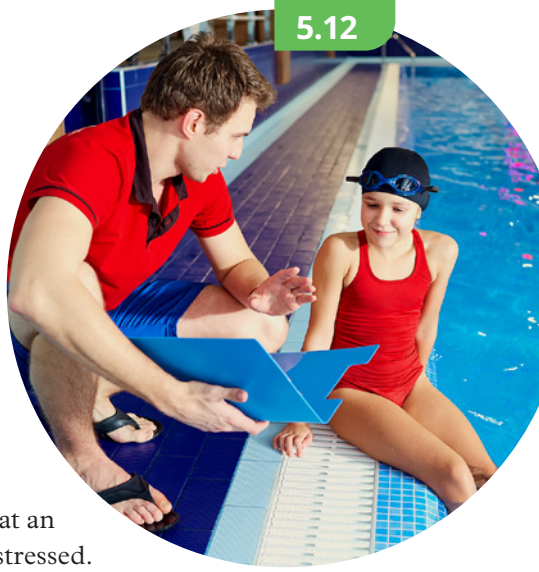
SOURCE 5 Teachers can have a profound impact on their students' attitudes towards physical activity.

Finally, if a teacher chooses to focus their efforts exclusively on students who demonstrate a particular level of skill or talent (or fit a certain stereotype of fitness), then this can also act as a barrier for students who do not fit the stereotype but may otherwise succeed and develop the positive social attributes associated with teacher support.

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Agents of socialisation as barriers and enablers: Coaches



SOURCE 6 It is important that coaches of school-aged children do not pressure them to improve at the expense of their enjoyment of the sport.

Coaches have great influence on equity and access in the sports that they coach. More than being responsible for guiding an athlete in their chosen sport, coaches often support other aspects of the athlete's life too. As a result, coaches can play many roles in the life of an athlete, such as instructor, assessor, friend, mentor, facilitator, chauffeur, demonstrator, supporter, motivator and counsellor.

One important responsibility of coaches of school-aged children is to ensure that children are not pressured into specialising in sport when they are too young. Although having a passion to improve the outcomes of athletes makes for a good coach, over-zealous coaches run the risk of causing "athlete burnout", meaning that an athlete becomes fatigued and de-motivated in a sport due to being overworked or stressed. It is also common for coaches to be volunteers, such as parents who have an interest in the sport or were once good at the sport themselves, but are not necessarily trained to educate youth. When well-meaning coaches lack the skills to control the environment, manage multiple athletes and instruct in an organised, systematic and effective way, this can lead to diminishing motivation and enjoyment for the athletes. This may lead to athletes eventually dropping out, limiting their access to many resources.

Check your learning 5.12

Check your learning 5.12: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. An example of a direct agent of socialisation is:
   A a book. **C** a television show.
   B a teacher. **D** social media.

2 Choose the correct answer. Refer to "In the news" (page 316). According to the University of Adelaide study, what percentage of children said that their parents sometimes to very often yelled at the referee during the game after a bad call was made?
   A 17 per cent **C** 32 per cent
   B 18 per cent **D** 69 per cent

3 In relation to your response to Question 2, what impact do you think this behaviour will have on these children and their relationship with organised sport as they enter adulthood?

4 **Explain** how learning occurs as a result of social relationships. Make reference to social cognitive theory in your response.

5 **Describe** two ways in which a parent can act as an enabler for equity and access in sport and physical activity.

Analytical processes

6 **Reflect on** the agents of socialisation who have had the greatest impact on your sport and physical activity access. Rank, in order of most influential, three social relationships that have been important in your sporting participation so far.

Knowledge utilisation

7 **Consider** the coaches you have had over the past few years of secondary school. **Assess** how supportive they have been in fostering a positive association with your selected physical activity. **Discuss** what they have done well and what they could do better.

8 Read "Theory in action: Agents of socialisation as barriers and enablers of physical activity" (page 317). **Evaluate** how agents of socialisation have acted as barriers and enablers to equity and access in physical activity for Ella and Liam Green. **Justify** your response.

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Lesson 5.13
Social factors that influence equity and access: The social construction of gender

Learning intentions and success criteria

Key ideas

- → The social construction of gender is the theory that society and culture create gender roles that are prescribed by many as ideal or appropriate for individuals of a particular sex.
- → The social construction of gender can act as a barrier or enabler to equity and access in sport and physical activity.

What is the social construction of gender?

social construction of gender the idea that society and culture create gender roles and that these roles (and the behaviours associated with them) are prescribed as ideal or appropriate for individuals of a particular sex

The **social construction of gender** is the theory that society and culture create gender roles and that these roles (and the behaviours associated with them) are prescribed as ideal or appropriate for individuals of a particular sex. In Australian society, some of the most important and influential attitudes and behaviours we learn through our interactions with other people (i.e. through socialisation) relate to the ways in which men and women are expected to act in society. As a result, the social construction of gender can play an important role in equity and access in sport and physical activity.

As discussed in Lesson 5.9 Personal factors that influence equity and access: Gender (page 308), gender is a term used to describe the combined product of a person's biological characteristics (i.e. their sex) with their social and cultural roles and identities, which are formed in response to their environment (e.g. through interactions with family, friends, teachers and coaches, religious institutions, the media, and so on). Gender is also used to refer to the characteristics of masculinity (traits often associated with men) and femininity (traits often associated with women) and – in particular – the socially valued and accepted ways of expressing masculinity and femininity.



SOURCE 1 Female participation rates in physically combative sports like rugby have grown substantially in recent years.

For this reason, we refer to gender as a "socially constructed" concept. This means that it is a concept created and perpetuated by society, rather than existing in nature. In other words, while we are *born* a particular sex, we *learn* what it means to be a particular gender. As a result, while there are just three biological sexes recognised under Australian law (i.e. male [M], female [F], and indeterminate/intersex/unspecified [X]), there are countless interpretations of what it means to be masculine or feminine.

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Gender is part of an individual's personal and social identity. It refers to the way a person feels, presents and is recognised within the community. A person's gender may be reflected in outward social markers, including their name, outward appearance, mannerisms and dress. A person's sex and gender may not necessarily be the same. Some people may identify as a different gender to their birth sex and some people may identify as neither exclusively male nor female.

Despite the existence of a range of different interpretations of what it means to be masculine or feminine – and changing social attitudes towards them in some sectors of the community – other sectors of the community prefer to hold on to more traditional views about what it means to be a woman and a man. To these sectors of the community, these new ideas are seen as "abnormal" or socially unacceptable.

Many of the more traditional views about what it means to be a man or a woman are narrow or exaggerated and include rules about the "proper way" that each sex should behave and act in society. These views and ideas are known as stereotypes. An understanding of gender as a social construct helps us to see that although stereotypes often seem "natural" or "just the way things are", they are really just a set of guidelines and expectations created by society. In fact, many sociological and historical studies have shown that behaviours considered to be masculine or feminine in certain countries and societies may be very different in other countries and societies. Similarly, these perceptions can vary over time in the same society.

Social construction of gender as a barrier and enabler

The social construction of gender can be either a barrier to or an enabler of equity and access in sport and physical activity. Consider how specific physical activities are often associated with particular attitudes and behaviours. For example, combat sports such as boxing are typically associated with displays of physical strength and aggression. These traits are often associated with men rather than women, which often results in boxing being thought of as a "masculine" sport. The social construction of gender and masculinity therefore acts as an enabler to participating in boxing if you are a man, but as a barrier if you are a woman. Similarly, if a man expresses traits that are traditionally regarded as "feminine" (such as gentleness and sensitivity) this can act as a barrier to engaging in sports that are traditionally regarded as "masculine".

For the record!

The term "intersex" refers to people who are born with genetic, hormonal or physical sex characteristics that are not typically "male" or "female". Intersex people have a diversity of bodies and gender identities, and may identify as male or female or neither.

Gender tends to be a strong enabler of access to a particular sport or physical activity when there is alignment between:

- the gender of the participant
- the gender that the sport or physical activity is commonly associated with
- the expression of this gender in a way that is in line with social norms.

For example, a girl who expresses "feminine" traits may find that her gender is an enabler to participation in ballet, as this is generally perceived as a "feminine" physical activity.

Conversely, gender tends to be a barrier to participating in a physical activity where there is a misalignment between a person's gender, gender expression and the stereotypes surrounding their chosen activities.

Retrieve it!

Justify a psychological technique to address a lack of motivation in sport. Check back to Lesson 4.9 Psychological techniques to optimise performance (page 238) to see if you retrieved the information correctly.

As sports often reflect society in general, it is important to point out that a number of gender stereotypes in sport have been broken down in recent years (see Source 1). However, you only need to look at the representation of male and female athletes in the media to notice that both sexes are still expected to adhere to established gender roles in many ways. One example of this is the official uniforms that male and female athletes are required to wear when competing. These often work to reinforce gender stereotypes rather than break them

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down. Tennis and beach volleyball are examples of sports where women are required to wear traditionally feminine outfits (such as skirts), or expose more of their bodies than their male teammates (see Source 3). For some women who choose to express themselves in ways that are not traditionally considered "feminine", a tight-fitting or revealing uniform can act as a significant barrier to participation. Similarly, women whose bodies may not match the physical ideals perpetuated by the media may also regard this as a barrier. To remove these barriers for both men and women, it is crucial that parents and coaches are aware of any potential gender stereotypes and prejudices. The removal of such barriers increases an individual's access to resources such as mental health support, like-minded friends and other support services.



SOURCE 2 Over the course of her career, Serena Williams faced criticism from certain commentators and media outlets who labelled her muscular physique "manly".





SOURCE 3 Although many gender stereotypes have been broken down in recent years, gender differences still exist, as seen in the official uniforms that male and female athletes are required to wear during competition. Official uniforms for men and women competing at the Olympic level in beach volleyball reflect traditional constructs of gender. Tight-fitting and revealing uniforms can act as a barrier to equity and access in this and other organised sports.

Check your learning 5.13

Check your learning 5.13: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. A stereotype can be defined as:
- **A** a detailed and accurate description of a person or group.
- **B** a belief that all members of a group share the same characteristics.
- **C** a positive and encouraging statement about someone's potential.
- **D** a unique and individual personality trait possessed by a single person.

2 Choose the correct answer. Gender can be a barrier for participating in physical activity when there is a misalignment between:
- **A** the person's gender, gender expression and the stereotypes surrounding their chosen activities.
- **B** the person's sex, ability and expectations.
- **C** the person's socio-economic status and access.
- **D** the person's values and goals.

3 In your own words, **explain** what is meant by the term "social construction of gender".

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4 **Identify** five gender stereotypes about:
   - girls and sport
   - boys and sport.

Analytical processes

5 **Analyse** your selected physical activity this term. **Consider** whether there are any particular rules, requirements or perceptions about the sport that influence (or are influenced by) the social construction of gender for males and females. Present your analysis in a written response of 300 words and provide evidence or examples to support your position.

Knowledge utilisation

6 Consider the uniform worn at an elite level for the sport that is the focus of your studies this term. Now consider the uniform worn by students participating in the same sport at your school for representative sport and in PE classes. **Evaluate** the choice of uniform at all three levels in terms of perpetuating the social construction of gender. Make recommendations for modifications to the uniform to enhance equity and access for all participants in this sport.

7 Take a position on the introduction of non-gender specific sport. Instead of gender divisions, should all sporting competitions be organised by weight, height and skill? **Justify** your response by drawing on appropriate sections from this module, plus additional secondary sources.

SKILL DRILL

Lesson 5.14
Investigate the impact of the social construction of gender

Aim

To assess the impact of uniforms on equity and access in physical activity

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks as homework

Equipment

- Equipment specific to your chosen physical activity
- Regulation school PE uniform
- Game Performance Assessment Instrument 12 (GPAI 12)
- Pen

Method

Step 1

Select one of the following physical activities: touch football, tennis or volleyball. Research the regulation uniform requirements for males and females at the professional level in your chosen sport.

Step 2

Conduct a warm-up and participate in your chosen physical activity for 10 minutes in your regular school PE uniform.

Template: Game Performance Assessment Instrument 12 (GPAI 12)

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Step 3

At the end of the 10 minutes, complete the "Performance" column of GPAI 12, rating your overall performance and your feelings of confidence, anxiety and concentration. You should also include a brief reflection of your experience.

Step 4

Imagine how your confidence, anxiety and concentration would be affected if you were performing in the regulation uniform for professional female athletes. Discuss these feelings with your fellow students, and record your findings in the "Discussion" column of GPAI 12. Include a brief reflection of your experience.



SOURCE 1 Official uniforms of men and woman competing at the Olympic level in beach volleyball.

	Performance				Discussion			
	Very low	Low	Moderate	High	Very low	Low	Moderate	High
Confidence								
Anxiety								
Concentration								
Overall performance	Poor	Okay	Good	Excellent	Poor	Okay	Good	Excellent
Reflection:								

SOURCE 2 GPAI 12

Analysis and discussion tasks

1 As a class, discuss the findings from this experiment.
   - **a** Are there any trends in the data that you can identify? **Discuss** what these trends are, and why they may have occurred.
   - **b** **Synthesise** your findings to determine whether there is a relationship between type of uniform and overall performance.

2 Uniforms can act as barriers to equity and access in sport and physical activity. As a class, explore the personal, social and cultural factors that inform the uniform regulations that require women to wear tight fitting and/or revealing clothes.
   - **a** **Compare** the two images of Olympic beach volleyball players (Source 1). Can you **generate** any reasons as to why the women are wearing tight fitting and revealing uniforms, while the men are wearing baggy singlets and shorts?
   - **b** Do you think that either uniform has an impact on the athlete's performance? **Justify** your answer.
   - **c** Do you think it is fair that the female volleyball players are dressed in more revealing uniforms than the male volleyball players, despite the fact that they are playing the same sport? In your discussion, refer to the levels of confidence, anxiety and concentration that you recorded in GPAI 12.

3 **Investigate** how the social construction of gender affects the rules and playing attire in sports. Record your findings, citing two secondary data sources.

4 **Devise** an equity strategy to help break down this barrier and increase access and engagement in sports. **Justify** your response using primary and secondary data.



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Lesson 5.15
Social factors that influence equity and access: Diversity

Key ideas

→ Diversity means difference. When used to describe people living in a society, it means empowering people by respecting the characteristics that make them different.

→ Diversity can act as a barrier or enabler to equity and access in sport and physical activity.

Learning intentions and success criteria

What is diversity?

In general terms, **diversity** simply means difference. However, when used to describe people living together in society, diversity takes on a much more complex and multi-dimensional meaning. It is one of the most significant social factors affecting participation rates in sport and physical activity. It is also an issue that people at all levels of society (at a personal, community, state and national level) have been working hard to address. In a social context, diversity is about:

- accepting that every person in society is unique
- recognising the characteristics that make people – and groups of people – within society different. These characteristics include (but are not limited to):
  - age
  - race and ethnicity
  - cultural identity
  - religious beliefs
  - gender identity and sexual orientation
  - physical and mental ability
  - socio-economic status
  - geographical location.
- empowering people by respecting and appreciating the characteristics that make them different
- working together as a group to value, celebrate and learn from each other's differences
- understanding and learning from each other – moving from simply tolerating those who are different to embracing and celebrating those differences and becoming a stronger, more cohesive society as a result
- developing a mutual respect for qualities and experiences that are different from our own
- recognising that all forms of discrimination (i.e. at the personal, club, school or government level) create advantages for some people in society while creating disadvantages for others
- working together to remove all forms of discrimination.

It is important to note that all the points listed above apply equally to the context of sport and physical activity as they do to society in general.

diversity a term used to describe difference; when used to describe people in a society, diversity means empowering people by respecting and appreciating the characteristics that make them different (e.g. age, sex, race, ethnicity, religious beliefs, gender, sexual orientation, socio-economic status, physical and mental ability, geographical location)

For the record!

Australia is one of the most culturally diverse countries on Earth. The 2021 Census figures revealed that:

- 7.7 million Australian residents were born overseas – that is nearly 30 per cent of our population
- one in five Australians have at least one parent born overseas
- twenty-two per cent of Australians speak a language other than English at home.

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Diversity as a barrier and enabler

Diversity plays a significant role in equity and access in sport and physical activity. Acknowledging the different characteristics that make individuals unique and celebrating them is key to enabling positive engagement in sport and physical activity.

When physical activity and sport is accessible for everyone, it can be an extremely effective vehicle for strengthening communities. However, factors such as racism, sexism and homophobia can also create barriers to equity and access for some people. A range of brief examples of the types of barriers and enablers experienced by people based on their particular differences is provided in Source 1.

When consideration is given to the diversity of interests, abilities, ethnicities and genders of the Australian population, there is a greater chance of providing people with opportunities they find personally meaningful and that are relevant to their personal circumstances. This enables their participation and unlocks their access to personal, social and community resources. Conversely, when a one-size-fits-all approach is taken to the provision of opportunities, the result is likely to be the creation of barriers to engagement because of a lack of personal meaning and relevance.

Characteristic	Definition	Brief examples of barriers and enablers to participation in sport and physical activity
Age	The length of time a person has been alive	A person's age can act as both a barrier and an enabler to participation. For example: • a lack of opportunities for older people (e.g. clubs and facilities offering appropriate activities) can act as a barrier • community programs, government funding campaigns and events designed to engage older people in sport (e.g. Australian Masters Games) can act as enablers.
Race and ethnicity	The physical characteristics that a person has, and/or the cultural traditions, history, language and shared experiences of a group to whom a person belongs or that they identify with	A person's race and ethnicity can act as both a barrier and an enabler to participation. For example: • in 2019–21, 17 per cent of complaints made to the Australian Human Rights commission related to the *Racial Discrimination Act 1975*. Discrimination against people based on their race or ethnicity, whether direct (i.e. in person) or indirect (e.g. in the media), can act as a barrier. • community programs and national events designed to educate the public on racial and cultural diversity (e.g. Harmony Day and the annual AFL and NRL Indigenous Rounds) and eliminate racial discrimination. These factors act as enablers.
Cultural identity	The ideas, customs, language and social behaviours of a particular people or society that a person belongs to or identifies with	A person's cultural identity can act as both a barrier and an enabler to participation. For example: • people from different cultural and language groups who have recently arrived in Australia can find it difficult to access sport and physical activities because they are unfamiliar with the language and culture, and they lack social networks (e.g. friends and family). These factors can act as barriers. • many cultural groups have their own sporting traditions and community organisations that offer opportunities for people from those cultures to participate in a range of sporting and cultural activities. These factors act as enablers.

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Characteristic	Definition	Brief examples of barriers and enablers to participation in sport and physical activity
Religious beliefs	The system of faith and worship	A person's religious beliefs can act as both a barrier and an enabler to participation. For example: • certain religions place restrictions on the types of physical activities that adherents can participate in and the types of clothing they are able to wear. Alternatively, people from some religions may be made to feel unwelcome at certain sporting clubs. These factors can act as barriers. • many religions promote healthy lifestyle choices in their teachings. They also commonly organise and encourage participation in a range of group sporting and cultural activities for their followers. These factors can act as enablers.
Physical and mental ability	The ability of a person to carry out physical activities and the degree to which they possess the power to learn and retain knowledge	A person's physical and mental ability can act as both a barrier and an enabler to participation. For example: • people with a physical or mental disability can experience difficulties accessing traditional sporting events. In many cases, facilities and equipment do not cater to their specific needs, funding for programs may not be provided and they may experience discrimination. These factors are all barriers. • many sporting clubs, competitions and programs are now focusing on including people with different physical and mental abilities. Many clubs are also improving facilities and offering more programs designed to meet the needs of all. National and international sporting events also help to break down stereotypes and educate the public (e.g. the Commonwealth Games integrating disabled and non-disabled athletes). These factors are all enablers.
Gender identity and sexual orientation	The sexual identity of a person and the gender they are attracted to (e.g. lesbian, gay, bisexual, transgender, intersex and other sexuality, sex and gender diverse people [LGBTQ+])	Gender identity and sexual orientation can act as both a barrier and an enabler to participation. For example: • discrimination directed at people on the basis of their sexual orientation (such as homophobia) by teammates, coaches or spectators can act as a barrier • sporting clubs and competitions established by LGBTQ+ people and community groups that are inclusive and welcoming to all people (e.g. Gay Games) can act as enablers.
Socio-economic status	The economic and social position of a person (and a person's family) in relation to others based on level of income, education and occupation	Socio-economic status can act as both a barrier and an enabler to participation. For example: • ABS data shows that people living in low-income households with low education levels and unskilled employment are the least likely to participate in sport and physical activity; these people do not have the financial means to participate in sports of their choice, so these factors act as barriers • ABS data shows that people living in high-income households with high education levels and skilled employment are the most likely to participate in sport and physical activity; these people have the financial means to participate in sports of their choice, so these factors act as enablers.
Geographical location	The place where a person lives and the types of resources (e.g. shops and sporting facilities) that are available there	A person's geographical location can act as both a barrier and an enabler to participation. For example: • people living in rural or remote areas may have fewer opportunities and access to sporting clubs and sporting facilities. There may also be a lack of qualified coaches and training staff available. These factors act as barriers. • people living in urban areas (i.e. cities and large towns) may have greater access to a broader range of sporting clubs and sporting facilities. Similarly, people living in rural locations close to natural environments ideal for certain sports (e.g. the ocean, mountains, rivers) may have greater opportunities to engage in physical activities that make use of these environments. These factors act as enablers.

SOURCE 1 Diversity is about recognising the characteristics that make people different. All these characteristics can act as barriers and enablers to equity and access in sport and physical activity.

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SOURCE 2 The Gay Games is a worldwide sporting and cultural event that promotes sexual diversity and inclusion. It is open to all people regardless of ability or sexual orientation. Events such as the Gay Games act as enablers to equity and access for LGBTQ+ people.



SOURCE 3 Each year, the AFL and NRL honour and celebrate First Nations players and cultures through the Indigenous Round (pictured here are AFL players during the Sir Doug Nicholls Round). Events such as this educate the public on the benefits of diversity and act as enablers to equity and access for First Nations people.

Theory in action Diversity in the news

It is important for sport and recreation organisations to reflect Australia's diversity and multicultural population. The media often addresses contemporary issues that have an impact on diversity and inclusion in sport. Research "diversity in sport" to read more about the latest news articles covering diversity issues such as those shown in Source 4 and Source 5.



SOURCE 4 The Queer Sporting Alliance (QSA) – the largest LGBTQIA+ sporting club in Australia and New Zealand – runs a basketball tournament open to athletes of any gender identity.



SOURCE 5 Western Bulldogs AFL player Jamarra Ugle-Hagan responded to racial abuse from spectators at a game in 2023 by pointing to his skin, mirroring the famous gesture by St Kilda player Nicky Winmar in similar circumstances in 1993.

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Check your learning 5.15

Check your learning 5.15: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. What percentage of Australians speak a language other than English at home?

A 9 per cent

B 16 per cent

C 20 per cent

D 22 per cent

2 Using the table below, **identify** three characteristics of diversity in the Australian population and provide an example of how each one acts as a barrier to equity and access and an enabler to equity and access in sport and physical activity.

Characteristic	Barrier	Enabler

Analytical processes

3 **Critique** your school's provision of access to physical activity for students with a disability. Are these students given equitable access to the personal and social resources gained through physical activity as non-disabled students? If not, make suggestions for how barriers to participation could be removed.

Knowledge utilisation

4 Research news and journal articles relating to discrimination based on race, gender identity or sexual orientation.

a **Assess** whether you believe that this issue should be addressed at one or more of the following levels: personal, social or cultural.

b Based on your position, **develop** a strategy to encourage greater inclusivity consisting of up to five dot points.

c **Outline** how this strategy would act as an enabler for the affected individuals to better access and engage with physical activity.

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SKILL DRILL

Lesson 5.16
Analyse the role of social factors on access

Aim

To devise equity strategies that overcome the social factors that act as barriers to access and engagement

Time

One lesson (60 minutes) with additional time to complete analysis and discussion tasks

Equipment

- Dodgeball
- Cones (for boundary and mid-court line)
- Whistle
- Stopwatch
- Dodgeball rules (available to download)
- Game Performance Assessment Instrument 13 (GPAI 13)
- Pen

Dodgeball rules

Template: Game Performance Assessment Instrument 13 (GPAI 13)

Method

Form two teams. In this two-part experiment, you will be playing dodgeball with two major modifications to the playing conditions:

- Team A will be notified of one major rule change (*Note to teacher:* ideas for this rule change are available for download).
- Team B will be unaware of this rule change and will not be allowed to talk during play.

Step 1

In your teams, start a 10-minute warm-up and practice period. Team A is advised about the rule change by the teacher, and can discuss their team strategy during the warm-up.

Meanwhile, Team B completes a standard warm-up at a distance from Team A, far enough away that they cannot hear Team A's strategy.

Step 2

Play one full game of dodgeball under the playing conditions outlined above.

Step 3

Stop and complete the Condition 1 column of GPAI 13. Reflect on your levels of autonomy, relatedness and competence, which are all indicators of motivation for participation in physical activity. Provide a score for your overall performance and add a reflection on your experience.

Step 4

Repeat steps 1 and 2; however, this time, your teacher will provide a different rule change.

This time, Team A is unaware of the rule change and is not permitted to speak during play, while Team B knows the rule change and has no constraints.

Step 5

Stop and complete the Condition 2 column of GPAI 13.

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	Your team: _____							
	Condition 1 (major rule change no. 1)				**Condition 2 (major rule change no. 2)**			
	Poor	Ok	Good	Excellent	Poor	Ok	Good	Excellent
Your level of autonomy								
Your level of relatedness								
Your level of competence								
Overall performance	Poor (Score 1)	Okay (Score 2)	Good (Score 3)	Excellent (Score 4)	Poor (Score 1)	Okay Score 2)	Good (Score 3)	Excellent (Score 4)
Reflection								

SOURCE 1 GPAI 13

Analysis and discussion tasks

1 **Determine** the average overall performance rating for your team, per game.
   - **a** To work this out, divide the total team score by the number of people in the team (e.g. if there are 10 team members and their overall performance scores in game 1 totalled 23, the average overall performance score for that game is [23 ÷ 10 =] 2.3).
   - **b** Use a bar graph to present:
     - your individual overall performance scores from games 1 and 2
     - your team's overall performance scores from games 1 and 2.

2 Use your graph to identify the impact of the equity constraint on motivation and performance.
   - **a** **Compare** and **contrast** the primary data from game 1 to game 2 for your individual performance and your team's performance.
   - **b** **Identify** any relationships between your levels of competence, relatedness and autonomy, and your overall performance.
   - **c** Suggest possible reasons for differences (if any) between your individual results and your team's average result in this Skill drill, referring to individual, social, cultural or environmental factors.

3 **Synthesise** primary and secondary data to answer the following questions.
   - **a** **Discuss** how the experience of some of your class members today might mirror the experience of culturally and linguistically diverse (CALD) members of society trying to access organised sport or physical activity.
   - **b** What conclusions can be drawn about the relationship between language as a barrier and enabler for sports participation of CALD citizens?

4 **Devise** an equity strategy to overcome the way that language acts as a significant barrier to access and engagement in physical activity.
   - **a** **Justify** your decision using at least two secondary sources.
   - **b** If your equity strategy was to be implemented in your school setting, predict how effectively it would increase levels of positive engagement for CALD students. Consider personal, social and community resources in your response.

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Lesson 5.17
Social factors that influence equity and access: Physical activity preferences

Learning intentions and success criteria

Key ideas

- → Physical activity preferences refer to the types of sports and physical activities that we choose to participate in.
- → Physical activity preferences can act as a barrier or enabler to equity and access in sport and physical activity.

What are physical activity preferences?

physical activity preferences the types of sports and physical activities that we choose to participate in (i.e. the sports we have a natural preference for over other sports)

Physical activity preferences refer to the types of sports and physical activities that we choose to participate in (i.e. the sports we have a natural preference for over other sports). On a personal level, we tend to be drawn to sports and physical activities based on factors such as our personality, genetics and personal abilities. On a social level, the sports we often develop a liking for tend to be the same as those that are popular and/or considered appropriate by the agents of socialisation in our lives (i.e. our parents and siblings, friends, teachers and coaches).

It is important to note that physical activity preferences are influenced by more than just our own personal likes and dislikes or the opinions of our friends and family. In fact, they are a result of many other factors such as:

- **culture** – certain sports have evolved over centuries to play an important cultural role in particular communities and countries, and have become a source of pride (e.g. wrestling is a sport central to Turkish culture and winter sports such as skiing are culturally significant in Scandinavian countries)
- **environment** – weather conditions in certain countries are more or less suited to particular sports and have an impact on what becomes popular (e.g. water sports such as surfing and swimming have higher participation rates and are more popular in Australia than snow sports)

Retrieve it!

Explain how social factors affecting equity and access to physical activity can influence personal factors. Check back to Lesson 5.7 Personal factors that influence equity and access: Personal ability (page 302) to see if you retrieved the information correctly.





SOURCE 1 Physical activity preferences are influenced by more than just our own personal likes and dislikes or the opinions of our friends and family. In fact, they are a result of many other factors, including environment.

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- **history** – certain sports have developed over time in particular places. These traditions are passed on from one group to another and evolve over time (e.g. the popularity of cricket in countries such as Australia and India are the result of our colonial ties to England).

Physical activity preferences can also vary on many different levels, including at:

- a personal level – from one person to another
- a social level – from one family to another, or from one group of friends to another
- an institutional level – from one school to another, or from one company to another
- a regional, national and international level – from one region or state to another, or from one country to another.

Physical activity preferences as a barrier and enabler

If a person's preference for a particular sport aligns with the preferences of people in their life whom they consider important (and whose opinions they value), it can be an enabler for engagement in that sport. For example, if a girl is naturally interested in playing soccer, and her family and friends are also interested in soccer, this shared affinity (i.e. preference) can generate feelings of belonging and acceptance that act as an enabler for engagement. It can increase access to resources such as confidence and socialisation with others.

On the other hand, if a person's preference does not align with the preferences of the people in their life whom they consider important (and whose opinions they value), it can be a barrier for engagement in that sport. For example, if the same girl is naturally interested in playing soccer, but her family and friends insist that it is an inappropriate sport for girls and instead have a preference for tennis, this creates a barrier to equity and access.



SOURCE 2 Feelings of belonging and acceptance can act as enablers for participation in sport.

Check your learning 5.17

Check your learning 5.17: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. An example of a social factor that helps shape our physical activity preferences is:
   - **A** encouragement from siblings.
   - **B** our personality.
   - **C** a sport being generationally popular.
   - **D** our genetics.

2 **Identify** the factors that influence our physical activity preferences at:
   - **a** a personal level.
   - **b** a social level.
   - **c** an institutional level.
   - **d** a national level.

Analytical processes

3 **Consider** whether your own physical activity preferences have acted as barriers or enablers to equity and access in the past. Was there ever a time when you passed up an opportunity to participate in a sport you were interested in because the sport was not popular or considered appropriate by friends or family members? **Explain** using examples to illustrate your point.

4 Conduct some research to **determine** why rugby league is played in Queensland and New South Wales more commonly than Australian football. **Consider** the reasons for this preference.

5 **Evaluate** the popularity of your current physical activity at your school. **Determine** the likelihood that you would participate in this sport at school (you may already) and **justify** whether the physical activity preferences of your peers have had an influence on your decision.

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Lesson 5.18
Cultural factors that influence equity and access

Learning intentions and success criteria

cultural factors a range of influences at a cultural level that can act as barriers or enablers to participation in sport and physical activities (e.g. influences nationally and internationally such as population changes, the role of institutions such as the government, the church and the mass media)

Retrieve it!

Use the social factor of diversity to explain how equity can affect access to sport and physical activity. Check back to Lesson 5.15 Social factors that influence equity and access: Diversity (page 325) to see if you retrieved the information correctly.

Key ideas

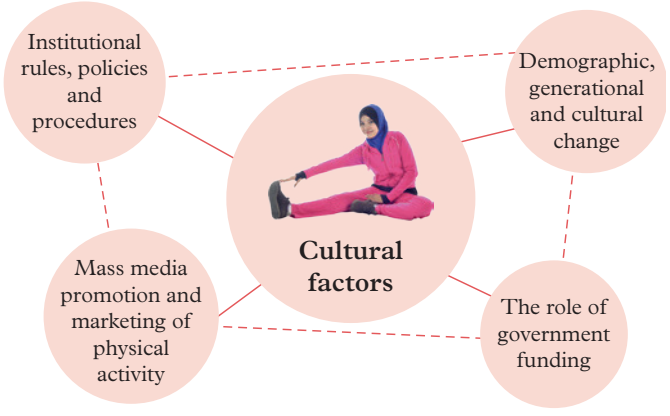
→ Cultural factors include a range of influences at a cultural level that act as both barriers and enablers to equity and access in sport and physical activity.

What cultural factors act as barriers and enablers?

There are many **cultural factors** that act as barriers and enablers to equity and access in sport and physical activity. Cultural factors include a whole range of influences at a cultural level (e.g. national and international influences such as population changes, the role of institutions such as the government, the church and the mass media). Some of the most important cultural factors that influence access include:

- **demographic, generational and cultural change** – the changes that take place at a national and international level that affect engagement in certain sports and physical activities (e.g. changes in popularity of certain sports over time or in certain sectors of society)
- **government funding** – the amount of government money allocated to certain sports over others and the promotion of certain sports over others
- **mass media promotion and marketing of physical activity** – the messages and information that the mass media chooses to promote about certain sports over others
- **institutional rules, policies and procedures** – the roles that organisations (e.g. schools, sporting clubs, companies) play in promoting certain sports and physical activities.

In the lessons that follow, we will look at each of these factors in detail and examine how they act as barriers and enablers to personal, social and community resources for different people. Although we will be learning about each factor separately, it is important to keep in mind that – in reality – these cultural factors are acting on us (i.e. affecting our decisions and behaviours) simultaneously. These factors can affect one another (for example, generational change can affect policies; policies can draw media attention; mass media can influence government funding, and so on). Not only that – we are also almost always influenced by a combination of other factors at the personal, social and environmental level at the same time.



SOURCE 1 A range of different cultural factors play a role in an individual's access to the available personal, social and community resources found in sport and physical activity participation.

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Lesson 5.19
Cultural factors that influence equity and access: Demographic, generational and cultural change

Key ideas

→ Demographic, generational and cultural changes are those that take place within human populations.

→ Demographic, generational and cultural change can act as barriers and enablers to equity and access in sport and physical activity.

Learning intentions and success criteria

What are demographic, generational and cultural changes?

Demographic, generational and cultural changes are all terms used to describe changes that take place within human populations. A population refers to a group of people who live in the same place (such as a town, city, regional area, country or even a planet). Because populations are made up of individuals, they are constantly changing. People join populations by being born into them or joining them from other places, and people leave populations by dying or moving away. These changes are all cultural factors affecting participation in sport and physical activity.

Although demographic, generational and cultural change are all related terms that describe changes that take place within populations – and are often used interchangeably – they each have a distinct meaning.

- **Demographic change** is a general term used to describe changes in the size, age, composition and structure of a population. In fact, "demography" is a word that comes from ancient Greek and literally means "describing the population". Common demographic changes that can have an impact on engagement in sport and physical activity include age, sex, income, employment and education.
- **Generational change** is a term used to describe the changing tastes, influences and preferences that take place within a population over time. A generation is defined as the average period (generally considered to be about 30 years) in which children grow up, become adults and have children of their own. As generations of people in a population age and die, and as new generations follow them into adulthood, values, styles, attitudes, interests and trends change in response to a number of factors (such as the environment, the economy and social, cultural and historical events).
- **Cultural change** is a term used to describe the changing levels of cultural diversity that take place within a population over time. As people of different cultural and ethnic backgrounds join a population over time, the culture of that population often changes with them. Data collected by the **Australian Bureau of Statistics (ABS)** in 2022 shows that 29.3 per cent of people living in Australia were born overseas, an increase from 26.4 per cent in 2016. The different cultural traditions, languages, preferences, beliefs and values of those people influence the overall culture of Australia over time.

demographic change a general term used to describe changes in the size, age, composition and structure of a population

generational change a term used to describe the changing tastes, influences and preferences that take place within a population over time

cultural change a term used to describe the changing levels of cultural diversity that take place within a population over time

Australian Bureau of Statistics (ABS) an independent statistical agency of the government of Australia that provides key statistics on a wide range of economic, population and social issues (including information on sport and physical activity trends)

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Demographic, generational and cultural change as barriers and enablers

The population of Australia, and indeed many developed countries, is undergoing a significant transformation. Demographic trends point towards an ageing population and a growing cultural diversification. These changes will inevitably reshape the landscape of sport and physical activity in Australia. We will now look at the implications of these demographic and cultural shifts, exploring how they are likely to act as barriers and enablers to equity and access by influencing the types of sports we participate in, how we participate and the very nature of sporting organisations themselves.

Demographic change

Older people make up a considerable proportion of Australia's population. A person's age can act as a barrier or an enabler to participation. According to census data collected by the ABS, in 2020 there were an estimated 4.2 million older Australians (aged 65 and over) – 16 per cent of Australia's population. This number is set to grow, with increasing lifespans and lower birth rates leading to an ageing population. In fact, the Australian Government Intergenerational Report (2023) projected that Australia's population will continue to age over the next 40 years, with the number of Australians aged over 65 expected to double in that time. Source 2 also shows the significant increase in older people in Australia over the past 100 years, including future projections.

Involvement in organised sport and physical activity generally decreases with age. For example, in 2022, people aged 15–19 years had the highest rate of sport-related participation (61 per cent). In comparison, people aged 55 years and over had the lowest rate of sport participation (31 per cent). Age in this sense acts as a barrier.



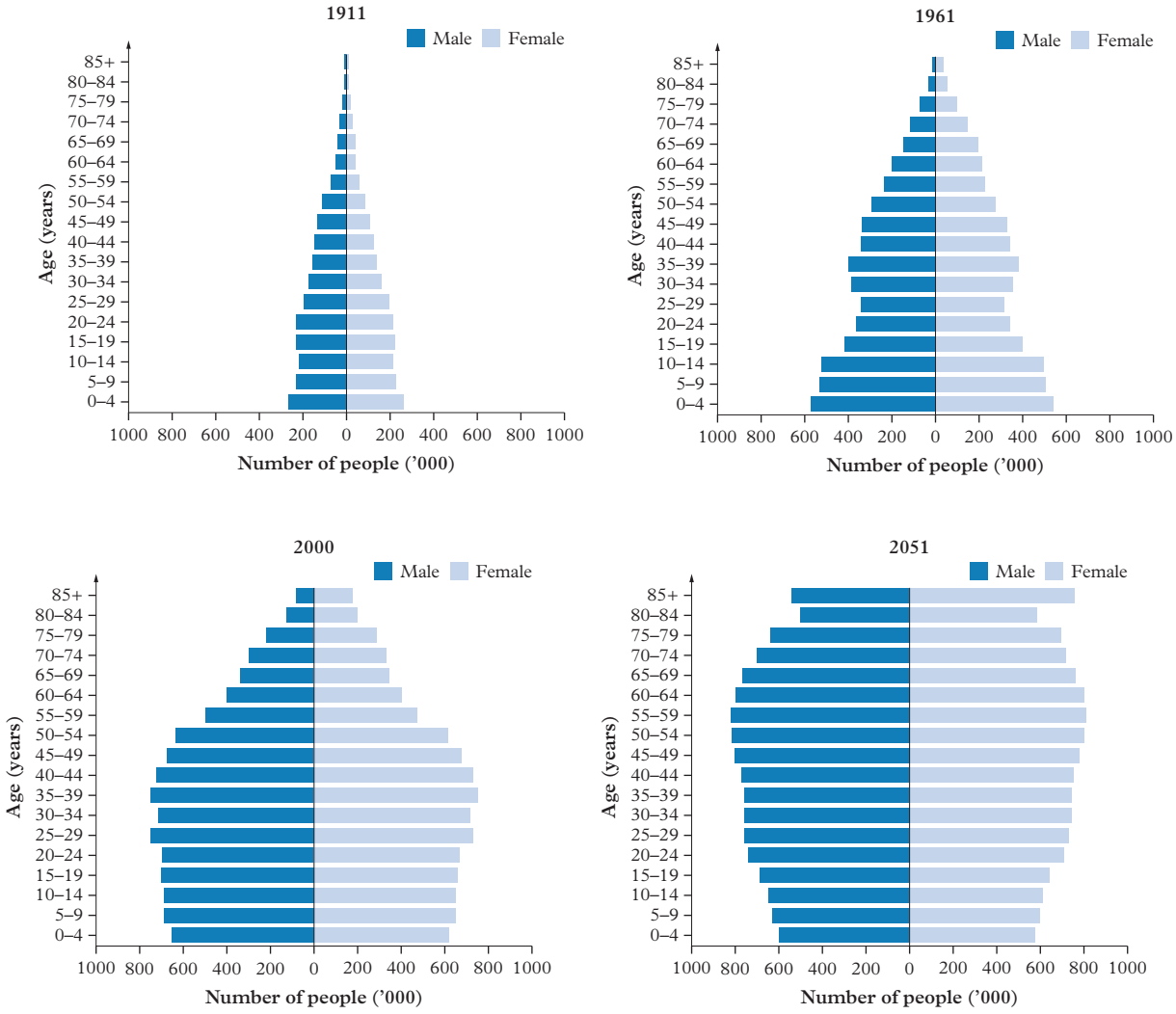
SOURCE 1
Demographic, generational and cultural changes are all factors used to analyse and describe changes that take place in human populations over time. These are all cultural factors that can affect equity and access in sport and physical activity.

While older citizens have traditionally preferred non-organised recreational activities (such as swimming and walking), a significant proportion of this group is now seeking greater access to competitive sport, including a sport rising in popularity – pickleball. This is reflected in the growing number of older citizens competing in masters-level competitions (i.e. competitions for those aged 35+), where Australia ranks as one of the highest participating nations worldwide. This attitude held by older Australians helped our country secure the rights to host the Masters Games in 2029. Access to organised events has ensured continued growth in such events will further enable this trend.

In contrast, younger generations are increasingly participating in entertainment sports and using technology to monitor their exercise. The rapid rise in popularity of entertainment sports, which include digital sports (e-sports) and urban/adventure sports, has sparked controversy, with many traditionalists claiming this class of sport does not satisfy traditional definitions of sport. The surge in e-sports can be largely attributed to the increased exposure of such content through streaming and on-demand media services. E-sports, offering entirely virtual competitions and experiences, have exploded in popularity and even acted as substitutes for real-world sporting events during the COVID-19 pandemic. Similarly, urban and adventure sports, once niche activities, are grabbing the attention of a new generation, thanks to their growing visibility on streaming platforms.

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SOURCE 2 These population pyramids shown how the age and sex structure of Australia's population has changed since 1911, and projects further changes to 2051. Source: Australian Institute of Family Studies

Australians are heavy users of technology, for both everyday work and leisure. While this can be a significant barrier to engagement in physical activity, it can also be an enabler. For example, the use of fitness devices such as smart watches and fitness apps to monitor, track and record physical activity can educate and motivate young people to engage in such activity. Accessing physical activity through technology can unlock personal, social and community resources for individuals, for example, online friendships to help maintain motivation.

Gender is another changing demographic factor that can act as a barrier and enabler to resources through sport and physical activity. In the past decade, both men and women have been participating in sports and physical activity at similar rates. Women have traditionally favoured non-organised physical activity and men were more likely to participate in organised sports. Following the COVID-19 pandemic, organised sports participation has remained steady, but participation in non-organised sports has increased greatly, with many appreciating the flexibility such physical activity offers.



SOURCE 3 Older Australians are now staying active for longer, with an unprecedented number seeking to be involved in competitive sport.

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SOURCE 4 Technology can act as either a barrier or an enabler to engagement in physical activity, depending on how individuals use it.

There is an opportunity for local and state governments to work with this growing trend and provide additional resources for populations experiencing barriers, such as the elderly, remote and regional Australians, people with disabilities and First Nations people.

In recent years, increases in the cost of living have affected many Australian families. Income is a barrier and an enabler to engagement in sports and physical activity and the personal, social and community resources subsequently available through such participation. Children, adolescents and adults from lower socio-economic backgrounds tend to have lower physical activity levels compared to those from high-income backgrounds. Limited resources can make it difficult to afford gym or club memberships, equipment or transportation to sporting events. Additionally, those in lower income brackets may have less leisure time due to working multiple jobs or longer hours. The Queensland Government has attempted to address this equity dilemma by introducing FairPlay sporting vouchers for Queensland families. This equity strategy aims to offset some of the costs acting as barriers to families who would otherwise be able to engage in sporting activities.

Generational change

Australia's sporting landscape constantly evolves as new generations emerge with different preferences and priorities. Generational change refers to the distinct characteristics, attitudes and experiences that shape each age group.

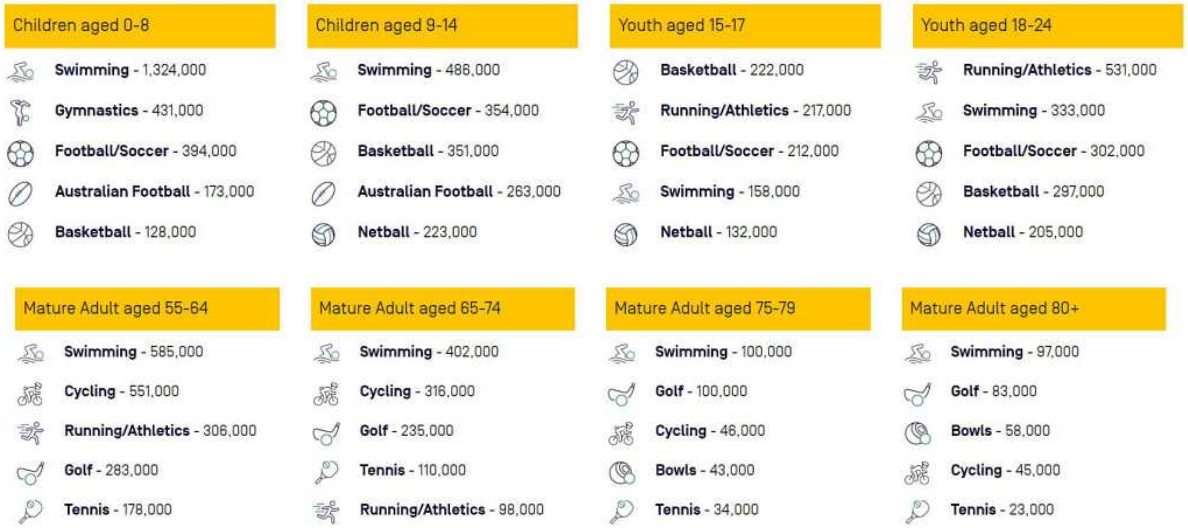
For example, Baby Boomers (born 1946–1964) often grew up with a strong emphasis on traditional and competitive team sports, and now in their older years are embracing sports such as lawn bowls, golf and pickleball to meet their needs for competition. Millennials (born 1981–1996), on the other hand, may prioritise individual activities such as running or yoga that offer flexibility and cater to their busy lifestyles. Generations Z and Alpha, born after the mid-1990s, present a unique shift in sports participation. They tend to engage in more sedentary activities, spending significant time on screens, which can be a barrier for these groups to access the many resources on offer through participation in sports and physical activity.

A report compiled by the Australian Government in 2022 on the future of Australian sport found that a significant proportion of Australian youth stop participating in sports in their high school years (13–17 years old). Understanding these evolving preferences is crucial for sporting organisations and policy makers to ensure they continue to offer engaging and accessible options for all Australians to stay active throughout their lives.

As well as affecting participation rates on the whole, the changing age of a population also influences the types of sports that are played and how these sports are organised. Source 5 shows the most popular sport-related activities in Australians aged under 24 and over 55.

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SOURCE 5 The changing sport-related participation preferences of Australians as they age

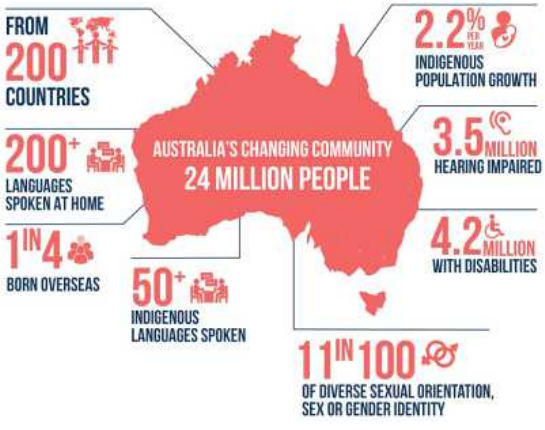
Cultural change

Since 1945, more than 7.5 million people have settled in Australia from countries overseas, helping to establish it as one of the most culturally diverse countries in the developed world. In 2022, the ABS estimated that 29.5 per cent of Australia's population was born overseas. As of June 2023, the annual population growth was 624 100 people (2.4 per cent); of these, 106 100 were attributed to natural increase, and 518 100 were people migrating to Australia.

The increasing numbers of Australians who were born overseas has a significant effect on the way we access sport as a nation. As Australia becomes more culturally and ethnically diverse, the types of sports we are interested in as a nation evolve and change.

As people from different parts of the world settle in Australia, we must try to offer access to new types of sports and physical activities that people from those cultural backgrounds will want to participate in. Different cultures have different sporting preferences. Australian sporting organisations need to accommodate people with different recreational interests and habits; otherwise, a lack of suitable opportunities will act as a barrier to engagement for those coming here.

Sporting clubs and organisations also need to make an effort to welcome newcomers who have not previously been exposed to popular Australian sports. Offering introductory courses and events to teach newly arrived Australians the rules of popular sports and the etiquette that surrounds them is key – this is further explored in the following news article. This is particularly the case for adults who may have missed the opportunity to develop fundamental motor skills during childhood due to extreme hardships, such as famine and war, in their home countries. The fact that introductory sport programs usually only target children is a barrier to equity and access for these adults. Factors that increase their access have ongoing benefits through unlocking personal, social and community resources, such as self-confidence.



SOURCE 6 The demographic of communities in which sport operates in Australia has changed dramatically over the past decade.

Source: Australian Sports Commission

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In the news

Aquaversity – a "learn to swim" initiative removing barriers for Sudanese Australians

Glennie eNews, 18 May, 2018

Toowoomba swim school, The Glennie Aquatic, are celebrating national success after being awarded the Swim Australia's Outstanding Community Service Award for their latest swim program initiative, Aquaversity – a learn-to-swim program aimed at giving Sudanese Australians the opportunity to develop the essential life skill.

Run in partnership with the Royal Life Saving Society Queensland Inc, Toowoomba Regional Council and the Toowoomba African Community, Aquaversity commenced in September 2017 and was also held in the 2018 January school holidays.

"We have quite a few schools that use our Centre for swimming lessons and swimming carnivals, and our instructors notice the alarming number of Sudanese children either frightened of the water or simply not confident in basic swimming skills. Sadly, this becomes more of an issue when the parents and families of these children are also not confident in or around water," said Shannon Townsend, Centre Manager for Glennie Aquatic.

Local African Women's Association advocate Sisilia Ajang works closely with members of her community sharing opportunities to integrate into the Toowoomba community and the Australian lifestyle. Sisilia spread the word about Aquaversity, and as a result, the instructors introduced 15 babies to their first learn to swim experience, 70 children aged 3 to 17 experienced learn to swim classes and 12 adults were welcomed to the pool environment.

Through programs like this, participants get to be involved in a popular Australian sport, experience achievement in a supportive and inclusive environment and learn a skill for life.



SOURCE 7 The Aquaversity program has given some members of the Sudanese Australian community access to the physical activity of swimming, a sport they had little access to previously.

Check your learning 5.19

Check your learning 5.19: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. What percentage of Australia's population was born overseas?
   - **A** Less than 10 per cent
   - **B** 10 to 20 per cent
   - **C** 21 to 30 per cent
   - **D** More than 30 per cent

2 Choose the correct answer. Which sport features as a top-five participation sport across all age ranges from 0 to 85+?
   - **A** Cycling
   - **B** Swimming
   - **C** Running/Athletics
   - **D** Tennis

3 **Describe** some of the main demographic changes taking place in Australia at the moment.

4 **Identify** how old age can be both a barrier and an enabler for equity and access in physical activity. Provide examples to support your response.

Knowledge utilisation

5 Using the information provided and additional data gathered online, **predict** how demographic, generational and cultural change in Australia will affect access to sport and physical activity over the next 100 years. **Justify** your response, using examples.

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Lesson 5.20
Cultural factors that influence equity and access: Government funding

Key ideas

- → Government funding is any money given by the government to non-government institutions.
- → Government funding can act as a barrier or enabler to equity and access in sport and physical activity.

Learning intentions and success criteria

What is government funding?

Government funding is any financial assistance (i.e. money) from the government given to non-government institutions in the form of local, state or federal grants, loans, property or other assistance.

government funding any financial assistance (i.e. money) from the government received by non-government institutions in the form of local, state or federal grants, loans, property or other assistance

One of the primary roles of any government is to collect funds (e.g. in the form of taxes) and determine how these funds should be distributed for the greater good of the people. There are many government departments, agencies and public sector organisations in Australia. Many of these are owned and operated by the government and exist to provide services for all Australians, including opportunities to participate in sport and physical activity. These organisations regularly compete for government funding to ensure they have the money they need to provide the types of services and facilities for the people and communities they serve.

Government funding as a barrier and enabler

The total amount of government funding allocated to sport and physical activities can act either as a barrier or an enabler to equity and access in sport and physical activity.

Governments at a federal, state and local level regularly make decisions about how our taxes are spent. They do this based on the likelihood of receiving some kind of return on that investment. For example, most Australians would agree that it makes sense to spend money on education, health, job creation and infrastructure (such as roads, public transport or power stations) as these are necessary to keep the country moving forward. The case for investing government funds in other areas can sometimes be more controversial though, as the potential benefits of spending this money may not be obvious to all Australians. Government funding to support sport and physical activity is one such area.

The Australian Sports Commission (ASC) is the government-controlled organisation responsible for investing in sport at all levels; it decides how funds will be distributed to national sporting organisations (NSOs) to support both performance and participation pathways. In addition to this, the Australian Institute of Sport (AIS) funds elite athletes through scholarships and training programs. Although many people agree that government funding for sport and physical activity is necessary, the amount of funding and the ways in which it is shared can often be a source of disagreement.

Retrieve it!

List four social factors influencing equity and access to sport and physical activity. Check back to Lesson 5.11 Social factors that influence equity and access (page 313) to see if you retrieved the information correctly.

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SOURCE 1 Significant government funding will be invested in the Brisbane 2032 Olympics.

Study tip

When making a presentation to the class, consider multimodal forms of digital storytelling. In creating your story, weave together video, photos, narration and print to enhance the message you are sending. Music and sound effects can help add a dramatic or emotional impact, which draws the audience into the story you are telling.

Historically, the majority of government funding for the sports sector has been allocated to high-profile, elite-level and high-performance sports. This funding supports and develops Australian sporting talent and makes it possible for elite athletes to compete successfully at a national and international level. Often, this helps to inspire other Australians and in turn acts as an enabler to engagement at an amateur level.

Governments are often trying to raise Australia's sporting profile through this investment. However, in a post-COVID world amid global economic pressures and new emerging megatrends (see Lesson 5.26 Emerging megatrends in physical activity in Australia, page 359), the shape of Australian sport funding is changing. There is still a strong emphasis on Olympic, Paralympic and Commonwealth Games sports; however, NSOs are being more heavily scrutinised to ensure that there is accountability in how the funding is being spent.

Australians continue to ask questions about the amount of funding that is allocated to "big ticket" sporting events such as the Commonwealth or Olympic Games. Early estimates reveal that the Brisbane Olympic Games in 2032 will cost around AUD$7 billion, with funding split between the federal government and the Queensland State Government.

While these costs are extremely high, the preparation for and hosting of such high-profile sporting events creates employment and tourism opportunities that not only benefit the economy of the region but also achieve a flow-on effect, enabling increased sports participation rates.

Funding is perhaps one of the most straightforward enablers to equity and access in sport and physical activity. However, when one group of participants is being funded at a far higher level – in this case, elite athletes – a barrier to other participants is created. In other words, the existing funding allocation for sports in Australia enables athletes who participate in high-performance, elite-level sport; however, lack of government funding may act as a barrier for athletes who participate at the local or community level (participation growth funding as shown in Source 2). This creates an equity dilemma as not all citizens have access to the personal, social and community resources that become available through positive engagement in sport and physical activity.

National sporting organisation	High performance – Able	Pathways	High performance – Para	Pathways – Para	Participation growth funding	Other	Total
AFL	–	–	–	–	–	$1 100 000	$1 100 000
Athletics	$7 315 000	$910 000	$3 768 477	$150 000	$450 000	$135 000	$12 728 477
Badminton	–	$744 000	–	$68 000	$325 000	-	$1 137 000
Basketball	$5 992 500	$474 000	$1 148 000	$629 300	$950 000	$23 000	$9 216 800
Football	$2 246 000	$380 000	–	–	–	$3 115 000	$5 741 000

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National sporting organisation	High performance – Able	Pathways	High performance – Para	Pathways – Para	Participation growth funding	Other	Total
Netball	$2 679 000	$470 000	–	–	$950 000	–	$4 099 000
Swimming	$12 135 000	$705 000	$2 900 000	$250 000	$650 000	$180 000	$16 820 000
Tennis	–	–	–	–	–	$1 500 000	$1 500 000
Touch football	–	–	–	–	$650 000	–	$650 000
Triathlon	$2 827 000	$505 000	$1 156 000	$150 000	$450 000	$120 000	$5 208 000
Volleyball	$2 848 000	$470 000	–	–	$450 000	$174 800	$3 942 800

SOURCE 2 Investment allocation of known QCE PE syllabus sports by Australian Sports Commission in the financial year 2023–2024

Source: Australian Sports Commission

Check your learning 5.20

Check your learning 5.20: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which two national sporting organisations for QCE Physical Education syllabus sports receive the most participation funding from the government?
   - **A** Basketball Australia and Netball Australia
   - **B** AFL and Athletics Australia
   - **C** Swimming Australia and Athletics Australia
   - **D** Basketball Australia and Gymnastics Australia

2 Choose the correct answer. Which QCE Physical Education sport received the least amount of government funding?
   - **A** Basketball
   - **B** Netball
   - **C** Cycling
   - **D** Touch football

3 **Describe** how the Australian Government funds various types and levels of sport in Australia.

Analytical processes

4 **Analyse** the role that the Australian Sports Commission plays in ensuring equitable access to sport and physical activity for all Australians.

Knowledge utilisation

5 Referring to a sport or physical activity that you love, **argue** whether you believe the current model for government funding of Australian sport is fair and equitable in enabling individuals to achieve their personal participation or elite pathway goals.

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Lesson 5.21
Cultural factors that influence equity and access: Mass media promotion and marketing of physical activity

Learning intentions and success criteria

Key ideas

- → Mass media promotion and marketing describes activities by broadcast, print and digital media that communicate messages to large numbers of people.
- → Mass media promotion and marketing can act as barriers or enables to equity and access in sport and physical activity.

What is mass media?

mass media mass communication to a wide audience through a diverse collection of media technologies

Mass media refers to a collection of technologies used to communicate messages to very large numbers of people. Today, mass media is made up of:

- **broadcast media** – such as television, film and radio
- **print media** – such as newspapers, magazines, billboards, brochures and pamphlets
- **digital media** – such as the internet, websites and social media.

Information and messages that are communicated via the mass media – including advertisements and marketing materials – have enormous potential to influence the attitudes, opinions, values, thoughts and beliefs of the people that consume (i.e. read, watch, listen to, or interact with) them. Mass media is one of the most significant cultural factors affecting equity and access in sport and physical activity.

The media has the power to promote certain sports and reinforce certain attitudes to physical activity while undermining other sports and discrediting other attitudes to physical activity. In addition to this, mass media also can influence our engagement with sport and physical activity by constructing stereotypes about gender, ethnicity, religion and social class in relation to sport and reinforcing perceptions around issues relating to health and wellbeing (such as ideal body types). All these factors have the ability to act as barriers and enablers to equity and access in sport and physical activity.





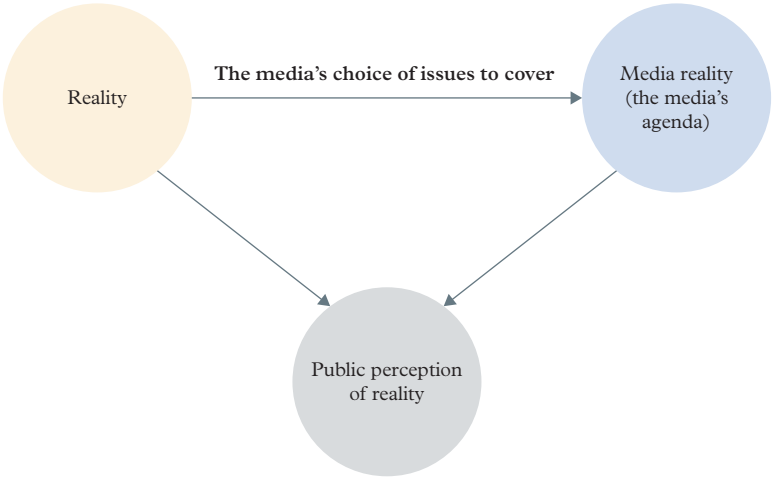

SOURCE 1 Information and messages communicated through mass media have enormous potential to influence the attitudes, opinions, values, thoughts and beliefs of the people who consume them.

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Agenda-setting theory

One theory proposed to help understand and explain the influence of mass media on the attitudes and perceptions of the public is agenda-setting theory. The theory – which was first proposed in 1968 by journalism professors Maxwell McCombs and Donald Shaw in relation to print media – proposes that the power of the media comes from its ability to control and decide which issues it will cover and when. In this way, the media has the ability to influence the public's perception of what is real (see Source 2).



SOURCE 2 Agenda-setting theory helps to explain how the selection of issues covered by the mass media can alter public perception of reality.

In the context of sport, agenda-setting theory suggests that the popularity and perception of certain sports can be increased when the media chooses to provide significant coverage of them. When the media gives priority to a select group of sports, it boosts public perception of these sports and validates them. This allows them to thrive. An example where agenda-setting had a positive impact on marginalised sports was the decision of broadcasters such as Channels 7, 9 and 10 to provide prime airtime to female sporting events such as the 2023 FIFA Women's World Cup and the Women's State of Origin.

On the other hand, sports and physical activities that receive no media coverage are delegitimised or devalued. As a result, these sports may struggle to attract new participants and fans needed to generate revenue and grow their popularity. Additionally, young aspiring athletes may be motivated to move to a more "mainstream" sport because they believe they will have greater chances for career success.

The commercial value of sport

The ability of a sport to elicit an emotional response from those who watch it has contributed to the phenomenon of sport as entertainment. Mass media has tapped into this potential and its coverage has led to a growing fan base for sport as entertainment. With this comes the opportunity to advertise to viewers, readers and listeners, bringing huge commercial value to sport. In economic terms, the process of turning something – in this case, sport – into an object of commercial value is known as **commodification**.

commodification the process of turning something into an object of commercial value

Sport is an incredibly lucrative and marketable commodity. The ownership of teams and the ability to broadcast sporting events in real time via multiple media channels (e.g. television, internet, social media, radio) results in broadcast rights being bought and sold for vast sums of money. Globally, the Indian Premier League (IPL) in cricket, American National Football League (NFL) and the English Premier League (EPL) hold the most expensive broadcasting rights. In Australia, the Australian Football League (AFL), National Rugby League (NRL) and Cricket Australia (CA) consistently command the highest broadcasting fees. In 2022, the AFL achieved the biggest broadcast rights deal in Australian history, extending its partnership with the Seven Network, Foxtel and Telstra, which will pay a total of $4.5 billion to broadcast AFL games until 2031. Football Australia's marketing power has also skyrocketed due to the exceptional performance and TV ratings of the Matildas at the 2023 FIFA Women's World Cup and their 2024 Olympic campaign, in conjunction with the Socceroos' strong performance at the 2022 Men's World Cup. This rise in the sport's national popularity will position it well to secure a lucrative deal when its current contract expires.

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SOURCE 3 The average Australian now owns three internet-enabled devices, and 81 per cent of the population regularly engage with some form of social media. This means that there has been a significant shift towards the integration of social media into sports marketing campaigns and promotions.

As a result of these mass media deals, the profiles and salaries of some high-profile athletes in Australia have skyrocketed. Many of these athletes now work with large numbers of support staff such as managers, sponsors and marketing advisors.

In the news

Matildas success prompts World Cup rights deal

Zoe Samios, *Australian Financial Review*, 13 October 2023

Cortnee Vine, Ellie Carpenter, Hayley Raso and Katrina Gorry weren't household names when the year began, but the Matildas' historic FIFA Women's World Cup campaign changed things – fast.

Two months on from the Matildas' semi-final loss to England, which was watched by more than 40 per cent of the Australian population, skipper Sam Kerr and her team have already appeared in ads for brands like Uber, Budgy Smuggler, Tequila Patron and Cetaphil.

Their unprecedented success captured the nation and inspired the federal government to take a harder look at women's sport. The impact was also the reason football's governing body decided to do something unprecedented.

It has secured the broadcast rights for the next FIFA Women's World Cup, which will take place in an undecided location in 2027, through a deal with global sports company IMG.

The terms of the agreement are not disclosed, but the last deal signed for a FIFA Women's World Cup, with local broadcaster Optus, was estimated to be worth between $10 million and $20 million.

Football Australia chief executive James Johnson told AFR Weekend that securing the Women's World Cup would allow it to provide a potential broadcaster with exclusive access to the Matildas until the deal expires in 2028.

…

"It'll increase the interest in the sport through the exclusivity of the content. It'll also help further build our revenues and ultimately get that distributed back into football, into our national teams, into the community."

Marketing and promotion of sport through mass media

sports marketing the action or business of promoting and selling sports-related products or services (including market research, sponsorship and advertising)

sponsorship the act of providing money (i.e. to an athlete, club or sport) in exchange for the opportunity to promote or advertise the brand, product or service of a company (i.e. the sponsor)

Sports marketing is the action or business of promoting and selling sports-related products or services (including market research, sponsorship and advertising). Traditionally, sports marketing has involved:

- **securing sports coverage** – gaining the rights to broadcast games and events on television and radio
- **increasing media exposure** – promoting sport through various media outlets such as print news
- **securing sponsorship deals** – arranging payments to athletes or clubs to endorse the products and services of companies (known as sponsors) by carrying their logos or brands on their uniforms and appearing in advertisements
- **increasing advertising** – on television, radio and in print
- **selling merchandise** – promoting retail sales of branded team items such as scarfs, hats, flags and t-shirts

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- **packaging sport** – adapting sporting events and game formats to be more media friendly, such as the development of Twenty20 cricket or having four quarters in basketball (instead of two halves) which offer more opportunities for ad breaks.

In the twenty-first century, we are seeing a significant increase in the inclusion of new social media channels for sports marketing and promotion. Social media marketing campaigns hold an edge over traditional media outlets because they are able to personalise and individualise a fan's experience of sport and physical activity.

The rise of social media has changed the way we consume sport as entertainment. Where traditional media (print, radio and television) engaged people at set times throughout the day and week, social media delivers news and coverage of events into audience feeds on a continuous basis. This has changed both the way traditional media approaches sport as entertainment (e.g. through social media accounts or live streaming) and the way that audiences interact with the content (e.g. through liking and sharing). In addition, spectators can now create their own videos or written reviews to share on social media platforms.

Mass media promotion and marketing as a barrier and enabler

The mass media and marketing of sport and physical activity plays a significant role in people's decisions to participate in it, but – as with most things – mass media coverage of sport can act as both an enabler of and a barrier to participation.

Media promotion

One of the most obvious ways in which mass media and marketing act as enablers to equity and access in sport and physical activity is through coverage. Large amounts of media attention, promotion and advertisements relating to a particular sport can be a huge enabler of engagement at all levels. Increased media prominence attracts fans, drives sponsorship of individual athletes and teams, and ultimately keeps those sports vibrant and growing. Sporting associations and clubs today rely heavily on revenue generated through international media and marketing deals to reinvest in the sport and to fund programs – from the grassroots level up – that keep people interested and playing their sports (see "In the news").

This revenue can then be allocated towards a whole range of participation campaigns and programs in countries around the world; be used to build world-class facilities (such as stadiums and training camps); attract expert coaching resources; and run international advertising campaigns and targeted and personalised social media campaigns (through a range of different apps and websites). All these factors act as enablers – keeping the sport vibrant and encouraging the next generation of players to get involved. They can also unlock resources at a personal, social and community level, such as culturally diverse social connections formed through engaging in a non-traditional sport.

There can also be downsides to mass media coverage and marketing promotion for elite sports. For example, in 2015 FIFA (the world governing body of soccer) was engulfed in accusations of widespread bribery and corruption. Media coverage of the scandal was intense and very public and ultimately resulted in the resignation of FIFA president Seth Blatter, who left in disgrace. The scandal also resulted in legal costs and lost earnings from cancelled sponsorship deals – all of which ended in a US$369 million net loss for FIFA in 2016. The coverage of such events can severely damage public perception of sports and damage their reputation among fans. The coverage can therefore act as a barrier to engagement.

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SOURCE 4 Yoga is an age-old physical activity that has surged in popularity over the past decade, partly fuelled by the work of social influencers on apps such as Instagram and Snapchat.

Sports that are newer, less popular and more recreational (i.e. not competitive team sports) are traditionally less attractive to media companies (due to the limited potential for profit in terms of broadcasting rights and sponsorship deals). This results in an absence of coverage in the mass media that can act as a barrier to engagement. However, newer forms of mass media are helping to address this imbalance. Social media has proven to be an inexpensive and successful way of promoting sports that are newer or less popular (i.e. those with smaller fan bases and a lack of public awareness). For example, the rise in popularity of yoga as a physical activity over the past decade has been driven largely by successful social media campaigns, online forums and the work of social influencers.

Sports marketing

Sports marketing can be an enabler for access, as it makes more people aware of the various activities on offer, whether it is a game that is available to stream online or a new class that has started at the gym.

When it comes to the marketing and promotion of sport, sponsorship is a great enabler of engagement. It can:

- be a source of income for athletes – allowing them to participate in a sport or physical activity they otherwise may not be able to afford
- be a source of income for clubs, teams and associations – allowing them to promote their sport or physical activity, run training events, finance the cost of venues, coaches, medical personal or other staff
- be a source of "free" goods or services to athletes and teams – such as clothes, shoes or training equipment.

Likewise, the inability to attract sponsorship can be a barrier to engagement insofar as it denies athletes, teams and sports access to these benefits and other potential resources.

Retrieve it!

Name two sporting teams whose access to participation has been enabled by mass media. Check back to earlier in this lesson to see if you retrieved the information correctly.

Check your learning 5.21

Check your learning 5.21: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. What percentage of the Australian population regularly engages in social media use?
   - **A** 77 per cent
   - **B** 79 per cent
   - **C** 81 per cent
   - **D** 83 per cent

2 Choose the correct answer. Which of the following best describes the process of commodification as explained in this lesson?
   - **A** Making something more emotional
   - **B** Broadcasting a sport to a wider audience
   - **C** Turning an activity into a product for commercial gain
   - **D** Creating a large fan base for a sport

3 **Define** the term "mass media" and **summarise** how it can shape values and attitudes in society.

4 **Describe** the purpose of sports marketing.

5 **Explain** how sport has become a commodity. Provide two examples from your own life that illustrate this point.

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Analytical processes

6 **Compare** and **contrast** two sports that are offered at your school by completing the following tasks.

a **Identify** any barriers or enablers to each sport that currently exist in your school.

b Copy and complete the following table, **assessing** the mass media appeal and marketing potential of the sports you have chosen.

Sport	Mass media appeal	Marketing potential
Sport 1		
Sport 2		

7 **Reflect on** the different ways in which fans and athletes engage with traditional media and social media. **Determine** how this affects the marketing and promotion of different sports.

Lesson 5.22

Cultural factors that influence equity and access: Institutional rules, policies and procedures

Key ideas

→ All institutions have rules, policies and procedures that outline their purpose, goals and how they should be run.

→ Institutional rules, policies and procedures can act as barriers or enablers to equity and access in sport and physical activity.

Learning intentions and success criteria

What are institutions?

Institutions are organisations that have been established to serve an educational, religious, professional or social purpose. There are many different types of institutions in Australian society, ranging from small, more informal institutions (such as local clubs and teams) through to large, formal institutions (such as parliament or the church).

Regardless of their size, all institutions have some kind of agreed set of rules, policies and procedures in place that help to define their purpose and principle, outline their goals, explain how they should be governed and run, and establish expectations about how their members should behave. For small, informal institutions, these rules, policies and procedures may consist of a very brief written statement or a set of agreed rules that are not even documented. For larger, more formal institutions, rules, policies and procedures can consist of thousands of pages of guidelines, legal requirements, codes of conduct and formal contracts.

institution a general term used to describe any organisation (such as a school, sporting club, company, government or other formalised group) founded for an educational, professional, religious or social purpose

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Institutions in sport

Institutions are important and often powerful organisations in sport. There are three main types of institutions that support and influence participation in sport and physical activity in Australia. These include:

- **sporting institutions** – such as local community sporting clubs, regional and state associations, and national/international federations and governing bodies
- **educational institutions** – such as primary and secondary schools, universities and technical colleges
- **religious institutions** – such as religious youth groups, societies and clubs.



SOURCE 1 Most young Australians have their first experiences of sport and physical activities through sporting institutions (e.g. clubs), educational institutions (e.g. schools) or religious institutions (e.g. youth sporting groups).

Together, these institutions are one of the key cultural factors affecting equity and access in sport and physical activity. They exist to ensure:

- sports are promoted and supported
- equipment and facilities are designed for player safety
- players behave appropriately (i.e. engage in fair and honest behaviour) and follow established rules
- breaches of established rules are dealt with fairly and consistently
- objective and fair results are achieved in competition.

Most young Australians have their first experiences of sport and physical activities through one or more of these institutions. As such it is important that their experiences be as positive and enjoyable as possible – as positive experiences may act as enablers and negative experiences may act as barriers to individuals accessing the many personal, social and community resources available.

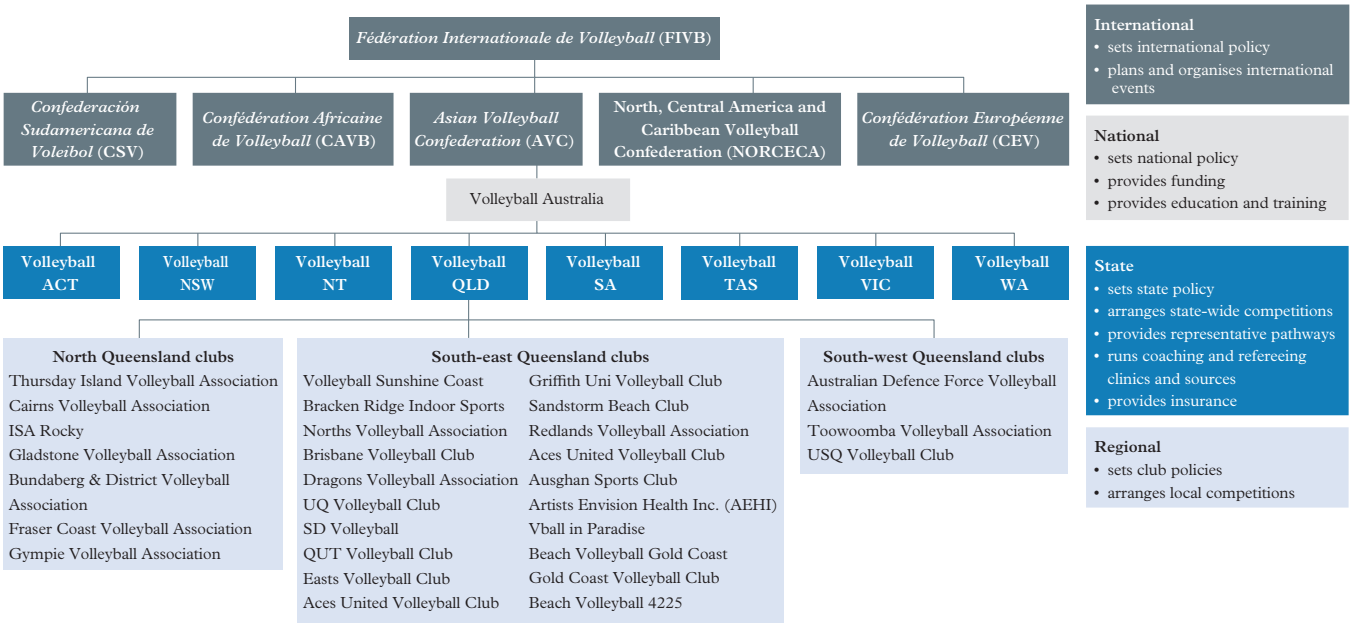
Sporting institutions: rules, policies and procedures as barriers and enablers

Organised and competitive sports in Australia are run and controlled by national sporting institutions. These institutions work with all levels of government to represent the interests and needs of their members and help ensure that their sport remains popular and profitable. National sporting institutions are responsible for setting the public agenda and goals for their sport by providing vision statements and writing overarching policies for state, territory and local community sporting bodies to adhere to. As shown in Source 2, rules, policies and

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procedures for an international sport such as volleyball flow from an international governing body down to a national, state and regional level. This centralised approach to rules, policies and procedures ensures consistency, fairness and equity around the world. This is an enabler to equity and access.



SOURCE 2 Policy flows from the top down to enable safe and fair access for all.

Sporting bodies at all levels have the chance to design and implement equitable, progressive policies that foster social inclusion and enable all people to gain fair access to the benefits of physical activity. Some of the social issues currently guiding policy development include:

- inappropriate spectator/parental involvement from the sidelines
- bullying
- discrimination
- transparent representative selection processes
- age versus weight debate in contact sports
- inclusive participation for people with disabilities
- fair access for people of all genders and identities.

Policies that work to make the sport or physical activity more equitable are enablers, increasing access to resources available through positive engagement. However, some rules and policies can have the opposite effect and act as barriers. Rules restricting access to certain people can deter them from participating. One rule that acts as a barrier to children's engagement in organised sport is cost. Policies that increase costs involved in participation (such as having to buy compulsory uniforms or pay high membership fees) act as a barrier to children from low-income households. Certain institutions can also implement and enforce policies about wearing certain uniforms that make some athletes feel uncomfortable or go against their religious beliefs. These are also barriers to equity and access.

From time to time, the rules, policies and constitutions of sporting bodies are placed under scrutiny or forced to change due to emerging issues in society or to satisfy viewers' needs. Issues such as cheating, the "spirit of the game" being brought into question, racism, doping, rule disputes and questions about athletes' participation eligibility have all emerged in recent years. When these issues gain traction in the mass media, it can result in institutional policy or rule changes.

For the record!

In 2022, swimming's world governing body, FINA, changed its eligibility criteria for transgender athletes and athletes with intersex variations in elite women's competitions. It voted in favour of male-to-female transgender athletes (i.e. transgender women) only being eligible to compete in the women's categories in FINA competitions if they transition before the age of 12 or before they reach a certain stage of puberty. FINA also outlined its intent to create a working group to establish an "open" category in some events moving forward where people could compete without regard to their sex or gender identity.

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In the news

Queensland families face biggest increase in sport costs

Sky News, 20 January 2024

Queensland families are facing the highest increase in community sports fees nationwide.

New data shows the cost of playing community sport has increased by over ten per cent.

It marks the highest rise in the country.

New figures released by the Australian Bureau of Statistics show that in the 12 months up to September last year the fees increased by 12.3 per cent in Queensland.

Well above the national average of 6.8 per cent.

Educational institutions: rules, policies and procedures as barriers and enablers

Educational institution rules, policies and procedures also influence engagement in sport and physical activity. Schools that have a successful sporting history often promote their achievements and gain a reputation for opening doors on behalf of students that attend them and play these sports. When this occurs, these celebrated sports thrive, and their participants can continue to access the benefits. But limited resources and funds can mean that the focus a school gives to one sport cannot be replicated for other sports. In this way, school procedures act as enablers for engagement in certain sports and barriers to engagement in others. A school with strong athletic traditions can also be a barrier to equity and access for less athletic students who might hesitate to join in out of fear of not being good enough.

Despite the wealth of benefits that physical activity provides, studies show that sport is being increasingly marginalised in schools. Fewer hours in the timetable are dedicated to sport and physical education, and fewer expert teachers are being employed. This acts as a direct barrier to engagement in sport and physical activity.



SOURCE 3 Schools can act as enablers to equity and access in sport and physical activity by allocating funding to facilities and dedicating time to sport classes in the timetable.

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Religious institutions: rules, policies and procedures as barriers and enablers

Religious institutions also follow procedures in the form of established traditions, some of which can impact on followers' access to physical activity. Many religions, including Christianity, Judaism and Islam, observe regular holy days and religious holidays. Strict followers of these faiths might not be able to participate in physical activity (e.g. training or competitions) on these days as they are expected to take part in traditions of their faith. Scheduling sports competitions on these days can be a direct barrier to participation. For example, Muslim people all over the world observe Ramadan each year – a period of 30 days when Muslims fast between dawn and dusk. The inability to drink makes Ramadan an especially stressful period for Muslims who participate in sport, especially when Ramadan occurs during the summer. Acknowledging religious beliefs and having flexible school and club attitudes can ensure children and adults of all faiths and cultures can experience positive engagement in sport and physical activity.

Check your learning 5.22

Check your learning 5.22: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. By what percentage did community sports fees increase in Queensland from 2023 to 2024, according to the ABS data?
   - **A** 3.5 per cent
   - **B** 6.8 per cent
   - **C** 10 per cent
   - **D** 12.3 per cent

2 Choose the correct answer. In addition to setting fees for sport, other institutional influences on individuals' access to physical activity include:
   - **A** procedures established by religious groups.
   - **B** athletes' preferences for physical activity.
   - **C** both a and b.
   - **D** neither a nor b.

3 **Define** what is meant by "institution" and **explain** the purpose of rules, policies and procedures.

Analytical processes

4 **Analyse** the sporting culture at your school and list the sports that receive the most funding and attention. Which sports, in comparison, are marginalised?

Knowledge utilisation

5 Refer to the "For the record!" (page 351) about FINA's ruling on transgender athletes in world swimming. Conduct research to uncover one other sporting institution that has also made significant policy changes in recent years and **identify** how these changes act as a barrier and enabler to equity and access in sport and physical activity.

6 **Develop** a strategy to enable greater equity and access for students at your school who want to participate in expensive representative sports. **Justify** your recommendations.

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Lesson 5.23
Environmental factors that influence equity and access

Learning intentions and success criteria

Key ideas

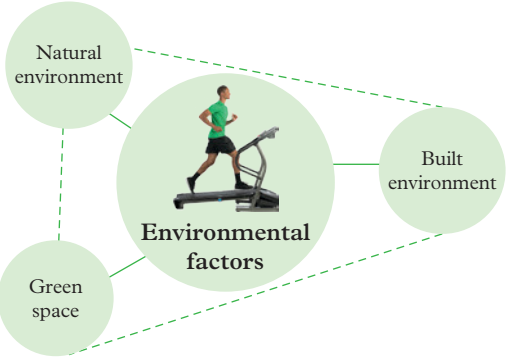
→ Environmental factors include a range of influences at an environmental level that act as both barriers and enablers to equity and access in sport and physical activity.

What environmental factors act as barriers and enablers?

environmental factors a range of influences at an environmental level that can act as barriers or enablers to participation in sport and physical activities (e.g. our ability to access the natural and human-made spaces that exist in the world around us)

There are many **environmental factors** that act as barriers and enablers to equity and access in sport and physical activity. Environmental factors include a range of influences at an environmental level (e.g. the natural and human-made spaces that exist in the world around us and our ability to access these). Some of the most important environmental factors include:

- **built and natural environments** – the spaces that humans have built to provide the setting for physical activity (e.g. gyms, stadiums, playing fields, courts) versus those spaces that exist naturally (e.g. mountains, rivers, grasslands, oceans)
- **green space** – areas of grass, trees or other vegetation set apart for recreational purposes in environments that are otherwise urban (i.e. built).



SOURCE 1 A range of different environmental factors play a role in an individual's access to the available personal, social and community resources found in sport and physical activity participation.



SOURCE 2 The environment plays a significant role in a person's decision to participate in sport and physical activity.

In the lessons that follow, we will look at each of these factors in detail and examine how they act as barriers and enablers to accessing personal, social and community resources for different people. Although we will be learning about each factor separately, it is important to keep in mind that, in reality, these environmental factors are acting on us (i.e. affecting our decisions and behaviours) simultaneously. Not only that – we are also almost always influenced by a combination of other factors at the personal, social and cultural level at the same time.

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Lesson 5.24

Environmental factors that influence equity and access: Built and natural environments

Key ideas

- → Our environment is made up of both built and natural environments.
- → Built and natural environments can act as barriers or enablers to equity and access in sport and physical activity.

Learning intentions and success criteria

What is the environment?

The environment is the surroundings or conditions in which we live our lives. For this reason, it is one of the most significant factors affecting participation in sport and physical activity. The environment is made up of two components:

- the **built environment** – a term used to describe any environment that has been significantly altered by humans (e.g. buildings, cities, parks, schools)
- the **natural environment** – a term used to describe any environment that has not been significantly altered by humans (e.g. deserts, mountains, coral reefs, forests, oceans).

built environments spaces that humans have built to provide the setting for daily life (e.g. houses, office buildings) and physical activity (e.g. gyms, stadiums, playing fields, courts)



SOURCE 1 The environment in which we live is one of the most significant factors affecting participation in sport and physical activity. It is made up of the built environment (e.g. towns, buildings and cities, such as Brisbane) and the natural environment (e.g. rivers, mountains, grasslands and forests, such as the Daintree Rainforest).

Built and natural environments as barriers and enablers

Built and natural environments play a significant role in people's decisions to participate in sport and physical activity. As shown in Source 1, people will have very different opportunities to participate in sport and physical activity depending on where they live, and this will either enable or restrict their access to subsequent personal, social and community resources.

natural environments a term used to describe any environment that has not been significantly altered by humans

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On a basic level, it is easy to understand how environments act as barriers and enablers to accessing resources. For example, living close to the beach makes water sports such as surfing and swimming highly accessible and is therefore an enabler to accessing resources such as the personal resource of fitness. Living close to mountains makes participation in activities such as mountain climbing, skiing and snowboarding much more accessible and is an enabler to accessing such resources as the social resource of a snowboarding mentor.

The situation becomes more complex when you consider built and natural environments. For example, a person living in central Brisbane has access to a wide range of opportunities to participate in organised sports and physical activities. There are world-class sporting facilities (such as training grounds, stadiums, gyms), coaches and trainers close by, and many different sporting clubs and associations to join. All these factors act as enablers to accessing personal, social and community resources from participation in sport and physical activity. However, depending on people's individual circumstances, these facilities may not be accessible (e.g. due to a lack of time or money, or due to the large number of people trying to access limited facilities). This becomes an equity dilemma as barriers exist and access to the potential resources for some people is reduced. Similarly, a person living in inner-city Brisbane may not have access to large open spaces required for certain sports. This lack of space may act as a barrier for these people.

On the other hand, a person living in a remote or rural area of Queensland (without a town or regional city close by) will not have access to any of the facilities available in Brisbane, may not be able to consult with coaches or trainers, and may not have access to any sporting clubs or associations. All these factors act as barriers to accessing personal, social and community resources. Despite these barriers, life in this more natural environment may act as an enabler to accessing a range of other recreational sports and physical activities that require large open spaces or access to natural environments, such as rock-climbing, kayaking, hiking or cross-country running.

According to the World Health Organization (WHO), "The way we build our cities, design the urban environment and provide access to the natural environment can be a great encouragement or a great barrier to physical activity and active living." Furthermore, the WHO states that a positive correlation exists between spending time in nature and physical, social and emotional health status.

Retrieve it!

List three cultural changes that affect equity and access in sport and physical activity. Check back to Lesson 5.18 Cultural factors that influence equity and access (page 334) to see if you retrieved the information correctly.



SOURCE 2 Built and natural environments play a significant role in people's decisions to participate in sport and physical activity.

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Check your learning 5.24

Check your learning 5.24: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Factors influencing equity and access in sports and physical activities can vary depending on location. Compared to someone living in a remote or rural area of Queensland, a person living in central Brisbane is most likely to have access to personal, social and community resources through:
   - **A** large open spaces for activities such as rock climbing and kayaking.
   - **B** a wider variety of sporting facilities and organisations.
   - **C** both a and b.
   - **D** neither a nor b.

2 Choose the correct answer. Which of the following BEST describes the impact of urbanisation on equity and access in physical activity?
   - **A** Urbanisation always acts as a barrier.
   - **B** Urbanisation always acts as an enabler.
   - **C** Urbanisation has no impact.
   - **D** Urbanisation can act as a barrier or an enabler.

3 **Define** the term "environment" and provide three examples of the built environment and three examples of the natural environment.

Analytical processes

4 **Identify** the environmental factors that could act as barriers or enablers to personal, social or community resources that a 16-year-old student attending a private, single-sex school in Brisbane may experience. **Compare** and **contrast** these with the environmental barriers and enablers that a 16-year-old student living in a remote area of Queensland attending the School of Distance Education may experience.

Knowledge utilisation

5 **Evaluate** your own environment in relation to environmental barriers and enablers. Create a list of each and draw conclusions about the access to personal, social and community resources within your community, based solely on environmental factors.

6 **Select** one environmental barrier that you identified in Question 4 and **develop** a strategy to overcome it for students in your community.

Lesson 5.25

Environmental factors that influence equity and access: Green space

Key ideas

→ Green space is any area of grass, trees or other vegetation set aside for recreational purposes in a built environment.

→ Green space can act as a barrier or enabler to equity and access in sport and physical activity.

Learning intentions and success criteria

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green space a general term used to describe any area of grass, trees or other vegetation set aside for recreational purposes in environments that are otherwise urban (i.e. built)

What is green space?

Green space is a term used to describe any area of grass, trees or other vegetation set aside for recreational purposes in an otherwise built environment. In other words, green spaces are large areas in cities that are protected from development so that people can use them for a range of different sporting activities.

Although Australia has an abundance of natural environments, approximately 90 per cent of all Australians live in cities (i.e. built environments). This directly influences access to personal, social and community resources. The availability of green space is an important environmental factor affecting equity and access in sport and physical activity for people who live in cities.

For the record!

New York's Central Park is one of the largest and most famous green spaces in the world.

A real estate appraisal conducted in 2018 estimated the land value of this 3.41 km^2 park at around US$600 billion, but many New Yorkers argue it is priceless!

One thing is clear – its removal would act as a serious barrier to sport and physical activity for people living in Manhattan.

Green space as a barrier and enabler

Because certain sports rely on the availability of green spaces, local councils and state governments have a responsibility to ensure that these areas are set aside for public use in large towns and cities. They also need to ensure that these green spaces are evenly spread and well maintained in all areas of the city or region to make sure people living in different areas have equitable access. Not having access to these areas is a direct barrier to participation in certain sports such as rugby, soccer and Australian football. This lack of access limits the opportunities for participants to benefit from the personal, social and community resources available to them through such sports.

Green space within built-up communities such as cities, schools and even workplaces offers many physical and mental health benefits. A casual game of cricket or a simple walk in the park can significantly improve a person's ability to concentrate. Studies have shown that green views from school windows are linked to improved academic performance. And children who grow up in greener neighbourhoods are often less depressed, less stressed and generally healthier and happier.

Green spaces also help to bridge the inequality gap for lower socio-economic groups of people. Having access to a free area to run around and play sport has been shown to increase social cohesion (the sense of community connectedness and solidarity) and reduce crime rates. Green spaces also provide areas for community programs such as park runs.

Retrieve it!

Describe three sport psychology techniques an athlete might use during a sporting match. Check back to Lesson 4.1 Introduction to sport psychology (page 208) to see if you retrieved the information correctly.

Check your learning 5.25

Check your learning 5.25: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. What is the most likely impact that living in a city (built environment) in Australia has on people's physical activity choices?

A There is no difference in physical activity choices between cities and natural environments.

B City living encourages participation in activities requiring large open spaces.

C The abundance of natural environments makes all physical activities readily available.

D The limited green space in cities may restrict options for some physical activities.

2 **Define** the term "green space" and **explain** how it can act as a barrier and enabler to personal resources for people living in urban areas.

Knowledge utilisation

3 **Identify** a green space in your local area and **evaluate** its effectiveness in terms of enabling citizens to access the benefits of social and community resources.

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Lesson 5.26
Emerging megatrends in physical activity in Australia

Key ideas

- → A megatrend is a large-scale change that takes place in a society over an extended period of time. The change may be social, economic, political, environmental or technological.
- → Emerging megatrends can act as barriers or enablers to equity and access in sport and physical activity.

Learning intentions and success criteria

The role of sport in people's lives

Sport is an important part of Australia's national identity. While not everyone may actually participate in regular physical activity, many Australians are involved with sporting clubs, support friends and family members who are involved in sport, and enjoy watching competitive and recreational sport (either in person or in the media). In short, many Australians are passionate about sport!

As we have learnt, the kinds of sports and physical activities that people engage in, and the ways in which they do so, are not static. Instead, they are constantly changing. If governments, sporting organisations, community groups and other members of the sports industry are to make informed strategic decisions and plan well for the future, they need reliable information about the role that sport and physical activity plays in the lives of contemporary Australians.

Emerging Australian megatrends

In 2013, recognising the value and importance of this kind of data, the Australian Sports Commission (ASC) authorised the **Commonwealth Scientific and Industrial Research Organisation (CSIRO)** to research and prepare a report on the social, economic and environmental changes likely to affect the Australian sports sector over the next 30 years.

Based on the primary and secondary data collected, the CSIRO identified six potential changes likely to have an impact on Australian sport over the next three decades. Because of their large scale, the CSIRO called these changes **megatrends**. In 2022, CSIRO and the ASC reviewed and updated these megatrends in acknowledgement of the vast changes that have occurred over the past 10 years, not the least of which was the COVID-19 pandemic. Each of the six megatrends identified relates to an important pattern of social,



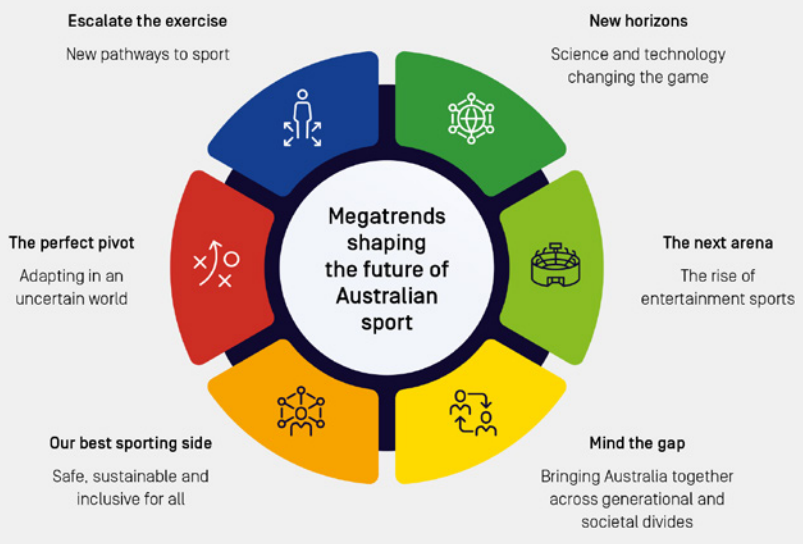
SOURCE 1 In 2022, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) prepared its second report for the Australian Sports Commission on the social, economic and environmental changes likely to affect the Australian sports sector over the next 30 years.

Commonwealth Scientific and Industrial Research Organisation (CSIRO) an independent scientific research agency funded by the Australian federal government and responsible for improving economic and social industry

megatrend a large-scale social, economic, political, environmental or technological change that takes place over an extended period of time

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SOURCE 2 Megatrends in Australia

Source: Australian Sports Commission

economic or environmental change. Each one also has significant implications for future investment and policy development at all levels of government.

The six megatrends are:

- Megatrend 1: Escalate the exercise – New pathways to sport
- Megatrend 2: New horizons – Science and technology changing the game
- Megatrend 3: The next arena – The rise of entertainment sports
- Megatrend 4: Mind the gap – Bringing Australia together across generational and societal divides
- Megatrend 5: Our best sporting side – Safe, sustainable and inclusive for all
- Megatrend 6: The perfect pivot – Adapting in an uncertain world.

As you can see in Source 2, these megatrends are interconnected. This means that the forces shaping one may also be shaping others, and the causes of one may be the consequences of another. We will now explore each CSIRO megatrend.

Megatrend 1: Escalate the exercise

New pathways to sport

Australians are increasingly finding ways to exercise in an informal way to suit their lifestyles. This might be at a gym, at home, in an exercise group or community, or using free recreational infrastructure or green space. This trend was particularly driven by government restrictions during the COVID-19 pandemic, when people lost access to organised physical activity or sport. Sporting organisations will need to find innovative ways to reach the population and maintain or increase their participant base in the future.

Megatrend 2: New horizons

Science and technology changing the game

Study tip

Each of the Skill drills for this module has been designed to enhance your understanding of personal, social and cultural factors that act as barriers and enablers to participation in sport and physical activity.

Remember to reflect on these experiences when planning for your final assessment task.

Advances in technology in fields such as human physiology, nutrition, psychology, engineering and materials science will undoubtedly change the face of high-performance sport and this will have a flow-on effect to the participation level. New technologies will help us achieve marginal gains in competition, but they will require constant ethical consideration. Hypothetical examples include a technologically powered suit that sprinters can wear to assist their running technique, or a biofeedback implant that monitors triathletes physiologically in real-time and feeds live data to a coach who can advise from the sidelines. Both examples arguably push the boundaries of "natural" performance.

Artificial intelligence and other technologies will mean exercise programs can be personalised to the individual. With momentum expected to build towards the Brisbane Olympic Games in 2032, it is predicted that Australia will be positioned as a global leader in sports science, which will have a positive economic impact.

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Megatrend 3: The next arena

The rise of entertainment sports

The way Australians are entertained by sport will change over the coming decades. Streaming platforms are becoming mainstream ways of watching entertainment programs, resulting in bigger, newer audiences. This is creating greater access to global sports and will enable activities once considered "alternative" to grow in popularity. With the emergence of artificial intelligence and other technologies, digital and e-sports will become more mainstream and visible. Due to the increase in streaming services, the revenue that certain sports have typically generated from big broadcast rights deals may diminish, so these organisations will need to adapt.

Megatrend 4: Mind the gap

Bringing Australia together across generational and societal divides

Australia is predicted to go through significant demographic, cultural and generational changes in the coming decades. For instance, the population will age and a greater number of people will have been born overseas. Sport will play an even bigger role in bringing Australians together through shared values of fair play, egalitarianism, inclusivity and teamwork. This will help to bridge the gap between generations and other societal divides.

Megatrend 5: Our best sporting side

Safe, sustainable and inclusive for all

Societal issues such as racism, abuse and other poor behaviours have generated significant public interest in sports integrity and ethical behaviour in the sports industry. Australia's increasingly diverse and multicultural population means that sporting organisations will need – more than ever – to provide safe, inclusive and welcoming environments. For their own sustainability, organisations will need to develop strong policies and informed practice to ensure they are meeting the diverse needs of participants for their own sustainability.

Megatrend 6: The perfect pivot

Adapting in an uncertain world

We live in increasingly uncertain times. Climate change is having an impact on the weather, geopolitical tensions are increasing, and evidence suggests that there is a reasonable chance the world will face a pandemic like COVID-19 within the next couple of decades. In the face of this unpredictability, sporting organisations will need to have highly adaptable plans to ensure continuity. This will require them to think about how they can build more flexibility into scheduling, event planning and infrastructure design.

Equity strategies addressing barriers and enablers

Megatrends have highlighted that there are many different barriers and enablers to sports engagement. It is important that Australian communities use the data to address barriers to enable access to the many personal, social and community resources that physical activity can offer.

Study tip

Interviews are a valid method for collecting primary data. Interview members of your school community to determine the impact that these megatrends are having.

Wording your questions in an objective (factual) manner will allow for an easier comparison of responses. For instance, instead of asking an open question (such as "How have the megatrends had an impact on your engagement with physical activity?"), you could devise closed questions (such as "Are technological devices or apps an integral part of your fitness routine?" "If you answered yes, do you use these apps always/sometimes/rarely?")

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Social sports can encourage people back into sports after they leave competitions in high school. They can also introduce adults to sports for the first time. People often lose interest in competitive sports as they age. Concerns about fitness, rusty skills or the lack of time for demanding training schedules can be barriers. However, many people still crave the fun and social aspects of sports, and social leagues provide a perfect solution. Two examples of community-run social sports opportunities are:

- SportUp – a social sport club, offering a range of sports to young adults looking to get active after work. It uses an app that lets users find other teams and individuals looking to play competitively in their area. It started as one friendly game in 2014 and now has more than 10 000 active members in the Brisbane region.
- Parkrun – a free, community event where you can walk, jog or run 5 kilometres in your local park each Saturday morning. It started in 2004 with 13 runners in the UK and there are now more than 2300 weekly Parkrun events across the globe with over 9 million registered runners.

Another strategy to increase engagement is the development of specialist or modified leagues to address barriers experienced by people with low confidence, differences or disabilities. Modified leagues take traditional sports and modify rules, court or field dimensions or equipment to help make them accessible. Examples in Australia include girls' bike-riding groups led by female instructors, focusing on camaraderie and fun rather than competition; modified cricket games catering to those with neurodiversity; and "walking" versions of popular sports such as netball, football and basketball, offering a low-impact option for older adults, those returning to activity or complete beginners.

Check your learning 5.26

Check your learning 5.26: Complete these questions online or in your workbook.

Retrieval and comprehension

1 Choose the correct answer. Which megatrend focuses on the importance of diversity, inclusion and fair play in Australian sport?
   - **A** Escalate the exercise
   - **B** Our best sporting side
   - **C** The next arena
   - **D** New horizons

2 Choose the correct answer. The megatrend "The next arena" highlights the growing importance of:
   - **A** traditional broadcast media in covering major sporting events.
   - **B** grassroots participation and community-based sports programs.
   - **C** entertainment experiences such as augmented reality in sports viewership.
   - **D** the role of science and technology in improving athletic performance.

Analytical processes

3 "The types of physical activities that people engage in – and the way in which they do so – are not static; they change over time." **Identify** the types of changes this statement may be referring to and **categorise** them into what you perceive to be *enabling changes (enablers)* and *limiting changes (barriers)*.

Knowledge utilisation

4 Locate demographic data on the generational and cultural make-up of your local community. Using these data as a reference point, **assess** the appropriateness of the physical activity services and facilities available in your community. **Propose** and **justify** two ways that these services and facilities could be better tailored to the needs and interests of your community based on what you know about the megatrends.

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Lesson 5.27
Assessment support – Internal assessment: Investigation – report

Overview of internal assessment: Investigation – report

As part of your assessment for Unit 2 of the QCE Physical Education syllabus, you will be required to complete an Investigation – report.

This part of the module is designed to support you as you complete your Investigation – report. It provides a structured explanation of what is required in the task and offers practical tips and suggestions to help you perform at your best.The Investigation – report requires you to research an equity dilemma relevant to a class, school or community physical event context by collecting, analysing and synthesising primary and secondary data to devise an equity strategy.

An **equity dilemma** is a situation that devalues or diminishes personal, social and cultural differences in society, especially as they relate to physical activity. An **equity strategy** is any plan of action that aims to value or celebrate personal, social and cultural differences in society, especially as they relate to physical activity.

Source 1 provides some examples of equity dilemmas and equity strategies to help you form a clear concept of these concepts.

equity dilemma a situation that devalues or diminishes personal, social and cultural differences in society, especially as they relate to physical activity

equity strategy any plan of action that aims to value or celebrate personal, social and cultural differences in society, especially as they relate to physical activity

Equity dilemma	Equity strategy
• Cost barriers • Disability discrimination • Environmental barriers • Gender-based media coverage disparity • Gender-based pay disparity • Lack of participation opportunities based on any personal, social, cultural or environmental factor • LGBTQIA+ discrimination • Racial and ethnic bias • Religious discrimination • Resourcing or quality of facilities • Social sports opportunities • Sports assessed in the curriculum • Sports offered at school • Transportation barriers • Uniform rules and regulations	A plan of action, relating to physical activity, that sets out to: • accommodate differences and/or make modifications to suit players' needs • campaign to challenge assumptions • develop a policy for increased access • establish a program to address barriers • improve the social/emotional safety within an environment • improve communication or relations between key stakeholders (i.e. a person with an interest or concern in something) • improve community awareness of a physical activity or sport • increase player/athlete access and/or attendance • increase player/athlete voice • increase spectator presence and attendance • make a physical activity or sport more inclusive • remove personal, social, cultural or environmental barriers • train or educate key stakeholders.

SOURCE 1 Some examples of equity dilemmas and equity strategies

The Investigation – report will be assessed and marked against an instrument-specific marking guide (ISMG). This means that all parts of the task must be completed to maximise your chances of success. Detailed information on how to structure, create and present your Investigation – report is provided in Lesson 1.5 Tips for success on the Investigation – report (page 10). In addition to this, Lesson 1.6 Skill drill: Creating and presenting an Investigation – report provides a number of useful tips and instructions to help you.

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It may help you to complete the Investigation – report in two sections. We will model one possible approach for completing the task, as follows.

- **Section 1** – Conduct research
- **Section 2** – Present your findings in report format

Section 1 – Conduct research

Section 1 of this task requires you to complete a number of steps in your research. You will need to:

- define an equity dilemma relevant to a class, school or community physical activity context
- gather and analyse primary and secondary data relating to the equity dilemma
- devise an equity strategy to optimise access and positive engagement, justifying the course of action
- evaluate the equity strategy.

At each step, we will provide an example of what this might look like in action for a student completing their Investigation – report.

Step 1 – Define an equity dilemma relevant to a class, school or community physical activity context

As noted above, an equity dilemma is any situation that devalues or diminishes personal, social or cultural differences in society, especially as they relate to people's engagement and access to physical activity. To begin your investigation, you will need to identify and define an equity dilemma that exists within a class, school or community physical activity context.

You may have a specific equity dilemma in mind; if so, once you have defined it, you will need to select a relevant class, school or community context to frame it.

Alternatively, you may like to select the class, school or community context first, and then identify and define an equity dilemma that exists within it. Once you have identified an equity dilemma and decided on the context (i.e. class, school or community) you will need to express it as a "should" question. Below is an example for each possible context.

Class context

- **Equity issue**: The sports we engage with in our Physical Education program do not capture the cultural identities of all students within our class.
- **"Should" question**: Should our class advocate for a refreshed Physical Education curriculum to better reflect the diverse cultural backgrounds of our students?

School context

- **Equity issue**: The sports on offer at Gum Tree High School do not reflect the interests and motivations of all students across the year levels.
- **"Should" question**: Should Gum Tree High School improve its offering of sports to better reflect the interests and motivations of all students across the year levels?

Community context

- **Equity issue**: Participation rates in sport-related activities decrease markedly once students leave school.
- **"Should" question**: Should a strategy be implemented to prevent students dropping out of organised sport during the post-school transition?

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Example

Edwin's mate, Didier, migrated to Australia from the Seychelles last year and joined Edwin's Senior Physical Education class. Although Didier is an exceptionally talented football player for his age, Edwin has observed the difficulties Didier has faced navigating the Queensland Representative Sport system and accessing trials and completing paperwork. Edwin feels that what Didier is experiencing is an equity dilemma that many other culturally and linguistically diverse (CALD) students face in the school system. For that reason, he decides to frame the equity dilemma in a school context and he turns this issue into the following "should" question: Should CALD students receive targeted, systematic support when trying to access representative sporting opportunities and pathways?

Step 2 – Gather and analyse primary and secondary data relating to the equity dilemma

Once you have defined your equity dilemma, you are required to investigate it by gathering a range of relevant primary and secondary data. You will then be required to analyse and synthesise this data to help you devise an equity strategy that appropriately addresses the dilemma. The data you gather and analyse should help you explore the relationships between:

- the equity dilemma
- barriers and enablers
- personal, social, cultural and environmental factors that result in limited access to personal, social and community resources in the class, school or community physical activity context
- strategies that have been used in response to similar equity dilemmas.

Through your analysis of the above relationships, you will be able to home in on the most significant needs of the individuals within the given context. The primary data you gather will need to show that the equity dilemma has an impact on people in the class, school or community physical activity context you have selected.



Example

Edwin engages with some online research about this issue, gathering several journal articles and other statistics from credible websites. He thinks about the most relevant types of primary data he could collect and he decides that he will conduct a series of surveys to gather mostly qualitative data about the experience of CALD individuals from both students and staff. An interview with Didier will be a key piece of data. Edwin also plans to interview his school's sport administration staff about the representative sport processes. Lastly, Edwin will conduct research about strategies that already exist in Australia to support CALD individuals.

Step 3 – Devise an equity strategy and justify the course of action

In response to the "should" question, you will need to create an equity strategy which will best serve the class, school or community and their access to physical activity. An equity strategy is any plan or course of action that aims to value or celebrate personal, social and cultural differences in society, especially as they relate to physical activity. It is essential that the strategy directly addresses the needs identified through your above analysis.If you can methodically outline how your strategy addresses the established needs, this will enable you to show or prove your strategy to be right or reasonable; that is, it will enable you to justify your strategy which is a key requirement of the task and ISMG.

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It is useful to be able to implement a version (or aspects) of this strategy, if possible, so that you can collect more primary data that further justifies the development of the strategy. If your context does not allow for the implementation, your secondary data can be used to analyse similar devised strategies and determine the best course of action.

Example

After analysing and synthesising all the primary and secondary data, Edwin devises an equity strategy for his school to implement, consisting of three elements:

- culturally sensitive workshops: informing students and families about representative pathways, application processes and available support (translated materials included)
- liaison role: appointing a staff member to guide CALD students through paperwork, navigate communication barriers and connect them with appropriate resources
- mentorship program: pairing CALD students with experienced athletes or coaches who can provide guidance and cultural understanding.

While Edwin knows that he cannot implement all of this in the timeframe of the assessment task, he asks his Physical Education teacher if he can pair Didier with the school's football coach so that he can gather some data about mentorship to help justify the development of his strategy.

Step 4 – Evaluate the equity strategy

To evaluate the effectiveness of the equity strategy you have developed, you will need to consider:

- the potential outcome of the strategy – you will need to use the data to predict whether the equity strategy you have devised will be effective within your context and explain why
- the potential limitations of the strategy – you will need to predict whether the equity strategy may have any issues.

Example

Edwin reflects on his strategy and gathers feedback from Didier about the mentorship element of his strategy. He concludes that his equity strategy has the potential for positive outcomes such as increased participation for CALD students such as Didier, as well as improved equity and cultural understanding for all involved. He also identifies that sustainability and resources might limit the ongoing success of this strategy. He backs up these conclusions with primary and secondary data.



Section 2 – Present your findings in report format

Unlike the Project – folio, your Investigation – report needs to follow a specific format. Lesson 1.5 Tips for success on the Investigation – report (page 10) provides a detailed description of the structure of the report you will need to write and what you need to include in each section. It also provides a number of tips and suggestions for referencing and crediting sources in your report.

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MODULE 5

Lesson 5.28
Review: Equity – barriers and enablers

Summary

5.1
- Equity is a concept that relates to fairness and justice in the way all people are treated. It means striving for fairness and justice by treating people differently (based on their individual needs and personal differences).
- Access is the opportunity a person is given to participate.
- Barriers are factors that decrease access to the resources people need for sport and physical activity.
- Enablers are factors that increase access to the resources people need for sport and physical activity.

5.3
- Personal factors are a range of influences at an individual level that act as both barriers and enablers to equity and access in sport and physical activity.

5.4
- Motivation refers to the drive we have to behave in a particular way to achieve our goals.
- Motivation is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

5.5
- Confidence is the belief that a person can have faith in (or rely on) themselves, someone or something.
- Confidence is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

5.6
- Personality traits are psychological qualities and characteristics that determine our patterns of thinking, feeling and behaving.
- Personality traits are personal factors that can act as a barrier or enabler to equity and access in sport and physical activity.

5.7
- Personal ability describes the qualities and skills a person uses to complete a task or achieve a goal.
- Personal ability is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

5.8
- Genetic disposition describes the physical and psychological characteristics that every person inherits from their biological parents.
- Genetic disposition is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

5.9
- Gender refers to the state of being male or female. It usually refers to social and cultural differences between men and women.
- Gender is a personal factor that can act as a barrier or enabler to equity and access in sport and physical activity.

5.10
- Previous experiences of physical activity are the memories we have of participating in certain sports and physical activities in the past.
- These experiences are personal factors that can act as barriers or enablers to equity and access in sport and physical activity.

5.11
- Social factors are a range of influences at a social level that act as both barriers and enablers to equity and access in sport and physical activity.

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5.12
- Agents of socialisation are the people in our lives who teach us how to act and behave in a society, including our family, friends, teachers and coaches.
- Agents of socialisation are social factors that can act as a barrier or enabler to equity and access in sport and physical activity.

5.13
- The social construction of gender is the theory that society and culture create gender roles that are prescribed by many as ideal or appropriate for individuals of a particular sex.
- The social construction of gender can act as a barrier or enabler to equity and access in sport and physical activity.

5.15
- Diversity means difference. When used to describe people living in a society, it means empowering people by respecting the characteristics that make them different.
- Diversity can act as a barrier or enabler to equity and access in sport and physical activity.

5.17
- Physical activity preferences refer to the types of sports and physical activities that we choose to participate in.
- Physical activity preferences can act as a barrier or enabler to equity and access in sport and physical activity.

5.18
- Cultural factors include a range of influences at a cultural level that act as both barriers and enablers to equity and access in sport and physical activity.

5.19
- Demographic, generational and cultural changes are those that take place within human populations.
- Demographic, generational and cultural change can act as barriers and enablers to equity and access in sport and physical activity.

5.20
- Government funding is any money given by the government to non-government institutions.
- Government funding can act as a barrier or enabler to equity and access in sport and physical activity.y

5.21
- Mass media promotion and marketing describes activities by broadcast, print and digital media that communicate messages to large numbers of people.
- Mass media promotion and marketing can act as barriers or enables to equity and access in sport and physical activity.

5.22
- All institutions have rules, policies and procedures that outline their purpose, goals and how they should be run.
- Institutional rules, policies and procedures can act as barriers or enablers to equity and access in sport and physical activity.

5.23
- Environmental factors include a range of influences at an environmental level that act as both barriers and enablers to equity and access in sport and physical activity.

5.24
- Our environment is made up of both built and natural environments.
- Built and natural environments can act as barriers or enablers to equity and access in sport and physical activity.

5.25
- Green space is any area of grass, trees or other vegetation set aside for recreational purposes in a built environment.
- Green space can act as a barrier or enabler to equity and access in sport and physical activity.

5.26
- A megatrend is a large-scale change that takes place in a society over an extended period of time. The change may be social, economic, political, environmental or technological.
- Emerging megatrends can act as barriers or enablers to equity and access in sport and physical activity.

 **Revision notes: Module 5**

 **Module 5 summary**

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SOURCE 1 A range of personal, social, cultural and environmental factors influence participation in sport.

Review questions 5.28 Exam-style revision questions and tasks

Section A

- Ten multiple-choice questions

Question 1

Equity can be defined as:

A treating people the same regardless of their individual needs and personal differences.
B treating people differently based on their individual needs and personal differences.
C the distribution of equal resources to all.
D the distribution of monetary resources only.

Question 2

Giving every member on a softball team the same size and brand of glove is an example of:

A social giving.
B equity.
C diversity.
D equality.

Question 3

A person's genetic disposition is one example of _____ that can affect equity and access.

A environmental factors
B cultural factors
C social factors
D personal factors

Question 4

Social factors that can act as barriers and enablers to participation in sport and physical activity include:

A diversity, physical activity preferences, generational change, parents and siblings.
B diversity, physical activity preferences, parents and teachers.
C diversity, genetic disposition, parents and coaches.
D diversity, government funding, parents and friends.

Question 5

The opening of a state-of-the-art sporting facility within walking distance of your house is an example of _____.

A an environmental enabler
B a personal enabler
C a social enabler
D a personal barrier

Question 6

According to the CSIRO, one of the predicted megatrends relating to our world, politically, culturally and environmentally is:

A New horizons – Science and technology changing the game
B The next arena – The rise of entertainment sports
C Mind the gap – Bringing Australia together across generational and societal divides
D The perfect pivot – Adapting in an uncertain world

Question 7

Which of the following is **not** considered an agent of socialisation?

A Peers
B Parents
C Facilities
D Coaches

Question 8

Demographic change is a term used to describe:

A changes in the size, age, composition and structure of a population.
B influences at a cultural level that can act as barriers or enablers to participation in sport.
C the changing levels of cultural diversity that take place within a population over time.
D changes in tastes, influences and preferences that take place within a population over time.

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Question 9

The belief that a person's abilities can be developed through hard work is an example of:

A intrinsic belief.
B a growth mindset.
C fixed mindset.
D amotivation.

Question 10

Agenda-setting theory argues that:

A government policies influence the types of physical activities that receive the most funding.
B the rules of sporting organisations enable equitable participation.
C institutional rules and regulations improve access to opportunities.
D the choice of issues covered in the media affect public perception of reality.

Section B

- Two short-response questions
- One extended written response question

Question 11 (6 marks)

Compare and contrast a new migrant's ability to access the benefits of physical activity with the ability of someone who has lived in the same community their whole life. In your response, provide specific examples to a number of different barriers and enablers to participations.

Question 12 (6 marks)

The Australian Fitness Institute predicts that AI-powered resources for training, hormone-focused workouts and seeking meaningful fitness experiences will be trends that dominate the fitness world in the future. Describe the personal, social, cultural and environmental factors that are driving these predictions and discuss how this could act as a barrier or enabler to individuals accessing personal, social or community resources.

Question 13 (9 marks)

Identify a sport or physical activity that you have never participated in and have no interest in. Reflect on why you feel this way about the sport or physical activity and describe three barriers to participation. Identify each barrier as either personal, social, cultural or environmental. Justify your position on each barrier.

Practice assessment task

Subject	Physical Education
Instrument number	
Technique	Investigation – report
Unit	2 Sport psychology and equity in physical activity
Topic	2 Equity – barriers and enablers

Conditions	
Duration	5 hours in class
Mode	Report
Length	1500–2000 words
Individual / Group	Individual
Other	The reference list, title page and table of contents are not included in the word count. Schools implement authentication strategies that reflect QCAA guidelines for ensuring student authorship.

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Context

In this topic, you have engaged in integrated learning experiences relating to equity, identifying a range of barriers and enablers that impact on physical activity. Equity strategies to optimise engagement in physical activity were developed, used as learning experiences and analysed to determine their effectiveness on physical engagement and performance. Within various class groups, you have developed and participated in many games where personal, social and cultural factors were manipulated to increase equitable opportunities and optimise physical engagement in activities.

Task

Evaluate the use of equity strategies in optimising your engagement and performance in physical activity this term. Justify the implementation of one equity strategy to increase physical engagement and performance at your school.
To complete this task, you must present a response in a report format that includes the following assessable evidence:

Introduction

- Briefly explain how barriers and enablers affect equity in physical activity.
- Identify the class, school or community physical activity context to frame the investigation.

Discussion

- Select an equity dilemma in a class, school or community physical activity context to devise an equity strategy.
- Define the equity dilemma.
- Analyse and synthesise primary data and secondary data to ascertain the most significant relationships between the:
  - equity dilemma
  - barriers and enablers
  - personal, social, cultural and environmental factors that have limited access to personal, social and community resources in the class, school or community physical activity context
  - strategies that have been used in response to similar equity dilemmas.
- Analyse and synthesise primary data and secondary data to devise an equity strategy that provides a course of action in response to the equity dilemma.
- Evaluate the effectiveness of the equity strategy to optimise access and positive engagement in the class, school or community physical activity context by appraising the potential outcome and limitations.

Conclusion

- Justify the development of the equity strategy using evidence from primary data and secondary data.

Reference list

Acknowledge all sources cited in the investigation.

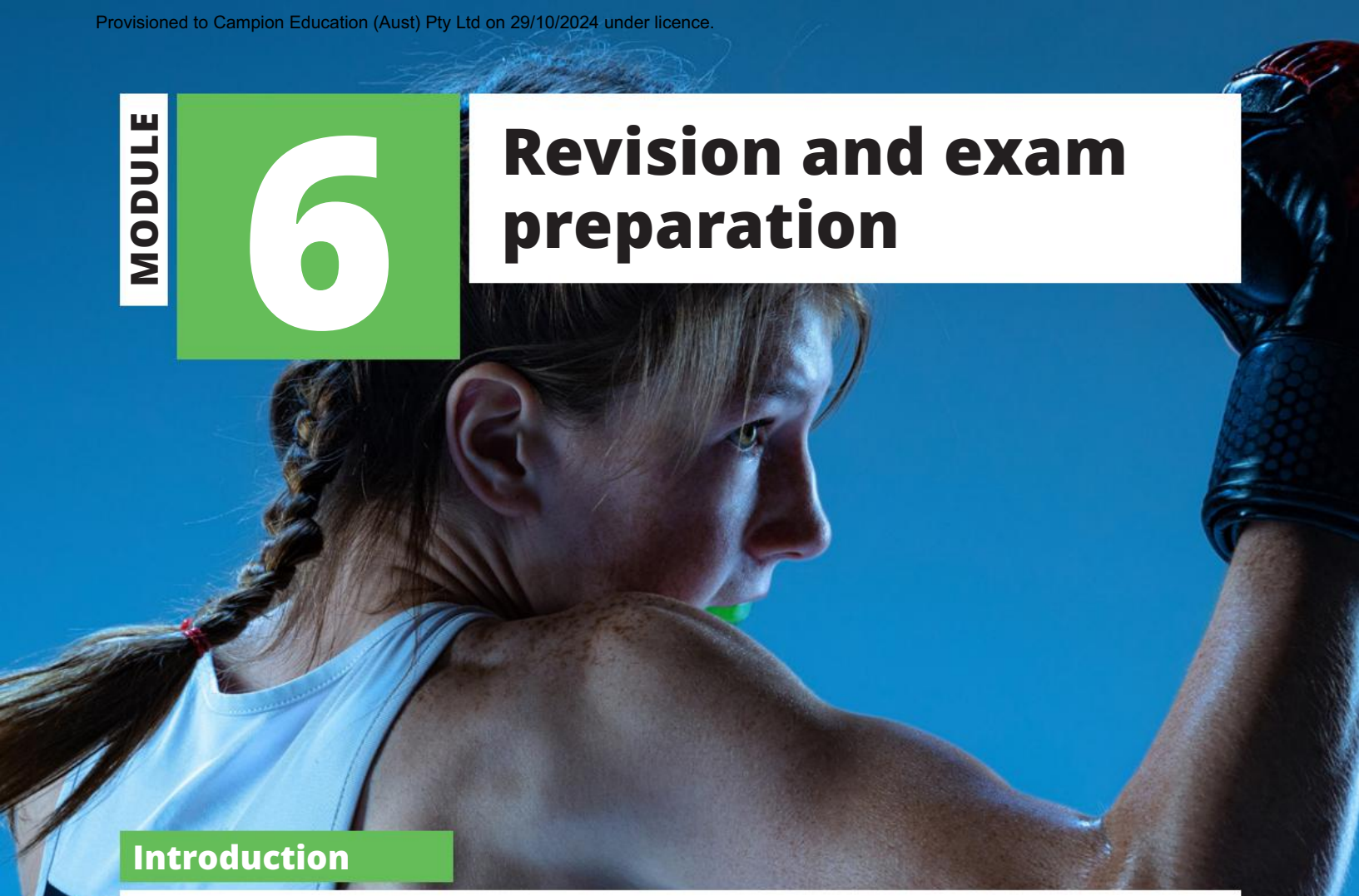
A detailed instrument-specific marking guide (ISMG) for this task is available for teachers to download.

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MODULE 6

Revision and exam preparation



Introduction

This module contains a range of information and practical tips to help you thoroughly revise the subject matter in Unit 1: Motor learning, functional anatomy and biomechanics in physical activity, and prepare you for the Examination – Combination response. It is important to prepare well and ensure you have all the information you need to perform at your best under exam conditions.

This module is divided into 18 lessons (including Skill drills). Each lesson is designed to target specific areas from the subject matter dot points included in the syllabus. Lessons include:

- Key concepts – a brief summary of one or more key concepts (or subject matter dot points) covered in Unit 1 – Motor learning, functional anatomy and biomechanics in physical activity
- Find it here! – a handy reference table to help you locate the information you need to revisit and revise in Unit 1 – Motor learning, functional anatomy and biomechanics in physical activity
- Retrieve and apply – a graded activity designed to test your knowledge and understanding of particular concepts (or subject matter dot points)
- Practice exam – a complete practice examination paper (i.e. featuring multiple-choice, short-response and extended-response questions) focused on one or more key concepts (or subject matter dot points) covered in Unit 1 – Motor learning, functional anatomy and biomechanics in physical activity
- Skill drill – an integrated physical performance activity designed to help you make clear links between the theory covered in each section and your own physical performance (including opportunities to gather primary data).

This module has been designed and structured so that you can approach it flexibly, depending on how your teacher has structured your lessons over the course of Unit 1.

Best of luck with the exam!

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Lesson 6.1
Revision: Motor skills

Key ideas

→ Review of key concepts in motor skills and motor programs

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on motor skills and motor programs.

Motor skills

Motor skills are voluntary movements that involve the use of specific muscles to achieve a defined purpose or goal. They can be classified into three categories:

- **fine and gross motor skills** – this category is based on the size of the muscles involved; for example, off-spinning a cricket ball with the fingers is a fine motor skill, whereas sprinting is a gross motor skill
- **open and closed motor skills** – this category is based on the stability of the environment in which the skill is being performed; shooting a three-pointer in basketball while under pressure is an open skill, whereas taking a close-range penalty shot in indoor netball is a closed skill
- **discrete, continuous and serial skills** – this category is based on whether the skill has a specific beginning and end point; a soccer throw-in is a discrete skill, racewalking is a continuous skill and dribbling in soccer is a serial skill as it consists of a combination of movements.

Motor programs

A motor program is a movement plan (i.e. a plan of action) that contains all the commands from the brain to the muscles that are needed to perform a complex motor skill. Motor programs are made up of a number of simple motor skills put together in a specific sequence to produce the successful and controlled execution of a more complex motor skill. These simple motor skills are often referred to as sub-routines. An example of a motor program is the golf swing, which made up of the following sub-routines: the address, back swing, down swing, impact position and follow through.

When developing motor skills, the learning journey of athletes typically features five characteristics over time. The five characteristics of motor skill learning are:

- **improvement** – the ability of an individual to get better at performing a motor skill over time
- **consistency** – the ability of an individual to perform a particular motor skill reliably and dependably over time
- **stability** – the ability of an individual to control the influence of internal and external factors on their performance of a motor skill
- **persistence** – the ability of an individual to retain (i.e. keep) and perform a motor skill over time
- **adaptability** – the ability of an individual to perform a particular motor skill in response to what is required in a given situation.

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SOURCE 1 Matildas player Mary Fowler displays exceptional open motor skills and adaptability during play.

Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
Motor learning	Lesson 2.1 Introduction to motor learning (page 32)
Motor skills	Lesson 2.2 Motor skills (page 35)

Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in Unit 1 of the QCE Senior Physical Education Syllabus – Motor learning, functional anatomy and biomechanics in physical activity. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts in motor skills, complete the following questions in Source 2. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

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Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	A softball pitcher practises the release of the pitching action 30 times in a row. In this example, the release is: **A** an open motor program. **B** an open sub-routine. **C** a closed motor program. **D** a closed sub-routine.	Lesson 2.1, "What are motor programs?" (page 33)	Total: 1 mark Select the correct option.
Short response question	Explain how knowledge of functional anatomy and biomechanical concepts could assist a beginner runner in achieving the motor skill learning characteristic of improvement.	Lesson 2.2, "Characteristics of motor skill learning" (page 38) Module 3 Functional anatomy and biomechanics (page 94)	Total: 6 marks For full marks on this question, you will need to: • select one relevant functional anatomy and one relevant biomechanical concept that relates to running (2 marks) • accurately link each concept to running (2 marks) • for each concept, explain with discernment (2 marks).
Extended response question	Devise a motor learning strategy for an athlete who wishes to increase the consistency of their performance (in a physical activity of your choice) by using knowledge of performance as feedback.	Module 2 Motor learning (page 28)	Total: 10 marks For full marks on this question, you will need to: • discuss the relevance of the learner's stage of learning to the strategy design (1 mark) • select at least one relevant type of practice and justify (2 marks) • identify the type of environment in which the practice should take place and justify (2 marks) • state the frequency of practice and justify (2 marks) • identify at least one form of knowledge of performance as feedback and justify (2 marks) • justify why it should increase consistency (1 mark).

SOURCE 2 Complete these tasks to see how well you can retrieve and apply key concepts in motor skills.

Practice exam



Practice exam 6.1

Now that you have tested your understanding of key concepts relating to motor skills, it is time to put your learning to the test by completing Practice exam 6.1.

Practice exam 6.1 only includes questions relating to motor skills. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are available to teachers, so ask your teacher for them if you wish to check your responses.

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SKILL DRILL

Lesson 6.2
Motor skill bingo

Aim

To identify the different types of motor skills

Time

One lesson (60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Equipment for chosen physical activity (e.g. cones, bibs, balls)
- Video camera
- Game Performance Assessment Instrument 14 (GPAI 14)
- Pen

Template: Game Performance Assessment Instrument 14 (GPAI 14)

Method

Step 1

Select a sport or physical activity that you have not yet played as a class this year. Familiarise yourselves with the rules.

Step 2

Form two teams and set up the court or field for play including a camera to record the whole court or field.

Step 3

Complete a standard teacher-led warm-up. Play or perform your physical activity for 10 minutes, filming the entire play.

Step 4

At the end of the 10 minutes, return to class. The two teams need to sit together and one member of each team requires a printed copy of GPAI 14.

Step 5

Play a round of motor skill bingo: play back the 10-minute video as the two teams watch. Every time an accurate example of one of the types of motor skills is seen in the video, it is recorded in GPAI 14. The first team to find all seven motor skill types and to yell "Bingo!" (and whose examples are endorsed by the teacher) is the winner.

Motor skill type	Tick when found in play	Example (must be endorsed as an accurate example by the teacher)
Fine motor skill		
Gross motor skill		
Closed motor skill		
Open motor skill		
Serial motor skill		
Discrete motor skill		
Continuous motor skill		

SOURCE 1 GPAI 14

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Analysis and discussion

1 For the serial motor skill identified in GPAI 14, **describe** how it might be executed as a motor program with sub-routines.
2 **Comment** on the skill level of your class in the performed physical activity, using the five characteristics of motor learning as the basis for your opinion.
3 Imagine you have played the above physical activity for some time and over time your performance has demonstrated the characteristics of improvement, consistency, stability and persistence. Suggest a strategy to allow your performance to display the characteristic of adaptability.

Retrieve it!

1 For one of the identified motor skills in GPAI 14:
   a **Identify** the major muscles, bones and joints involved in the successful performance of this skill.
   b **Identify** and **explain** a biomechanical force that is applied.

Lesson 6.3
Revision: Approaches to motor learning

Key ideas

→ Review of key concepts in motor learning

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on the two approaches we use to describe the process of learning motor skills:

- the cognitive systems approach
- the dynamic systems approach.

The cognitive systems approach to motor learning

According to the Physical Education General Senior Syllabus, the **cognitive systems approach** is considered the more traditional approach, and is also known as the cognitive model. It involves a hierarchical model of control where higher control centres pass commands in a pre-determined order to lower control centres, resulting in linear changes in movement. This approach requires an understanding of the process that occurs in making decisions, planning and executing movement. The **information processing model** assumes that the central nervous system controls the body. This model describes separate cognitive stages involving perception, decision making and response execution to enable a performer's decision making prior to any action. Source 1 shows the three separate cognitive stages described in this model.

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Stage 1 Stimulus identification (perception)	• The learner recognises and identifies the input. • Example: a volleyball serve receiver uses their sight to receive information about whether the oncoming serve is fast, slow, short or deep.
Stage 2 Response selection (decision-making)	• The learner makes a decision or develops a motor program in response to the input. • Example: the volleyball player in the Stage 1 example detects that the ball is dropping short and decides to move forward to prepare for a dig.
Stage 3 Response execution (action)	• The learner executes (produces) a response or action. • Example: in the previously mentioned volleyball serve-receive, the player executes a motor program, bending their legs and taking a long step forward before using their arms to perform a dig.

SOURCE 1 The three stages in the cognitive systems approach

Fitts and Posner's (1967) stage model of motor learning

The efficiency of an athlete's information processing can be explained by a second cognitive model: **Fitts and Posner's stage model of motor learning**. This model suggests that an athlete moves through three stages of proficiency in a sport, as shown in Source 2:

- Stage 1 – the cognitive stage
- Stage 2 – the associative stage
- Stage 3 – the autonomous stage.

An athlete using a cognitive systems approach to develop specialised movement sequences and movement strategies will rely on a variety of different practice and feedback types depending on their stage of learning. A coach might use massed, whole or part practice, blocked, constant or drill-based practice to ensure a particular technique can be explicitly developed. They might also offer a range of feedback including verbal, visual and kinaesthetic feedback.

Stage 1 Cognitive stage	• Learners try to understand what is required of them and their body as they undertake the sport. • They begin to identify the goal of the sport. • They experience rapid performance gain. • Their performance is error-ridden. • They use inefficient movement sequences.
Stage 2 Associative stage	• Athletes have a better understanding of the skills within their sport. • They are able to associate environmental cues with actions. • They refine their technique to achieve consistency in their movement sequence performances. • They make few errors and can detect and correct errors they do make.
Stage 3 Autonomous stage	• Athletes have performed, refined and improved their technique over a long period. • They can perform their sport with consistency and without conscious effort. • They can multitask, taking in cues from teammates, the opposition and the environment to ensure their movement sequences are suitable. • They make few errors.

SOURCE 2 The three stages of Fitts and Posner's stage model of motor learning

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SOURCE 3 Broncos star Reece Walsh is an autonomous rugby league player. He demonstrates automatic execution of specialised movement sequences, such as making a pass, with habitual, subconscious control.

The dynamic systems approach to motor learning

The **dynamic systems approach** views motor learning as a much more complex and unpredictable process than the cognitive systems approach. It suggests that movements emerge or self-organise through the dynamic interaction of three constraints, as shown in Source 4.

Task constraints	• The aspects of the task that need to be overcome or adapted to • Examples: the rules of a game, the shape and weight of equipment, the size and shape of the playing surface
Environmental constraints	• The changeable aspects of the environment that need to be overcome or adapted to • Examples: weather conditions, the condition of the playing surface, the number of spectators
Individual constraints	• The characteristics of the individual that need to be overcome or adapted to • Examples: height, weight, skill, strength, motivation and confidence

SOURCE 4 The three constraints in the dynamic systems approach

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The dynamic systems approach also proposes that movements are not organised hierarchically; rather, they involve non-linear and unpredictable changes, and emerge as part of a complex dynamic system. Essentially, this approach to motor learning believes that specialised movement sequences and movement strategies are acquired through participation in activities that closely replicate the requirements of the sport. Through participation in such activities, the individual's whole body will organically respond to the demands of the task and begin to move in ways that support a successful movement outcome. The movement solution demonstrated by the individual will be dependent on the constraints shown in Source 4.

An athlete who is working with the dynamic systems approach to motor learning will tend towards problem solving and random practice. This ensures the athlete experiences a repetition of skills in an environment that exposes them to the constraints they will experience in their game or performance.

Rate limiters

According to the dynamic systems approach, task, environmental and individual constraints compel an athlete to move in a certain way. In many cases, these constraints contribute positively to the development of the ideal movement solution specific to the individual. In other cases, the development of specialised movement sequences or movement strategies is restricted by the constraints. In these cases, the constraints are considered **rate limiters**. Athletes experiencing rate limiters will need to consider alternative ways to overcome these. For example, a young basketball player who is short in height and lacking physical strength may benefit from having the basketball hoop lowered to help them experience success when they shoot in spite of the rate limiters present.

Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
The cognitive systems approach to motor learning	Lesson 2.3 The cognitive systems approach to motor learning (page 43)
The dynamic systems approach to motor learning	Lesson 2.4 The dynamic systems approach to motor learning (page 52)

Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in the QCE Senior Physical Education syllabus. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts in approaches to motor learning, complete the following questions in Source 5. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

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Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	Select the correct response. Which of the following concepts relate to the cognitive systems approach to motor learning? **A** Rate limiters **B** Information processing model **C** Task constraints **D** Self-organisation	Lesson 2.3 The cognitive systems approach to motor learning (page 43)	Total: 1 mark Select the correct option.
Short response question	Explain how the five characteristics of motor skill learning could be used to determine at which stage of learning an athlete is sitting.	Lesson 2.2 Motor skills (page 35) Lesson 2.3 The cognitive systems approach to motor learning (page 43)	Total: 6 marks For full marks on this question, you will need to: • explain the characteristics of motor skill learning (2 marks) • link at least three characteristics to the three stages of learning (3 marks) • explain how the characteristics can be used to determine the stage of learning (1 mark).
Extended response question	Compare and contrast the cognitive and dynamic systems approaches to motor learning considering how each approach acquires specialised movement sequences and movement strategies and the best types of practice for each approach.	Lesson 2.3 The cognitive systems approach to motor learning (page 43) Lesson 2.4 The dynamic systems approach to motor learning (page 52)	Total: 8 marks For full marks on this question, you will need to discuss the similarities and differences, as well as including at least three defining features and two practice recommendations for each approach: • describe similarities between the two approaches (2 marks) • describe differences between the two approaches (2 marks) • explain how the dynamic systems approach proposes specialised movement sequences and movement strategies are acquired (1 mark) • explain how the cognitive systems approach proposes specialised movement sequences and movement strategies are acquired (1 mark) • identify types of practice suitable for each approach (2 marks).

SOURCE 5 Complete these tasks to see how well you can retrieve and apply key concepts in approaches to motor learning.

Practice exam



Practice exam 6.3

Now that you have tested your understanding of key concepts relating to motor skills, it is time to put your learning to the test by completing Practice exam 6.3.

Practice exam 6.3 only includes questions relating to approaches to motor learning. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are available to teachers, so ask your teacher for them if you wish to check your responses.

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SKILL DRILL

Lesson 6.4
Determining an athlete's stage of learning based on features of performance

Aim

To determine the stage of learning of an athlete in basketball

Time

One lesson (60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Basketball
- Two sets of bibs
- Basketball court
- Video camera
- Game Performance Assessment Instrument 15 (GPAI 15)
- Pen

Template: Game Performance Assessment Instrument 15 (GPAI 15)

Method

Step 1

Form two teams for a game of basketball (small classes may wish to play half-court basketball).

Step 2

Complete a standard teacher-led warm-up.

Step 3

Play a game of basketball for 10 minutes, filming the entire play.

Step 4

If you have enough students for substitutes, have them complete a printed copy of GPAI 15, counting errors and successes in a variety of specialised movement sequences such as shooting, dribbling, passing, catching and decision making. Otherwise, watch the the video to complete GPAI 15. Add a description of the features of your performance (e.g. passes are strong and accurate; dribbling is tentative; the ball is easily stolen by the defender).

Specialised movement sequence	Error made by (initials) _____	Effectively performed by (initials) _____
Shooting		
Dribbling		
Passing		
Catching		
Decision making		

SOURCE 1 GPAI 15

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Analysis and discussion

1 **Analyse** GPAI 15 and **determine** how many errors you made in total. How did this result compare with the number of effective specialised movement sequences you performed?
2 Based on these results and your reflection on the quality of your movements, **describe** the features of your basketball performance.
3 Based on these features, **determine** the stage of learning you would place yourself in for the sport of basketball. **Justify** your decision based on the characteristics of performers at that stage of learning.
4 **Decide** which types of feedback you would benefit the most from receiving in basketball. **Justify** your decision referring to features of your performance and your stage of learning.

Retrieve it!

1 Shannon is starting to feel a niggle in her right shoulder from trying to overarm serve in volleyball training. Video analysis shows she steps forward with her right foot before contacting the ball slightly out in front of her body. Provide detailed feedback to Shannon, using functional anatomy and biomechanics terminology to **explain** how she should modify her technique to reduce the chance of injury and optimise her serving performance.

Lesson 6.5
Revision: Types of practice

Key ideas

→ Review of key concepts in types of practice that can be used to develop motor skill learning

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on the types of practice that can be used to develop motor skill learning.

Types of practice

Practice enables an athlete to experience the five characteristics of motor skill learning: improvement, consistency, stability, persistence and adaptability. It also increases their confidence and ability to make better decisions under pressure. Practice must be relevant and appropriate to the athlete's stage of learning to be effective. For instance, learners in the cognitive stage often practise in a closed environment for initial skill development and improvement, while learners in the autonomous stage require increased opportunities to adapt their performance in stressful real-life situations.

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Practice can be classified into the following types:

- **massed practice** – when a skill is practised in a continuous and constant manner (and rest periods are either very short or non-existent)
- **distributed practice** – when a skill is practised with periods of rest that are equal to (or longer than) the periods spent training
- **whole practice** – when a skill is practised as a whole (i.e. in its entirety)
- **part practice** – when a skill is practised in its separate parts
- **blocked practice** – when learners repeat an isolated skill for a period of time or number of repetitions
- **serial practice** – when a set of skills is performed in a set sequence
- **random practice** – when several different sets of skills are practised in an order that is constantly changing
- **constant practice** – when a skill is practised under the same (i.e. constant) conditions
- **varied practice** – the process of practising the same skill or set of skills with varied demands such as distance from target
- **drills** – activities that are set up to allow for practising skills; they can target the development of one or multiple skills in various environments and can vary from simple to complex in nature
- **problem solving** – a type of task that requires learners to solve common problems (e.g. reading environmental cues) and respond to those problems in the most suitable way.
- **specificity** – when skills are practised in an environment that is as close to match conditions as possible
- **variability of practice** – when the learner's experience while practising a skill or strategy includes variations to the context in which they are being practised, as well as variations of the skill or strategy itself.

Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
Types of practice	Lesson 2.6 Types of practice (page 61)

Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in the QCE Senior Physical Education Syllabus. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts in types of practice, complete the following questions in Source 1. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

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Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	Which type of practice most strengthens neural pathways through the use of more complex and unpredictable movement, equipment or environment changes? **A** Variability practice **B** Constant practice **C** Serial practice **D** Blocked practice	Lesson 2.6 Types of practice (page 61)	Total: 1 mark Select the correct option.
Short response question	Develop an argument consisting of three points for why it would be appropriate to use part practice over whole practice.	Lesson 2.6 Types of practice (page 61)	Total: 6 marks For full marks on this question, you will need to: • make an appropriate argument – 1 mark per point (3 marks) • effectively justify your argument – 1 mark per point (3 marks).
Extended response question	Anya is a 14-year-old touch football player in the associative stage of motor skill learning. She has mostly played on the wing. Her coach has begun playing Anya in the middle and she is feeling a little "out of her depth". She occasionally feels flustered when playing against strong teams. This leads her to make slow or poor choices in attack. Devise and justify a practice strategy for Anya, recommending two preferred types of practice to support Anya to feel more comfortable in this transition from the wing to the middle.		Total: 15 marks For full marks on this question, you will need to: • select three ideal practice types – 1 mark per type (3 marks) For each practice type: • accurately explain its features (3 marks) • discuss the benefits (3 marks) • justify the strategy by linking to Anya's needs (3 marks) • communicate effectively (3 marks).

SOURCE 1 Complete these tasks to see how well you can retrieve and apply key concepts in types of practice.

Practice exam



Practice exam 6.5

Now that you have tested your understanding of key concepts relating to types of practice, it is time to put your learning to the test by completing Practice exam 6.5.

Practice exam 6.5 only includes questions relating to types of practice. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are available to teachers, so ask your teacher for them if you wish to check your responses.

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SKILL DRILL

Lesson 6.6
Novice basketball

Aim

To identify an appropriate type of practice based on the athlete's stage of learning

Time

One lesson (60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Basketball
- Two sets of bibs
- Basketball court
- Game Performance Assessment Instrument 16 (GPAI 16)
- Pen

Template: Game Performance Assessment Instrument 16 (GPAI 16)

Method

Step 1

Form two teams for a game of basketball (small classes may wish to play half-court basketball).

Step 2

Complete a standard teacher-led warm-up.

Step 3

Play a 15-minute game (2 x 7.5-minute halves). Standard basketball rules apply, but *all players must perform all ball-related skills with their non-dominant hand,* i.e. dribble, pass, shoot and defend with their non-dominant hand.

Step 4

At the end of the 15 minutes, return to class and complete GPAI 16.

Reflect on the performance of the majority of students in your class and consider if the following statements are mostly true or false.	True	False
We spent a lot of time thinking about what was required and working through the technical requirements.		
We had poor timing.		
We made a lot of errors.		
Our movements were slow, inconsistent and inefficient.		
We had to refine the accuracy and consistency of skills.		
We had the ability to correct our own errors as play went on.		
The more we played, the more our confidence developed.		
We performed the skills accurately and consistently.		
We could detect environmental cues easily.		
We were able to focus mostly on strategies and tactics.		
We are at the stage where we would benefit from psychological skills over physical skills.		

SOURCE 1 GPAI 16

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Analysis and discussion

1 Using the data from GPAI 16:
   - **a** draw on your knowledge of the cognitive systems approach to motor learning to **decide** on the stage of learning and skill level of the majority of the class.
   - **b** **identify** a significant area for improvement in your performance (imagining you will continue to play with your non-dominant hand going forward).

2 Based on your answer to Question 1, **propose** a practice strategy for your class.



Retrieve it!

1 Use your knowledge of functional anatomy and biomechanics to **explain** why most athletes' shooting or passing accuracy or strength under the non-dominant hand conditions is less than under normal playing conditions

Lesson 6.7
Revision: Types of feedback

Key ideas

→ Review of key concepts in types of feedback that can help motivate learners, change performance and reinforce learning

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on the types of feedback that can help motivate learners, change performance and reinforce learning.

Types of feedback

Feedback is an essential element of motor learning. It provides athletes with information about their performance of a skill or strategy. Feedback is organised into two categories:

- **intrinsic feedback** – the internal (or sensory) information within the body
- **extrinsic feedback** – information from an external source (also known as augmented feedback).

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Intrinsic feedback

Intrinsic feedback includes sensory information detected by the performer during and after a movement. The main types of intrinsic feedback are:

- visual (what you see)
- tactile (what you feel)
- auditory (what you hear)
- proprioceptive (what you sense).

Learners at the cognitive stage of learning will find it difficult to make meaning of intrinsic feedback as they are still determining what the ideal performance of the specialised movement sequence or movement strategy should look and feel like. However, it is important that they pay attention to the feedback they receive, because it plays a crucial role in their ability to make appropriate tweaks to their movements to optimise performance.

Learners at the associative stage understand what their ideal performance looks and feels like and can therefore interpret intrinsic feedback to make decisions about how to improve.

Learners in the autonomous stage of learning are particularly attuned to the proprioceptive and auditory feedback and can often make tweaks to their movements mid-performance.

Extrinsic feedback

Extrinsic feedback is information a player receives from an external source after the completion of a movement. This type of feedback is also known as augmented feedback as it supplements the intrinsic feedback the athlete gathers. Extrinsic feedback can be categorised into two types:

- knowledge of results
- knowledge of performance.

Knowledge of results (KR) feedback provides information about the outcome of the performance and is useful in all stages of learning. Individuals in the cognitive and associative stage of learning rely on KR feedback to help them determine how successfully they are learning a skill. Those in the autonomous stage rely less on KR feedback because they can determine the success of their performance based on how it feels.

Knowledge of performance (KP) feedback is concerned with the execution or process of movement (i.e. the technique). KP feedback is useful for cognitive learners to draw their attention to errors in their movement that they cannot detect themselves. For example, an athlete who throws a pass in touch football might initially throw the ball while facing forward and a coach might offer them feedback to remind them to turn their hips to where they want the ball to go.

KP feedback is important at all stages of learning. In the cognitive stage, the feedback will focus on the basics of technique including timing and gross leg, arm and body movements. In the associative stage, KP feedback might cue an athlete into fine-tuning technique and to be responsive to external cues such as positioning of the opposition, teammates and court or field positioning.

Extrinsic feedback can be provided through the following means:

- verbal (spoken) – suited to autonomous and some associative learners who understand what the feedback means
- visual (demonstration or video) – suited to all stages of learning
- kinaesthetic (coach guides athlete's body part through the correct motion) – suited to cognitive and some associative learners who require additional guidance to ensure their body moves through the correct movement.

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Timing of feedback

The timing of the feedback is important. Feedback can be received:

- before performance
- during performance
- after performance.

Offering feedback too quickly and too often can inhibit optimal learning. Time should be given to the learner to process intrinsic feedback before extrinsic feedback is offered. Similarly, individuals should be encouraged to perform multiple times before feedback is provided. Research suggests that every five performances is ideal.

Feedback should be both encouraging and useful. Learners are more likely to take on the feedback provided by teachers and coaches if their efforts have been positively acknowledged before corrections are offered.

Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
Types of feedback	Lesson 2.8 Types of feedback (page 69)



SOURCE 1 Extrinsic feedback can be verbal (spoken), visual (demonstration or video) or kinaesthetic (coach guides athlete's body part through the correct motion) and should be both encouraging and helpful to the athlete.

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Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in the QCE Senior Physical Education syllabus. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning based on the bottom half of the syllabus subject matter. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts in types of feedback, complete the following questions in Source 2. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	Extrinsic feedback is: **A** sensory information received during performance. **B** augmented information received from within. **C** augmented feedback from an external source. **D** sensory information received after the performance.	Lesson 2.8 Types of feedback (page 69)	Total: 1 mark Select the correct option.
Short response question	In the context of physical performance, how does knowledge of performance feedback impact a cognitive learner's ability to refine and excel in their skills? Provide specific examples from your selected physical activity.	Lesson 2.8 Types of feedback (page 69)	Total: 8 marks For full marks on this question, you will need to: • refer to technique or process cues within your selected physical activity (2 marks) • link these cues with the features of a cognitive learner (3 marks) • clearly explain how knowledge of performance feedback links to performance improvement (3 marks).
Extended response question	Evaluate the impact of intrinsic and extrinsic feedback on your development of specialised movement sequences and strategies in your chosen physical activity. Provide specific examples to illustrate the impact of both types of feedback on your skill acquisition, error detection and overall performance optimisation.	Lesson 2.8 Types of feedback (page 69)	Total: 16 marks For full marks on this question, you will need to: • refer to three features of intrinsic and extrinsic feedback (6 marks) • refer to elements of the specialised movement sequences and movement strategies that benefited from feedback (4 marks) • refer to elements of skill acquisition, error detection and performance optimisation (6 marks).

SOURCE 2 Complete these tasks to see how well you can retrieve and apply key concepts in types of feedback.



Practice exam 6.7

Practice exam

Now that you have tested your understanding of key concepts relating to types of practice, it is time to put your learning to the test by completing Practice exam 6.7.

Practice exam 6.7 only includes questions relating to types of feedback. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are available to teachers, so ask your teacher for them if you wish to check your responses.

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SKILL DRILL

Lesson 6.8

Determining the most effective type of feedback for a performer in a selected physical activity

Aim

To determine how the type of extrinsic feedback can impact learning in a selected physical activity

Time

One lesson (60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Equipment specific to your selected physical activity
- Game Performance Assessment Instrument 17 (GPAI 17)
- Pen

Template: Game Performance Assessment Instrument 17 (GPAI 17)

Method

Step 1

Complete an appropriate warm-up. Participate in your selected physical activity for 5 minutes or, if your sport is a performance sport, for three to five attempts. At the end of 5 minutes, your teacher will provide the class (or individuals in a performance sport) with verbal feedback based on results/outcomes only, e.g. "Team A, you made six successful passes and two passing errors".

Following that verbal feedback on results, participate in your selected physical activity for another 5 minutes. Then complete row 1 of GPAI 17.

Step 2

Now your teacher will provide verbal feedback based on performance, e.g. "Team A, you made your pass and then took too long to move into position to continue the attack. When you make a pass, you must immediately run down the court to provide further options to the ball carrier."

Following that verbal feedback based on performance, participate in your selected physical activity for another 5 minutes. Complete row 2 of GPAI 17.

Step 3

Your teacher will now provide verbal and visual feedback based on performance, i.e. they will provide a demonstration of the feedback so students can see what the error is and then what they should do instead.

Following that verbal and visual feedback based on performance, participate in your selected physical activity for another 5 minutes. Complete row 3 of GPAI 17.

Step 4

Now your teacher will provide verbal and kinaesthetic feedback based on performance, i.e. you will be given the opportunity to walk through the feedback and physically enact the feedback offered by the teacher.

Finally, following that verbal and kinaesthetic feedback based on performance, participate in your selected physical activity for another 5 minutes. Complete row 4 of GPAI 17.

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Types of feedback	Description of feedback provided	Effectiveness of feedback on performance (Scale 1 to 5)
Verbal – results		
Verbal – performance		
Verbal/visual – performance		
Verbal/kinaesthetic – performance		

SOURCE 1 GPAI 17

Analysis and discussion

1 State the stage of learning you consider yourself to be in for your selected physical activity.
2 According to secondary data, what is the best type of feedback for your stage of learning?
3 **Analyse** GPAI 17 and **describe** how the different types of feedback affected your learning potential.
4 **Compare** your primary data to the secondary data collected in Question 2. **Discuss** the similarities and attempt to account for any differences.
5 Draw conclusions about the type of feedback best suited to you as a learner of your sport. **Justify** your response, referring to both primary and secondary data.

Retrieve it!

1 **Select** a specialised movement sequence that was focused on in your feedback. **Describe** the shoulder or knee joint movements present during the effective performance of this skill.

Lesson 6.9
Revision: Body and movement concepts

Key ideas

→ Review of key body and movement concepts

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on body and movement concepts.

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Body and movement concepts

Body and movement concepts describe movement. They can be used to help individual athletes or teams to be more aware of their bodies and adapt their movements to achieve specific goals. Over time, knowledge of body and movement concepts supports the development of skill mastery and proficiency by providing a framework for understanding and improving:

- **specialised movement sequences** (i.e. combinations of fundamental movement skills, and sequences relative to a position or event)
- **movement strategies** (i.e. possible solutions to the movement problems posed by any particular game).

There are four body and movement concepts:

- **quality of movement**: the characteristics (i.e. qualities) of a movement. It involves an understanding of time and speed, accuracy, force development, effort, efficiency, effect, flow, sequence, continuity, and outcome of movement,
- **body awareness**: the sense (or consciousness) we have of our own body when performing a skill. It involves an understanding of our balance, stability, weight bearing, transfer of weight and flight.
- **space awareness**: the relationship between the body and its surroundings (i.e. the space around it). It involves an understanding of general and personal space, direction, pathways of movement, and levels and planes of movement.
- **relationships**: the interaction (e.g. positioning) between the people and objects that an athlete interacts with during the performance of specialised movement sequences and movement strategies. These include implements, equipment and other players.



SOURCE 1 Moving in response to where your defender is situated is an example of the body and movement concept of relationships.

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Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
Body and movement concepts	Lesson 2.10 Body and movement concepts (page 74)

Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in the QCE Senior Physical Education syllabus. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts in types of feedback, complete the following questions in Source 2. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	Which is an example of the body and movement concept "quality of movement"? **A** Speed **B** Body shape **C** Direction **D** Levels	Lesson 2.10 Body and movement concepts (page 74)	Total: 1 mark Select the correct option.
Short response question	There are three planes of movement that help to describe the movement of the body. Identify these planes and provide an accurate example of movement along each plane.	Lesson 2.10 Body and movement concepts (page 74)	Total: 6 marks For full marks on this question, you will need to: • identify each plane correctly – 1 mark per plane (3 marks) • provide an accurate example of movement along each plane – 1 mark per example (3 marks).
Extended response question	Reflect on a motor learning strategy that you have implemented in this unit of study. Using body and movement concepts, defend your motor learning strategy's success by ascertaining the most significant relationships between it and your personal performance in your chosen physical activity.	Lesson 2.6 Types of practice (page 61) Lesson 2.8 Types of feedback (page 69)	Total: 12 marks. For full marks on this question, you will need to: • describe different types of feedback (e.g. knowledge of results, knowledge of performance) and how it was utilised in the chosen activity (2 marks) • explain different practice methods (e.g. whole vs. part practice, blocked vs. random practice) and how it was incorporated into the strategy (2 marks) • demonstrate understanding of body and movement concepts in relation to the chosen activity (2 marks) • identify the most significant relationships between the strategy and personal improvement in the chosen physical activity using body and movement concepts (2 marks) • justify using examples and evidence from experience in the unit (4 marks).

SOURCE 2 Complete these tasks to see how well you can retrieve and apply key concepts in body and movement concepts.

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Practice exam

Now that you have tested your understanding of key concepts relating to types of practice, it is time to put your learning to the test by completing Practice exam 6.9.

Practice exam 6.9

Practice exam 6.9 only includes questions relating to body and movement concepts. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are available to teachers, so ask your teacher for them if you wish to check your responses.

SKILL DRILL

Lesson 6.10

Exploring how body and movement concepts interact to develop specialised movement sequences and strategies

Aim

To explore how body and movement concepts interact to develop specialised movement sequences and movement strategies

Time

One lesson (i.e. 60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Two volleyball courts:
  - one beach volleyball size court – 8 x 8 m using flat markers
  - one standard size volleyball court – 9 x 9 m. (You may wish to set up more courts for larger classes.)
- Volleyball
- Game Performance Assessment Instrument 18 (GPAI 18)
- Clipboards
- Whistle

Template: Game Performance Assessment Instrument 18 (GPAI 18)

Method

Step 1

Select two volleyball specialised movement sequences for which you would like to assess your skill level. Record them in the first column of GPAI 18.

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Step 2

Form two teams of three ready for a game of volleyball and complete a standard teacher-led warm-up.

Step 3

Play two 10-minute games under the following conditions:

- Condition A: three players per team on a beach volleyball-sized court, using normal volleyball rules.
- Condition B: three players per team on a standard volleyball-sized court, using normal volleyball rules.

Step 4

At the end of each game, complete the relevant section of GPAI 18, rating your performance of the specialised movement sequences using the body and movement concepts, i.e. complete Part 1 after Condition A and Part 2 after Condition B.

Key: E = Excellent G = Good O = Okay P = Poor	Body and movement concepts															
	Quality of movement (accuracy, continuity and outcome of movement, effect, efficiency, effort, flow, force development, sequence, time and speed)				**Body awareness** (balance, flight, stability, transfer of weight and weight bearing)				**Space awareness** (direction, levels and planes of movement, pathways of movement, using general space and using personal space)				**Relationships** (interaction with opponents, interaction with other players, interaction with implements and objects)			
Part 1: Condition A Specialised movement sequences	E	G	O	P	E	G	O	P	E	G	O	P	E	G	O	P
1																
2																
Part 2 – Condition B Specialised movement sequences	E	G	O	P	E	G	O	P	E	G	O	P	E	G	O	P
1 (same as above)																
2 (same as above)																

SOURCE 1 GPAI 18

Analysis and discussion

1 **Comment** on the value of using body and movement concepts to assess an individual's sporting performance.

2 Using data from GPAI 18, **identify** which of the body and movement concepts:
   - **a** changed the most from Condition A to B, i.e. which concepts were challenged by the new conditions.
   - **b** were the most unchanged from Condition A to B, i.e. which concepts were not affected by the new conditions.

3 Give a plausible explanation for your answer to Question 2a, using knowledge of body and movement concepts.

4 **Reflect on** your quality of movement data in GPAI 18 and **devise** a strategy to improve your performance of one specialised movement sequence, assuming you will be required to permanently perform under Condition B in the future.

Retrieve it!

1 Select a specialised movement sequence in which you rated your quality of movement concepts highly.
   - **a** **Identify** the major muscles and type/s of joints used to execute this movement.
   - **b** Use one biomechanical concept to **explain** why you were able to rate highly in this quality of movment.

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Lesson 6.11
Revision: Functional anatomy

Key ideas

→ Review of key concepts in functional anatomy

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on functional anatomy.

Functional anatomy

Functional anatomy is concerned with how the skeletal and muscular systems work together to produce movement around joints.

Joints

Joints are formed where two or more bones meet. Most of the joints in the human body are called **synovial joints**, which are the only joints that allow true mobility. Critical anatomical and joint movement in physical activities can include:

- **flexion** – decreasing the angle between two bones
- **extension** – increasing the angle between two bones
- **abduction** – moving a body part (e.g. arm) away from the midline of the body
- **adduction** – moving a body part (e.g. arm) towards the midline of the body
- **pronation** – rotating a body part (e.g. the forearm) so that the palm is posterior (facing backwards) or inferior (facing downwards)
- **supination** – rotation of the forearm so that the palm is anterior (facing forwards) or superior (facing upwards)
- **rotation** – movement of a bone around its longitudinal axis
- **circumduction** – movement of a body part in a circular motion where one end remains mostly stationary while the other end moves in a circular motion (e.g. making circles in the air with the hand)
- **plantar flexion** – bending the foot downwards, away from the shin
- **dorsiflexion** – bending the foot upwards towards the shin
- **inversion** – movement of the sole of the foot towards the midline of the body
- **eversion** – movement of the sole of the foot away from the midline of the body.

When analysing the performance of specialised movement sequences by a learner, it can be helpful to describe the joint movements used. In many cases, arms and legs will need to perform joint movements simultaneously. For example, when throwing a shoulder pass in netball, the wrist, elbow and shoulder joints are all engaging in movements such



SOURCE 1 Several joints engage in a variety of movements during a netball shoulder pass.

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as flexion, extension, abduction and rotation simultaneously as well as sequentially to ensure a coordinated and effective pass is made.

Muscle contractions

Muscles can contract, which enables them to produce movement. Muscle contractions in physical activities can be categorised in two ways:

- **isotonic contractions** (muscles under tension through a range of movement)
- **isometric contractions** (muscles under tension without movement).

During isotonic contractions, muscles can either shorten or lengthen. When muscles shorten it is known as a **concentric contraction**. This occurs during the upward phase of a bicep curl, when the biceps brachii muscle concentrically contracts. When a muscle lengthens, it is known as **eccentric contraction**. During a bicep curl, as the biceps brachii muscle moves through the downward phase, it eccentrically contracts.

For muscles to contract and produce movement, a process known as reciprocal inhibition must occur. **Reciprocal inhibition** is the process of muscles on one side of a joint relaxing to accommodate muscle contraction on the other side of the joint. The muscle contracting is known as the **agonist** and the muscle relaxing on the other side of the joint is the **antagonist**. **Stabiliser muscles** support the movement by either promoting the same movement or reducing unnecessary movement. There are two types of stabiliser muscles:

- **synergists** – these muscles stabilise the joint where movement is occurring
- **fixators** – these muscles stabilise the area where the agonist originates.

Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
The structure and function of bones	Lesson 3.2 The structure and function of bones (page 103)
The structure and function of joints	Lesson 3.3 The structure and function of joints (page 107)
The structure and function of muscles	Lesson 3.5 The structure and function of muscles (page 116)

Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in the QCE Senior Physical Education syllabus. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts related to this lesson, complete the following questions in Source 2. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

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Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	When an arm reaches out to catch a ball, shoulder joint experiences which movement? **A** Abduction **B** Adduction **C** Eversion **D** Inversion	Lesson 3.3 The structure and function of joints (page 107)	Total: 1 mark Select the correct option.
Short response question	How does an understanding of biomechanics and functional anatomy enhance an athlete's ability to refine and optimise their performance of specialised movement sequences in a selected physical activity?	Lesson 3.1 Introduction to functional anatomy (page 98) Lesson 3.3 The structure and function of joints (page 107) Lesson 3.5 The structure and function of muscles (page 116) Lesson 3.6 Introduction to biomechanics (page 125)	Total: 6 marks For full marks on this question, you will need to: • explain how knowledge of biomechanics concepts such as levers and force can be used to improve technique in the chosen activity (e.g. maximising force production, minimising energy expenditure) (1 mark) • explain how movement analysis can be used to improve technique in the chosen activity (e.g. identifying inefficiencies, optimising movement patterns) (1 mark) • explain how knowledge of muscles and their actions can improve technique in the chosen activity (e.g. identifying agonist/antagonist relationships for effective movement) (1 mark) • explain how knowledge of joint range of motion can be used to improve technique in the chosen activity (e.g. maximising power output) (1 mark) • provide specific examples of how **both** biomechanical and anatomical knowledge have been used to refine a chosen movement sequence in the selected physical activity (e.g. adjusting body position to improve leverage and joint mobility in softball batting) (2 marks).
Extended response question	Considering the functional anatomy involved in a specialised movement sequence from a physical activity of your choice, explain how agonist, antagonist and stabiliser muscles contribute to optimal performance.	Lesson 3.1 Introduction to functional anatomy (page 98) Lesson 3.3 The structure and function of joints (page 107) Lesson 3.5 The structure and function of muscles (page 116)	Total: 12 marks For full marks on this question, you will need to: • identify a specific movement sequence from a chosen physical activity (1 mark) • accurately identify the primary agonist muscle(s) responsible for the movement in the chosen sequence (1 mark) • accurately identify the antagonist muscle(s) that provide control and opposition to the movement in the chosen sequence (1 mark) • accurately identify the stabiliser muscle groups that provide joint support and stability during the movement sequence (1 mark) • explain how the coordinated action of agonist and antagonist muscles optimises force production and movement control in the chosen sequence (4 marks) • explain how stabiliser muscles contribute to maintaining proper joint alignment and preventing unwanted movement during the chosen sequence, thereby enhancing efficiency and reducing injury risk (4 marks).

SOURCE 2 Complete these tasks to see how well you can retrieve and apply key concepts in functional anatomy.

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Practice exam 6.11

Practice exam

Now that you have tested your understanding of key concepts relating to types of practice, it's time to put your learning to the test by completing Practice exam 6.11.

Practice exam 6.11 only includes questions relating to functional anatomy. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are available to teachers, so ask your teacher for them if you wish to check your responses.

SKILL DRILL

Lesson 6.12
The impact of muscle engagement on athletic performance

Aim

To determine how specific muscle engagement can optimise performance

Time

One lesson (60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Cones or markers
- Open space (e.g. gymnasium, outdoor field)
- Stopwatch
- Game Performance Assessment Instrument 19 (GPAI 19)
- Pen

Template: Game Performance Assessment Instrument 19 (GPAI 19)

Method

Step 1

Set up a simple agility course using cones or markers in an open space. Aim for the circuit to take 20 to 30 seconds to complete. Divide the students into three groups and name them Group A, Group B and Group C.

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Step 2

Instruct each group to complete the agility course at their normal pace, without any specific focus on muscle engagement. Record the time taken for each group to complete the course in GPAI 19 in the Trial 1 column.

Step 3

Have Group A complete the course again, telling them only the time it took them to complete the first trial. Record results in the Trial 2 column on GPAI 19.

Step 4

Provide the following information to Group B: "To complete the agility course, you need to engage your abdominis rectus, quadriceps, hamstrings and gastrocnemius muscles." Have Group B complete the course. Record results in the Trial 2 column.

Step 5

Provide Group C with the following information: "The quadriceps are important agonists for extending the knee during the push-off phase while the hamstrings control the flexion of the knee during the swing phase. The gastrocnemius and soleus muscles contribute to ankle plantar flexion, crucial for push-off and forward momentum. The hip flexors lift the knee during the swing phase and the hip extensors propel the body forward during push-off. The core muscles (abdominals, obliques, lower back) provide stability and facilitate efficient movement."

Step 6

Guide Group C through a 5- to 7-minute warm-up and demonstrate exercises to engage and activate the muscles described in Step 5. Have students practise each described movement individually during this time. Have Group C complete the course. Record results in the Trial 2 column.

Step 7

Record all your group's data in a central location and determine the average of the group by adding the times together and dividing the total by the number of students in your group. Record the results in the Trial 2 Group average column.

Group	Trial 1 (secs)	Trial 2 (secs)	Trial 2 Group average (secs)
Group A (control group)			
Group B (minimal information)			
Group C (detailed information)			

SOURCE 1 GPAI 19

Analysis and discussion

1 **Analyse** your primary data and **compare** your individual results from Trial 1 to Trial 2.
2 Draw conclusions about the type of feedback best suited to you as a learner of your sport. **Justify** your response referring to both primary and secondary data.
3 Select a specialised movement sequence that was focused on the feedback you were given during your group's trial. If no feedback was given, select a specialised movement sequence you completed during your agility run, e.g. pushing off. **Describe** the shoulder or knee joint movements present during the effective performance of this skill.

Retrieve it!

1 Draw conclusions about the type of feedback best suited to you as a learner of your sport. **Justify** your response, referring to both primary and secondary data.

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Lesson 6.13
Revision: Force production in physical activity

Key ideas

→ Review of key concepts in force production in physical activity

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on force production in physical activity.

Force

A force is an interaction that (when unopposed) causes (or has the potential to cause) a change in the motion of an object. Forces can be grouped into two broad categories, according to where and how they are generated:

- **internal forces** – these are generated inside the body and include movements caused by muscles contracting and relaxing
- **external forces** – these are generated outside the body.
  There are two main types of external forces:
- **contact forces** – these forces act on objects that come into direct contact with each other and include:
  - **ground reaction force** – exerted by the ground on a body or object that is in contact with it
  - **joint reaction force** – generated by two bones acting on each other across a joint
  - **friction force** – generated by the surface of an object rubbing against the surface of another object
  - **drag force** – generated by a fluid (e.g. air or water) opposing the movement of an object
  - **inertial force** – generated by the resistance to change in the velocity of an object
  - **elastic force** – generated by the resistance of an object to change shape
- **non-contact force** – these forces act on objects without coming into contact with them. The most common type of non-contact force in sport is gravitational force, which is a force that attracts a body or object towards the centre of the Earth (or towards any other body that has mass).

Force production in physical activity

Athletes need to produce and control force to overcome one or more external forces acting upon them during physical activity. Force production is often the combined result of different biomechanical concepts. These include:

- **momentum**: a term used to describe the tendency of a moving object to continue moving (in a straight line); the mass (e.g. in kilograms) of an object multiplied by its

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velocity (measured in metres per second). Whenever two objects collide, their combined momentum will be the same after the collision as it was before (i.e. it will be conserved). This is called conservation of momentum.

- **summation of forces**: a term used to describe the sequential combination of forces produced by different parts of the human body acting together to maximise force production. Force can be summated in two ways:
  - simultaneous summation of force: harnessing the power of almost every part of the body at the same time to maximise force production, e.g. long jump
  - sequential summation of force: producing controlled amounts of force in a sequence by transferring momentum and energy from one body part to another, e.g. using larger through to smaller muscles to successfully land the shot during a basketball lay-up
  - impulse: a term used to describe the change in momentum that occurs over time when force is applied to an object.

Levers

Levers can help athletes produce force. Levers have three main parts:

- the load (**resistance** or output force) – the object to be moved
- the **effort** (force or input force)– the energy used to move the lever
- the pivot point (**fulcrum**) – the point at which the lever pivots.

The human body contains many levers made up of bones and muscles. In many types of sports and physical activities, athletes combine the use of anatomical levers (internal levers) with the use of sporting equipment such as bats and racquets (external levers).

There are three different types of levers:

- **first-class levers** (where the fulcrum is positioned between force and resistance)
- **second-class levers** (where the resistance is positioned between the effort and the fulcrum)
- **third-class levers** (where the effort is positioned between the resistance and the fulcrum).

Third-class levers are the most common type of lever found in the body and they are also the most widely used in sports and physical activities. The action or advantage gained from using a lever is known as leverage.

Some levers help athletes to multiply (increase) force, while others help them to multiply (increase) speed:

- **force multipliers**: levers that make it easier to move a heavy object with less force by increasing the distance over which the force is acting
- **speed multipliers**: levers that make the load move through a longer distance. The velocity at the end of a long lever is faster than the velocity at the end of a short lever. This means the end of a lever will move more quickly than any other point on the lever.

Calculating force

Concepts associated with force can be calculated in different ways. Source 1 (page 404) provides the formulae and examples for calculating force, momentum and impulse.

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Force concept	Formula	Example
Force (measured in newtons, expressed as N)	Force(F) = mass(m) × acceleration(a)	Find the force that is required to accelerate a 43-kilogram gym sled at 5 m/s². Force(F) = 43 kg × 5 m/s² = 215 N
Momentum (measured in kilogram metres per second, expressed as kg m/s)	Momentum(p) = mass(m) × velocity(v)	Find the momentum of a basketball with a mass of 0.6 kilograms moving at a speed of 3 m/s. Momentum(p) = 0.6 kg × 3 m/s = 1.8 kg m/s
Impulse (measured in newton seconds, expressed as N s)	Impulse(J) = force(F) × time(t)	Find the impulse applied to a volleyball during a set when a force of 15 N is applied for 0.2 seconds. Impulse(J) = 15 N × 0.2 s = 3 N.s

SOURCE 1 Formulae and examples for calculating force, momentum and impulse



SOURCE 2 When executing a forehand volley, a tennis player applies internal force against the grip to steady the racquet in preparation for the oncoming force of the ball.

Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
Force	Lesson 3.7 Force (page 129)
Force production	Lesson 3.8 Force production (page 133)
Levers	Lesson 3.10 Levers (page 143)

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Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in the QCE Senior Physical Education syllabus. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts relating to this lesson, complete the following questions in Source 3. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	If a shotput with a mass of 4 kilograms is accelerating at 5 m/s², how much force was exerted by the athlete? **A** 9 N **B** 9 m/s² **C** 20 N **D** 20 m/s²	Lesson 3.7 Force (page 129)	Total: 1 mark Select the correct option.
Short response question	A touch football player is attacking the try line and finds a gap in the defence. She dives to score a try. In no more than 150 words, explain how she uses summation of forces, outlining the approximate order of the major muscles activated from the start to the end of the dive.	Lesson 3.8 Force production (page 133)	Total: 7 marks For full marks on this question, you will need to: • correctly explain the concept "summation of forces" (1 mark) • differentiate between simultaneous and sequential summation of force (1 mark) • correctly select major muscles from lower legs, upper legs, glutes, torso, and arms (5 marks).
Extended response question	Identify how the six types of contact forces impact your performance in your chosen physical activity. Devise a strategy to reduce the impact of negative contact forces to optimise your performance of a specialised movement sequence and one movement strategy.	Lesson 3.7 Force (page 129) Lesson 3.8 Force production (page 133)	Total: 15 marks For full marks on this question, you will need to: • identify six contact forces (6 marks) • explain how each impacts your performance (3 marks) • devise a strategy reducing the impact of contact forces on your selected specialised movement sequence and movement strategy (3 marks) • explain how your strategy optimises your performance (3 marks).

SOURCE 3 Complete these tasks to see how well you can retrieve and apply key concepts in force production in physical activity.

Practice exam



Practice exam 6.13

Now that you have tested your understanding of key concepts relating to force production, it is time to put your learning to the test by completing Practice exam 6.13.

Practice exam 6.13 only includes questions relating to force production in physical activity. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are are available to teachers, so ask your teacher for them if you wish to check your responses.

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SKILL DRILL

Lesson 6.14
Investigate the impact of third-class levers on performance

Aim

To explore third-class levers in the selected physical activity as force multipliers and speed multipliers

Time

One lesson (60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Standard softball equipment with the following specific batting gear:
  - one standard-length softball bat
  - one short softball bat, e.g. a primary school tee ball bat. If you do not have access to this, a plastic paddleboard bat will suffice. Put all other bats away so that there can be no mixing of bats.
- Tape measure
- Game Performance Assessment Instrument 20 (GPAI 20)
- Pen

Template: Game Performance Assessment Instrument 20 (GPAI 20)

Method

Step 1

Form two teams (Team A and Team B) and set up the field for a game of softball. Give a copy of GPAI 20 to one class member and put them in charge of recording the data throughout the game.

Step 2

Complete a standard teacher-led warm-up.

	Team A				Team B			
	First inning – short bat		Second inning – standard bat		First inning – short bat		Second inning – standard bat	
	Successful outfield hit	Approx. distance (m)	Successful outfield hit	Approx. distance (m)	Successful outfield hit	Approx. distance (m)	Successful outfield hit	Approx. distance (m)
1st batter	☐		☐		☐		☐	
2nd batter	☐		☐		☐		☐	
3rd batter	☐		☐		☐		☐	
4th batter	☐		☐		☐		☐	
5th batter	☐		☐		☐		☐	
6th batter	☐		☐		☐		☐	
7th batter	☐		☐		☐		☐	
8th batter	☐		☐		☐		☐	
9th batter	☐		☐		☐		☐	

SOURCE 1 GPAI 20

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Step 3

Play two 10-minute innings of softball under the following conditions:

- Inning 1: Both teams bat using the same short bat. The approximate distance of all successful outfield hits is recorded on GPAI 20.
- Inning 2: Both teams bat using the standard-length softball bat. The approximate distance of all successful outfield hits is recorded on GPAI 20.

Analysis and discussion

1 **Analyse** GPAI 20 and:
   - **a** draw a conclusion about which bat generated better outcomes for the team
   - **b** use your knowledge of levers, force multipliers, and speed multipliers to provide an explanation for your conclusion in Question 1a.

2 Draw a rough sketch of a batter, **identifying** which of the three types of levers is in action during the softball batting motion, labelling the effort, resistance and the fulcrum.

3 Using biomechanical concepts, **consider** the implications for the softball batting technique if the standard-length softball bat was lengthened in the future of the sport.

Retrieve it!

1 **Explain** the joint movements associated with the softball batting technique.

Lesson 6.15
Revision: Motion in physical activity

Key ideas

→ Review of key concepts in motion in physical activity

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on motion in physical activity.

Motion

Motion is the action or process of moving or being moved; more specifically, the change in position of an object over time due to forces being applied to it. When describing the motion of an athlete, ball or other piece of sporting equipment, biomechanists look at the shape of movement (curved or straight) and whether the object rotates around an axis (i.e. a central point).

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There are four main types of motion:

- **linear motion** – where movement is along a straight line, there is no rotation and all body parts move in the same direction at the same speed
- **curvilinear motion** – where movement is along a curved line in the same direction at the same time
- **angular motion** – where movement happens along a circular line around an axis at the same angle, in the same direction and at the same time
- **general motion** – a combination of linear and angular motion.

Motion can also be described and measured using the following concepts:

- **speed** – the distance travelled per unit of time speed
- **velocity** – the rate at which an object changes position
- **displacement** – the quantity used to describe the extent of a body's motion (i.e. the distance and direction travelled between a starting point and an endpoint as the crow flies)
- **acceleration** – the rate at which an object changes its velocity.

Source 1 provides the formulae and examples for calculating speed, velocity, displacement and acceleration.

Motion concept	Formula	Example
Speed	speed(v) = distance(d) ÷ time taken(t)	Calculate the speed of a sprinter who has run the 100-metres event in 12 seconds. speed(v) = 100 m ÷ 12 s = 8.33 m/s
Velocity	velocity(v) = displacement(s) ÷ time taken(t)	In 2 seconds, a soccer player kicks the ball from midfield and lands it directly in front of the goal (which is 40 metres away). What is the ball's velocity? velocity(v) = 40 m ÷ 2 s = 20 m/s
Displacement	displacement(Δx) = final position(x_f) − initial position(x_i)	Calculate the displacement of a softball player who attempts to steal from first base to second base but after running 5 metres, turns and retreats back to first base due to a nearby fielder with the ball. displacement ($\Delta \vec{x}$) = 0 m − 0 m = 0 m
Acceleration	acceleration(a) = change in velocity(Δv) ÷ time taken(t)	A runner reaches a velocity of 10 m/s 3 seconds after starting the race. Calculate their acceleration. Change in velocity = 10 m/s (final velocity − starting velocity) acceleration(a) = 10 m/s ÷ 3 s = 3.33 m/s^2

SOURCE 1 Formulae and examples for calculating speed, velocity, displacement and acceleration

Newton's laws of motion

Newton's laws of motion describe the relationship between objects and the forces acting on them. It is useful to have an understanding of Newton's laws of motion to understand how to work with forces acting upon you and objects, and to subsequently refine physical performance. Newton described three laws of motion:

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- **Newton's first law of motion (inertia)** – a body continues in a state of rest or uniform velocity unless acted upon by an external force
- **Newton's second law of motion (acceleration)** – when a force acts on an object, the acceleration experienced by the object is proportional to the size of the force and takes place in the direction in which the force acts
- **Newton's third law of motion (reaction)** – for every action there is an equal and opposite reaction.

Projectile motion

Projectile motion describes the movement of any object that has been launched, hurled or thrown into the air. Understanding the motion of a projectile can help us determine how to, for example, best pitch a softball, shoot a basketball or throw a javelin. It allows us to accurately predict and analyse the trajectory, range and impact of these objects. The trajectory of an object depends on a range of factors, including:

- angle of release
- height of release
- speed of release.

Refining each of these areas when launching a projectile, specific to the task requirements, can optimise the outcome of the performance.



SOURCE 2 The faces of golf clubs have different angles (lofts) to produce various angles of release depending on what shot the golfer wants.

Bernoulli's principle

Bernoulli's principle states that any increase in the velocity of a fluid (air or water) is accompanied by a simultaneous decrease in pressure. The forces produced by this directly impacts the movement of a person or implement through air or water in many physical activities. Bernoulli's principle explains how athletes generate lift force: when air or water travels further over the top of a moving object than underneath creates a pressure difference, resulting in the object pushing upwards. In particular, Bernoulli's principle also helps us to understand how implements travelling through the air are subject to **Magnus force**, which explains the impact of spin on the trajectory of a ball. Magnus force explains the following:

- **topspin** – when an object rotates forwards, causing it to drop sharply during flight
- **backspin** – when an object rotates backwards, causing it to fall slowly towards the end of its flight
- **sidespin** – when an object rotates sideways, causing it to curve left or right during flight

Athletes can manipulate spin on implements such as balls to influence flight and gain a competitive edge. For example, adding topspin to a volleyball serve allows an athlete to apply more force to a ball and still have it drop into the opposition's court. Applying backspin to a tennis ball means the ball travels more slowly through the air which enables a player to regain court position between shots. Sidespin can be applied to a cricket ball during the bowling action to make it curve in or out from the batter increasing their chance of mis-hitting the ball and the fielding team gaining a wicket. Lift is experienced by balls with backspin but also in water sports such as swimming. Athletes can shape and move their hands to create a pressure difference which results in a lift force upwards.

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Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
Motion	Lesson 3.12 Motion in physical activity (page 153)
Newton's law of motion	Lesson 3.13 Newton's laws of motion (page 161)
Projectile motion	Lesson 3.14 Projectile motion (page 165)
Bernoulli's principle	Lesson 3.15 Bernoulli's principle (page 171)

Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in the QCE Senior Physical Education syllabus. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts relating to this lesson, complete the following questions in Source 3. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	Which type of motion is characterised by movement along a straight line, with no rotation, and all body parts moving in the same direction at the same speed? **A** Curvilinear motion **B** Angular motion **C** General motion **D** Linear motion	Lesson 3.12 Motion in physical activity (page 153)	Total: 1 mark Select the correct option.
Short response question	Describe how factors such as the angle of release, height of release, and speed of release contribute to optimising the performance of a discus throw.	Lesson 3.14 Projectile motion (page 153)	Total: 6 marks For full marks on this question, you will need to: • explain how the angle of release affects the trajectory and distance of the throw (e.g. optimal angle for maximising flight time and distance) (1 mark) • provide a specific range for the optimal release angle in discus throwing (e.g. 35–40 degrees) (1 mark) • explain how the height of release affects the discus's path and distance (e.g. movement from low to high during wind up) (1 mark) • describe the ideal height of release relative to the thrower's shoulder (e.g. slightly above the shoulder) (1 mark) • explain how the speed of release contributes to the distance of the throw (e.g. higher speed translates to greater initial projectile velocity) (1 mark) • acknowledge the importance of balancing speed with control for an accurate throw (1 mark).

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Question type	Retrieve it!	Find it!	Mark it!
Extended response question	Explain the role of spin in either volleyball, tennis or soccer, focusing on how Bernoulli's principle influences the trajectory and behaviour of the ball in at least two different ways. Provide specific examples of specialised movement sequences and movement strategies from your chosen sport and discuss how players strategically utilise spin to enhance their performance in the chosen sport.	Lesson 3.15 Bernoulli's principle (page 171)	Total: 13 marks For full marks on this question, you will need to: • explain how spin affects the trajectory of the ball in the chosen sport (e.g. topspin creates lift, backspin creates dip) (2 marks) • apply Bernoulli's principle to explain the influence of spin on trajectory (e.g. faster airflow over a spinning ball creates a pressure difference, affecting lift) (2 marks) • explain how spin affects another aspect of the ball's behaviour in the chosen sport (e.g. sidespin creates a curve, affecting direction) (2 marks) • apply Bernoulli's principle to explain the influence of spin on this behaviour (e.g. Magnus effect for sidespin) (2 marks) • identify two distinct specialised movement sequences used to generate different types of spin in the chosen sport (e.g. serving or spiking techniques in volleyball, forehand and backhand strokes in tennis) (2 marks) • for each chosen movement sequence, explain how players strategically utilise specific techniques to generate the desired spin (e.g. wrist and arm action for topspin serve in volleyball) (2 marks) • explain how the generated spin enhances performance in the chosen sport for each sequence (e.g. topspin serve for increased service difficulty) (1 mark).

SOURCE 3 Complete these tasks to see how well you can retrieve and apply key concepts in motion in physical activity.

Practice exam

Now that you have tested your understanding of key concepts relating to types of practice, it is time to put your learning to the test by completing Practice exam 6.15.



Practice exam 6.15

Practice exam 6.15 only includes questions relating to motion in physical activity. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are available to teachers, so ask your teacher for them if you wish to check your responses.

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SKILL DRILL

Lesson 6.16
The impact of spin on the flight of a volleyball during a serve

Aim

To determine how topspin, backspin and sidespin impact the flight of a volleyball during a serve

Time

One lesson (60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Volleyball
- Cones
- Volleyball court (with net)
- Flat markers
- Video camera
- Game Performance Assessment Instrument 21 (GPAI 21)
- Pen

Template: Game Performance Assessment Instrument 21 (GPAI 21)

Method

Step 1

Select at least four competent overarm servers to serve volleyballs across the net (name them Student A to D). Select two students to video the serve. Take one video facing the server side on and following the path of the ball over the net, and one video from the other side of the court directly opposite the server.

Step 2

Set a flat marker in the middle of the baseline at the server end of the court – this will be the position each server serves from. Place another flat marker in position 6 on the opposite side of the court – this will be where the serve should be aimed.

Step 3

Video Student A performing five serves with no spin applied to the ball (hit with palm of hand only). Review the video and complete GPAI 21 row A.

Step 4

Video Student B performing five serves with topspin applied to the ball (hit with palm of hand and wrap fingers over the ball). Review the video and complete GPAI 21 row B.

Step 5

Video Student C performing five serves with backspin applied to the ball (hit with palm of hand with fingers tilting backwards, scraping the underside of the ball). Review the video and complete GPAI 21 row C.

Step 6

Video Student D performing five serves with sidespin applied to the ball (if right-handed, hit with whole hand towards the right side of the ball with palm angling inwards and wrapping around the side of the ball). Review the video and complete GPAI 21 row D.

Student	Describe the spin of the ball (speed and direction)	Describe the flight of the ball (straight, curved left/right, etc.)	Describe where the ball lands in relation to the marked spot
A (control serve)			
B (topspin)			
C (backspin)			
D (sidespin)			

SOURCE 1 GPAI 21

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Analysis and discussion

1 View the video footage collected and **compare** the spin and flight of the ball between the four conditions.
2 Research online and **determine** whether the flight matches an expert performance of the serves.
3 **Compare** the accuracy of the ball in relation to the target.
4 Find two pieces of secondary data that describe how spin in a volleyball serve should affect the flight of the ball. Does this support your findings? Why or why not?
5 Write a paragraph drawing conclusions about the impact of spin on the flight of a volleyball serve, referring to both primary and secondary data in your response.

Retrieve it!

1 **Describe** the types of practice you would use to improve your performance of a sidespin serve. **Justify** your choices using secondary data about types of practice.

Lesson 6.17
Revision: Balance and stability

Key ideas

→ Review of key concepts in balance and stability in force production and movement

Key concepts

Let's start by reviewing the following key concepts from the syllabus. This lesson focuses on balance and stability in force production and movement.

Balance and stability

A level of balance and stability is required to perform most physical activities. **Balance** is a term used to describe the even distribution of weight that enables a person or thing to remain upright and not fall over. There are two types of balance:

- **static balance** – when a body is stationary
- **dynamic balance** – when a body is moving.

When participating in a game of volleyball, an athlete requires both static and dynamic balance. For example, holding a squat position ready to receive a pass from a ball being served requires static balance, while dynamic balance is required at the point of contact with the ball as the receiver makes adjustments to their positioning in response to the ball's spin and movement through the air.

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Stability is a term used to describe the degree to which a person or thing can resist challenges to their state of equilibrium. With stability, an athlete has the ability to adapt to the internal and external forces they experience in their physical activity. They are also better able to produce force efficiently and effectively. For example, a strong rugby union player who adopts a low position before making a tackle will have greater stability and be better able to produce the desired force to complete the tackle than a weaker player who remains upright and unstable.



SOURCE 1 A volleyball pass receiver must find the optimal positioning to ensure their stability is balanced but still allows for movement.

Balance and stability can be increased by:

- increasing the base of support as required (i.e. extending the base of support in the direction of an oncoming force)
- ensuring the line of gravity falls within the base of support
- shifting the line of gravity towards the oncoming force
- lowering the centre of gravity
- increasing mass.

Sometimes, athletes need to find the optimal positioning to ensure their movement is not compromised. In some instances, too much balance has a negative impact on performance because the movability of the athlete is reduced. In the case of the volleyball pass receiver, if their squat position is too stable (i.e. close to the ground) they may not be able to quickly and easily return to a more mobile position for the next part of play.

Find it here!

For exam success, you will need to know about the concepts discussed above in detail. You will also need to be prepared to respond to questions on them. If any of these concepts are unclear or unfamiliar to you, you can revisit and revise them using the table below.

Subject matter	Lesson
Balance and stability	Lesson 3.16 Balance and stability (page 178)

Retrieve and apply

To perform well on the exam, you will need to be able to **retrieve** the subject matter content listed in the QCE Senior Physical Education syllabus. You will also need to be able to **apply** higher-order thinking skills to respond to more complex questioning based on the bottom half of the syllabus subject matter. Remember, success is in the detail!

To see how well you can retrieve and apply key concepts related to balance and stability, complete the following questions in Source 2. Answers for these tasks are available to teachers, so ask your teacher for them if you wish to check your responses.

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Question type	Retrieve it!	Find it!	Mark it!
Multiple choice question	Dynamic balance: **A** enables athletes to remain upright when moving. **B** enables athletes to remain upright when stationary. **C** can be increased by moving faster. **D** can be decreased by lowering the centre of gravity.	Lesson 3.16 Balance and stability (page 178)	Total: 1 mark Select the correct option.
Short response question	Explain why a soccer goalkeeper should NOT lower their centre of gravity too much.	Lesson 3.16 Balance and stability (page 178)	Total: 4 marks For full marks on this question, you will need to: • explain how a lower centre of gravity can increase stability too much and limit a goalkeeper's agility and ability to react quickly to shots directed towards the corners of the goal (2 marks) • explain how a lower centre of gravity can hinder a goalkeeper's ability to generate explosive power for diving saves or jumping to reach high shots (2 marks).
Extended response question	Describe two situations in your chosen sport where an athlete's balance or stability could be challenged. How can an athlete improve their overall balance and stability for better performance?	Lesson 3.16 Balance and stability (page 178)	Total: 10 marks For full marks on this question, you will need to: • clearly describe two situations within the chosen sport where an athlete might struggle to maintain balance or stability (e.g. changing direction quickly in soccer, recovering from a dive in swimming) (4 marks) • explain why these situations are challenging for balance or stability (e.g. quick changes of direction require rapid adjustments, recovering from a dive requires controlling body position in the air and water transition) (3 marks) • identify a way to improve their balance and stability (e.g. lowering centre of gravity) (1 mark) • explain how the chosen strategy specifically improves balance and stability in the context of the chosen sport (2 marks).

SOURCE 2 Complete these tasks to see how well you can retrieve and apply key concepts in balance and stability.

Practice exam

Now that you have tested your understanding of key concepts relating to balance and stability, it is time to put your learning to the test by completing Practice exam 6.17.



Practice exam 6.17

Practice exam 6.17 only includes questions relating to balance and stability in force production and movement. It is structured and formatted in a similar way to the official QCAA Examination – combination response:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response question.

You can use the practice exam in any way you like. If you feel confident with this subject matter, then you may wish to complete only a few questions from each category. If you feel you need extra practice, you may wish to complete all questions. Answers are available to teachers, so ask your teacher for them if you wish to check your responses.

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SKILL DRILL

Lesson 6.18
Dynamic balance fitness test

Aim

To determine the dynamic balance of participants

Time

One lesson (60 minutes) with additional time to complete analysis, discussion and retrieval tasks

Equipment

- Tape measure
- Masking tape or flat markers
- Game Performance Assessment Instrument 22 (GPAI 22)

Template: Game Performance Assessment Instrument 22 (GPAI 22)

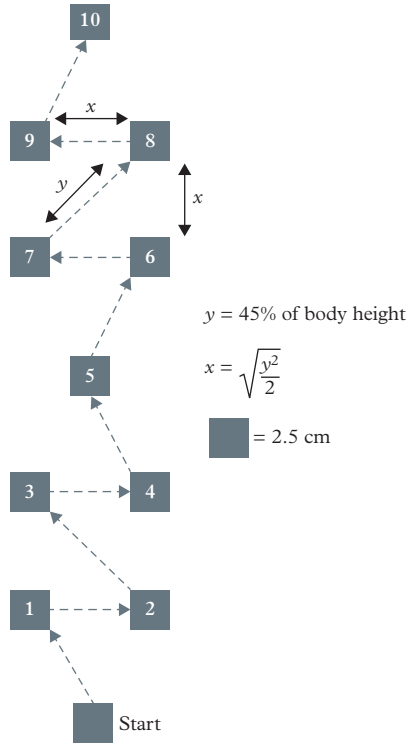
Method

Step 1

Select a partner of roughly the same height. Measure and record your heights on your copy of GPAI 22. Place the flat markers or use tape to set up the balance course as shown in Source 1, based on your respective heights.

Step 2

Stand with one foot at the Start marker and your hands on your hips. When instructed, hop to the next marker and hold your position for 5 seconds. Have your partner note any errors as tallies on GPAI 22. Use Source 2 as a guide. Participants can receive up to three landing errors and 10 balance errors per hop. Repeat until course is complete.



SOURCE 1 Balance course

Type of error	Operational definition of error
Landing error	Not covering tape mark
	Stumbling on landing
	Foot not facing forward with 10° inversion or eversion allowed
	Hands off hips
Balance error	Touching down with non-supporting limb
	Non-supporting limb touching supporting limb
	Non-supporting limb moving into excessive (>30°) flexion, extension or abduction
	Hands off hips

SOURCE 2 Definitions of various landing and balance errors

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Step 3

Switch roles and repeat Step 2.

Hop number	1	2	3	4	5	6	7	8	9	10	Totals
Landing error (max 3)											
Balance error (max 10)											
Total											

Score	Rating
<13	Very good
14–40	Good
41–80	Average
81–116	Poor
> 117	Very poor

SOURCE 3 GPAI 22

Analysis and discussion

1 For each hop, **determine** your total error count then calculate your overall total error count out of 130. What is your rating?
2 **Explain** why examining dynamic balance is more beneficial than static balance in invasion and net and court sports.
3 **Evaluate** your dynamic balance in your selected physical activity by referring to your test results and the movement sequences for one movement strategy.

Retrieve it!

1 **Predict** how dynamic balance might change as a performer moves through the three stages of learning.

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Glossary

A

acceleration
a measure of how quickly or slowly the velocity of an object changes over time

access
the opportunity a person is given to make use of something or take part in something; in a sporting context, access refers to the ways in which different institutions (e.g. schools, sporting clubs, organisations and governments) make sure that all people have the same opportunities to participate in sports and activities of their choice

adaptability
a characteristic of motor skills; adaptability refers to the ability of an individual to perform a particular motor skill in response to what is required in a given situation

afferent feedback
the information sent to the brain when a person moves various parts of their body, such as muscles, joints and skin, about the movements

affirmations
positive statements that are directly related to an athlete's qualities, abilities or goals

agents of socialisation
the people in our lives from whom we learn the types of behaviours that are expected of us in society (e.g. parents and guardians, siblings, friends, teachers and coaches)

agonist
a muscle that provides the main force to cause a particular movement

amotivation
the total absence of motivation

anatomy
a field of science that investigates the bodily structures of humans, animals and other living organisms often by dissecting and examining the muscles, bone and internal organs of the organisms being studied

angle of release
the angle at which an object is launched into the air relative to the ground

angular motion
any movement that happens along a circular line around an axis (i.e. central point)

antagonist
a muscle whose action opposes (or reverses) that of the agonist muscle

anxiety
psychological and physical symptoms brought on by a sense of apprehension about something

appendicular skeleton
the part of the skeleton consisting of the pectoral (shoulder) girdle and the upper extremities, the bones of the pelvic (hip) girdle and the lower extremities; the appendicular skeleton is so named because it supports the body's appendages (i.e. arms and legs)

arousal
a feeling of mental and physical alertness or excitement

associative stage
the second stage of Fitts and Posner's stage model of motor learning; during this stage, the learner has grasped the fundamentals and mechanics of the skill and their performance becomes more consistent with fewer errors

attention
a technical term used by sports psychologists to refer to the specific ability of an athlete to attend and respond to appropriate internal (e.g. thoughts or feelings) and external (e.g. the starter's gun, an opponent) stimuli during training and competition

Australian Bureau of Statistics (ABS)
an independent statistical agency of the government of Australia that provides key statistics on a wide range of economic, population and social issues (including information on sport and physical activity trends)

Australian Sports Commission (ASC)
a government agency in Australia responsible for providing strategic leadership and allocating funding for sporting activities at a national level. The ASC delivers the AusPlay survey, a large national survey updated every 6 months, tracking Australians' sporting behaviours

autonomous stage
the third stage of Fitts and Posner's stage model of motor learning; during this stage, the learner can perform the skill consistently and fluently in different environments without conscious effort

autonomy
a person's need to control their own life and make their own decisions

axial skeleton
the part of the skeleton consisting of the skull, vertebral column, ribs, sternum and coccyx; the axial skeleton is so named because it forms the long axis of the body

B

backspin
when an object (i.e. projectile) rotates backwards, causing it to fall slowly towards the end of its flight

balance
a term used to describe the ability of a person or thing to control their state of equilibrium (i.e. distribute their weight evenly in order to remain upright and not fall over)

barriers
factors that decrease access to resources; barriers discourage or prevent a person from participating in a sport or physical activity (e.g. poor health, high cost of equipment, lack of motivation)

base of support
the area beneath a person or thing that is in contact with a supporting surface

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Bernoulli's principle
a scientific theory that explains that any increase in the velocity of a fluid (e.g. air or water) is accompanied by simultaneous decrease in pressure; these differences in fluid velocity and pressure explain the movement of many objects (including how aeroplanes fly) as well as how lift force is generated

biomechanics
a field of science that studies the body systems responsible for movement (i.e. the musculoskeletal system) using concepts from a specialised branch of mathematics known as mechanics

blocked practice
when learners repeat an isolated skill for a period of time or number of repetitions

body and movement concepts
four categories that describe movement based on shared characteristics; used to help athletes evaluate their performance and develop and improve specialised movement sequences and movement strategies in different sports and physical activities. The concepts are body awareness, space awareness, quality of movement and relationships (e.g. to objects and other people)

body awareness
a body and movement concept; body awareness relates to the sense (or consciousness) we have of our own body when performing a skill

built environments
spaces that humans have built to provide the setting for daily life (e.g. houses, office buildings) and physical activity (e.g. gyms, stadiums, playing fields, courts)

C

cardiac muscle
a type of muscle that is found in the walls of the heart; it is a striated (i.e. striped), involuntary muscle (i.e. one that we have no control over)

cartilage
firm, flexible connective tissue found in many parts of the body, particularly on the articulating surfaces of joints

cartilaginous joints
where the bones have no joint cavity and are held together by cartilage

central nervous system
part of the larger body system known as the nervous system, the central nervous system consists only of the brain and spinal cord (i.e. the central part of the system). It does not include the network of nerves that run throughout our bodies (referred to as the peripheral nervous system)

centre of gravity
the central point of an object, around which all of its weight is evenly distributed and balanced

choke
(in sport) a term used to describe the failure of an athlete or team to perform to their full potential (e.g. freezing under pressure or making unnecessary errors due to nerves)

closed motor skills
skills that are performed in stable and predictable environments and where the person performing the task is in control of the timing of the movement sequence and does not need to consider other variables (e.g. serving a ball in tennis)

cognitive anxiety
anxiety felt as an emotional response

cognitive stage
the first stage of Fitts and Posner's stage model of learning; during this stage, the learner is trying to understand the skill and work out exactly what needs to be done in order to perform it

cognitive systems approach
a theoretical framework used to help explain the processes involved in motor learning; according to this approach, the brain acts as the central command centre for the body. It creates action plans for movements based on information it receives from the body's senses, and it instructs the muscles to perform these actions in a linear order (i.e. step-by-step)

cognitive verbs
task words that give information about what students are expected to provide in an answer to a question

cohesion
(in sport) the extent to which individual members of a team can work together and function as a single unified (i.e. united) whole

commodification
the process of turning something into an object of commercial value

Commonwealth Scientific and Industrial Research Organisation (CSIRO)
an independent scientific research agency funded by the Australian federal government and responsible for improving economic and social industry

compact bone
a solid mass of bony tissue that has a smooth appearance; this forms the solid outer shell of most bones

competence
a person's need to learn and master skills that challenge their abilities

concentration
an everyday term used to describe how a person focuses their mental energy

concentric isotonic contraction
a process in which the muscle shortens to pull on bones and bring them closer together

confidence
the belief that that an individual can have faith in (or rely on) themselves, someone or something

conservation of momentum
a biomechanical principle (i.e. law) that states that momentum cannot be lost. Instead, whenever two objects collide, their combined momentum will be the same after the collision as it was before

consistency
a characteristic of motor skills; consistency refers to the ability of an individual to perform a particular motor skill reliably and dependably over time

constant practice
when a skill is practised under the same (i.e. constant) conditions

constraint
any internal or external variable that has an impact on an athlete's performance

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contact force
a type of force that acts on objects that come into direct contact with each other (e.g. friction force, drag force)

continuous motor skills
skills that do not have a clearly defined start and finish point and are made up of discrete motor skills linked together continuously (e.g. running)

cultural change
a term used to describe the changing levels of cultural diversity that take place within a population over time

cultural factors
a range of influences at a cultural level that can act as barriers or enablers to participation in sport and physical activities (e.g. influences nationally and internationally such as population changes, the role of institutions such as the government, the church and the mass media)

curvilinear motion
any movement that happens along a curved line

D

data
information collected for reference, analysis and evaluation

demographic change
a general term used to describe changes in the size, age, composition and structure of a population

direction of movement
the direction a performer might move their body to complete a specialised movement sequence for a movement strategy

discrete motor skills
skills that have a clearly defined start and finish point (e.g. throwing a ball)

displacement
a measure of the distance and direction travelled between a starting point and an end point "as the crow flies"

distance
a measure of the length of space between two points

distributed practice
when a skill is practised with periods of rest that are equal to (or longer than) the periods spent training

diversity
a term used to describe difference; when used to describe people in a society, diversity means empowering people by respecting and appreciating the characteristics that make them different (e.g. age, sex, race, ethnicity, religious beliefs, gender, sexual orientation, socio-economic status, physical and mental ability, geographical location)

drag force
a type of contact force that is generated by a fluid (e.g. air and water) opposing the movement of an object

drills
activities set up to allow for practising skills; they can target the development of one or multiple skills in various environments and can vary from simple to complex

dynamic
a term used to describe a process or system that is constantly changing

dynamic balance
a term used to describe the ability of a person or thing to maintain balance while moving (i.e. a gymnast performing a jump on a balance beam)

dynamic systems approach
a theoretical framework used to help explain the processes involved in motor learning; according to this approach, the intelligence that coordinates and controls body movements is the result of complex interactions between the individual, the environment and the task

E

eccentric isotonic contraction
a process in which the muscle lengthens to release the bones and move them further apart

ectomorph
a body type that is leaner, longer and narrower with a low tendency to build muscle and store body fat

elastic force
a type of contact force that is generated by the resistance of an object to change shape

enablers
factors that increase access to resources; enablers encourage or support a person to participate in a sport or physical activity (e.g. closeness to sporting facilities, encouragement from parents and teachers, having friends on the team)

endomorph
a body type that is stockier, wider and shorter with a high tendency to build muscle and store body fat

environmental constraint
any changeable aspect of the environment that an athlete needs to overcome or adapt to (e.g. weather)

environmental cues
the relevant information from the environment

environmental factors
a range of influences at an environmental level that can act as barriers or enablers to participation in sport and physical activities (e.g. our ability to access the natural and human-made spaces that exist in the world around us)

equality
a concept that relates to being equal in terms of status, rights or opportunities; equality means striving for fairness and justice by treating people the same (regardless of their personal differences)

equity
a concept that relates to fairness and justice in the way all people are treated; equity means striving for fairness and justice by treating people differently (based on their individual needs and personal differences)

equity dilemma
a situation that devalues or diminishes personal, social and cultural differences in society, especially as they relate to physical activity

equity strategy
any plan of action that aims to value or celebrate personal, social and cultural differences in society, especially as they relate to physical activity

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external force
a type of force that is generated outside the body or through an interaction with the body and the external environment (e.g. gravity, resistance from the air or water, contact with other objects or people)

external stimuli
information or cues that come from outside the body (e.g. changes in the environment such as sounds, sights, smells)

extrinsic (augmented) feedback
information from external sources that is received at the completion of a movement

extrinsic motivation
a type of motivation driven by external factors (i.e. factors that come from outside a person) such as money and fame

F

feedback
information about a person's skills or performance; can include intrinsic and extrinsic feedback

fibrous joints
where the bones have no joint cavity and are connected via fibrous connective tissue

fight-or-flight response
an innate (instinctive) physiological response to a threat of danger or harm that prepares the body to defend or flee

fine motor skills
skills that require precise movements and use smaller muscle groups (e.g. writing with a pen)

first-class lever
a type of lever in which the pivot point (fulcrum) is positioned between the effort (force) and the load (resistance)

fixed mindset
a mental state in which the individual believes that their abilities (e.g. intelligence and talent) are set (i.e. fixed), without any room for change or development

flat bones
bones that are often wide and flat to offer protection to internal organs or areas for muscles to attach

force
a push or pull that happens when two objects interact; an interaction that (when unopposed) causes (or has the potential to cause) a change in the motion of an object

force multipliers
levers that make it easier to move a heavy object with less force by increasing the distance over which the force is acting

force production
a general term used to describe the ability of the body to produce internal force (i.e. movement) in order to overcome one or more external forces (e.g. gravitational force, drag force, friction force)

friction force
a type of contact force that is generated by the surface of an object rubbing against the surface of another object

frontal plane
one of the three planes of movement; movements in this plane are side to side. A star jump (or jumping jack) is an example of movement along this plane

functional anatomy
a specialised branch of anatomy that studies how muscles and bones in the human body produce and affect movement

G

gender
the combined product of a person's biological characteristics (i.e. their sex) along with their social and cultural roles and identities that are formed in response to their environment (through interactions with family, friends, teachers and coaches, religious institutions, the media and so on)

general motion
any movement that combines linear motion and angular motion

generational change
a term used to describe the changing tastes, influences and preferences that take place within a population over time

genetic disposition
the physical and psychological characteristics that every person inherits from their biological parents

goal setting
a technique used to identify a desired achievement and establish measures to track progress towards achieving it

government funding
any financial assistance (i.e. money) from the government received by non-government institutions in the form of local, state or federal grants, loans, property or other assistance

gravitational force
a non-contact force that attracts a body or object towards the centre of the Earth (or towards any other body that has mass)

green space
a general term used to describe any area of grass, trees or other vegetation set aside for recreational purposes in environments that are otherwise urban (i.e. built)

gross motor skills
skills that do not require a great deal of precision and use larger muscle groups or the whole body (e.g. running)

ground reaction force
a type of contact force exerted by the ground on a body or object that is in contact with it

group goals
the vision or aims of a team for their time together (i.e. the season)

group norms
the rules and expectations set out for all members of the team to follow

group roles
the formal and informal positions that each individual on the team is assigned or adopts

growth mindset
a belief that one's own abilities can be developed through hard work

H

height of release
the height at which an object is launched relative to the ground (or the landing point)

hierarchical
a term used to describe the process in which a higher control centre (i.e. the brain) passes commands down to lower control centres (i.e. the muscles and nerves) in order to control movements

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horizontal (or transverse) plane
one of the three planes of movement; movements in this plane are rotational. A golf swing is an example of movement along this plane

I

imagery
a mental rehearsal technique where the athlete creates a sensory experience related to their performance

implements
equipment (e.g. bats, balls, other sporting apparatus such as a balance beam) that an athlete carries or uses when participating in a physical activity

improvement
a characteristic of motor skills; improvement refers to the ability of an individual to get better at performing a motor skill over time

impulse
a term used to describe the change in momentum that occurs over time when force is applied to an object

in the zone
(in sport) a term used to describe a state of focused concentration that allows an athlete or team to perform at the peak of their physical and mental ability

individual constraint
any individual characteristic that an athlete needs to overcome or adapt to (e.g. height, weight, skill level)

inertia
the tendency of an object at rest to remain at rest or of an object in motion to stay in motion (in a straight line) unless acted on by an external force

inertial force
a type of contact force that is generated by a resistance to change in the velocity of an object

information processing model
a theory that suggests humans receive, process and store information from their environment via the central nervous system (i.e. the brain and spinal cord)

input
information received by the brain from the body's senses (such as sight, touch, taste, smell and hearing) according to the information processing model

institution
a general term used to describe any organisation (such as a school, sporting club, company, government or other formalised group) founded for an educational, professional, religious or social purpose

instrument-specific marking guide (ISMG)
a tool for marking that describes the characteristics evident in student responses and aligns with the identified objectives for the assessment

internal force
a type of force that is generated inside the body (e.g. muscles inside the body contracting and relaxing to pull on tendons and joints to generate movement)

internal stimuli
information or cues that come from inside the body (e.g. thoughts, feelings, urges)

intrinsic feedback
the internal or sensory information that a player receives during and after a movement

intrinsic motivation
a type of motivation driven by internal factors (i.e. factors that come from inside a person) such as fun, enjoyment and personal satisfaction

irregular bones
bones that are unusually-shaped and designed to fit into different positions and perform different functions

irrelevant cues
extraneous (unnecessary) information that can distract an athlete

isometric contraction
a process in which the muscle fibres produce tension (i.e. force), but they neither shorten nor lengthen and there is no movement across the joint (i.e. the joint does not move)

isotonic contraction
a process in which the muscle fibres produce tension (i.e. force) as they shorten or lengthen, and there is a range of movement across the joint (i.e. the joint moves)

J

joint reaction force
a type of contact force that is generated by two bones acting on each other across a joint

joints
the points at which bones meet and articulate with each other

K

knowledge of performance (KP) feedback
feedback that is concerned with the execution or process of the movement, as opposed to the outcome

knowledge of results (KR) feedback
feedback based on the outcome (i.e. result) of the performance

L

lever
a simple machine consisting of a solid bar supported by a pivot point (fulcrum) designed to help move a load (resistance) on one end by applying effort (force) on the other end

leverage
the advantage gained from using a lever

lift force
any force that acts to push an object or body upwards

ligament
a short band of tough, flexible fibrous connective tissue which connects two bones or cartilages or holds together a joint

line of gravity
the direction in which gravity is acting on a person or thing

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linear
a term used to describe the process in which commands are carried out one after the other in sequential order

linear motion
any movement that happens along a straight line

location of movement
the area of space in which the performance of a specialised movement sequence or movement strategy is happening

long bones
bones that have a long shaft and a curved ends to absorb and distribute force

M

Magnus force
a type of force that explains why objects that are spinning as they travel through the air curve away from the trajectory (i.e. pathway) they would ordinarily follow if they were not spinning

mass
a measure of how much matter (i.e. particles and atoms) there is in a body or object

mass media
mass communication to a wide audience through a diverse collection of media technologies

massed practice
when a skill is practised in a continuous and constant manner (and rest periods are either very short or non-existent)

mechanics
a branch of applied mathematics that deals with motion (and the forces that produce motion)

meditation
the practice of focusing attention on a single point of reference to create calmness and clarity

megatrend
a large-scale social, economic, political, environmental or technological change that takes place over an extended period of time

mental rehearsal
a psychological technique whereby athletes create mental pictures and movies of their performance in their minds

mesomorph
a body type that is lean and muscular

midline
an imaginary line that runs vertically down the middle of the body (or through the middle of a body part); used as a reference to describe the angle and direction of joint movements

mindset
an established set of attitudes that determines how a person may interpret a situation and respond to it

momentum
a term used to describe the tendency of a moving object to continue moving (in a straight line); the mass (e.g. in kilograms) of an object multiplied by its velocity (e.g. metres per second)

motion
the action or process of moving or being moved; more specifically, the change in position of an object over time

motivation
a desire, need or want that causes a person to behave in a particular way

motor learning
a field of science that investigates human movement with the goal of understanding how humans acquire and retain the motor skills needed to perform specialised movements (i.e. through practice, experience and/or feedback)

motor program
a movement plan (i.e. a plan of action) that contains all the commands from the brain to the muscles that are needed to perform a motor skill

motor reflex
an involuntary movement that is not consciously controlled and is not designed to achieve a particular purpose or goal

motor skill
a voluntary movement that involves the use of specific muscles with the aim of achieving a defined purpose or goal; motor skills can be learnt and improved with practice

movement strategies
a variety of approaches (tactics or plans) that will help an individual or team achieve a determined outcome

multimodal presentation
a presentation composed of more than one type of media or component

muscular system
a body system consisting of muscles and tendons that enables movement through connection to the skeleton; helps maintain temperature in the body

musculoskeletal system
a body system that is a combination of both the muscular system and the skeletal system; the musculoskeletal system provides support, stability, structure and movement in the body through the bones and muscles

N

natural environments
a term used to describe any environment that has not been significantly altered by humans

negative self-talk
saying negative comments to yourself

nervous system
a body system made up of organs, cells and fibres (including the brain, spinal cord and nerves) that collects information (stimuli) from different parts of the body and processes that information before transmitting impulses to activate responses in the muscles

Newton's first law of motion
a fundamental law of the physical world; this law states that an object will remain at rest or maintain a constant velocity unless an external force acts on it; also referred to as the law of inertia

Newton's second law of motion
a fundamental law of the physical world; this law states that the force required to accelerate an object at a given rate is proportional to the product of that acceleration and the mass of the body; also referred to as the law of acceleration

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Newton's third law of motion
a fundamental law of the physical world; this law states that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object; also referred to as the law of action and reaction

non-contact force
a type of force that acts on objects without coming into contact with them (e.g. gravitational force)

non-linear
a term used to describe a process in which commands are not carried out step-by-step in sequential order

non-self-determined motivation
a type of motivation that is not controlled by the individual

norm
a standard or pattern of behaviour that is typical or expected

O

open motor skills
skills that are performed in unstable, unpredictable or changing environments and require the person performing the skill to react to many different variables (such as passing the ball or shooting for goal in a netball game)

optimal angle of release
the angle at which both vertical and horizontal forces are equally applied to the projectile (in order to maximise the distance it will travel); the optimal angle of release required to maximise distance is generally considered to be around 45°, but varies depending on different situations and sports

outcome goal
a type of goal that focuses on winning and losing

output
in the information processing model, a physical response or action executed by the body

over-arousal
a state of arousal generally considered too high for optimum performance

P

parallel processing
the act of processing multiple pieces of information at the same time

part practice
when a skill is practised in its separate parts

pathways of movement
a term used to describe the pattern of direction the body is moving in (e.g. straight, curved, zigzag, angular or twisted)

performance goal
a type of goal that focuses on enhancing specific aspects of performance, often using statistics

performance segmenting
the process of breaking up a performance into more manageable periods in one's mind

persistence
a characteristic of motor skills; persistence refers to the increasing ability of an individual to retain (keep) and perform a motor skill over time

personal ability
a term used to describe the combination of inherited qualities and learned skills a person uses to complete a task or achieve a goal

personal factors
a range of influences at an individual level that can act as barriers or enablers to participation in sport and physical activities (e.g. age, personality traits, personal ability, gender, past experiences)

personality traits
psychological qualities and characteristics that determine our patterns of thinking, feeling and behaving

PETTLEP model
a framework to help athletes get the most out of mental rehearsal and visualisation by making it as close as possible to the real situation

phase
a distinct, observable period within the execution of a motor program or specialised movement sequence; for example, a tennis serve or volleyball spike could be organised into preparation, action and follow-through phases or, similarly, into pre-impact, impact and post-impact phases

physical activity preferences
the types of sports and physical activities that we choose to participate in (i.e. the sports we have a natural preference for over other sports)

planes of movement
an approach used to describe the different movements of the body; there are three planes (i.e. imaginary flat surfaces) that run through the body and along which the body moves

positive cue words
single words or short statements to help refocus attention and combat negative thoughts or emotions

positive emotions
emotions that create an uplifting effect

positive self-talk
saying encouraging and motivating messages to yourself

pre-performance routines
a sequence of actions and/or thoughts that an athlete follows just prior to performance or competition

pre-task routines
actions performed by athletes immediately prior to performing a task (e.g. a serve, free kick or pitch) within a performance

primary data
any data that you collect yourself that relates directly to your performance (e.g. video footage or photographs of your performance, sketches, personal performance statistics)

problem solving
a type of practice task that requires learners to solve common problems (e.g. reading environmental cues) and respond to those problems in the most suitable way

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problem-solving drill
a type of task that requires learners to solve common problems (e.g. reading environmental cues) and respond to those problems in the most suitable way

process goal
a type of goal that focuses on improving technique

progressive muscle relaxation (PMR)
a stress-relief technique that involves the systematic tensing and relaxing of particular muscle groups in the body

projectile
any object (i.e. sporting implement or human body) that is launched, hurled or thrown into the air

projectile motion
a term used to describe the movement of any object that has been launched, hurled or thrown into the air

Q

qualitative analysis
a type of analysis that focuses on data that can be recorded in words (e.g. describing and analysing aspects of performance such as personal journals or diaries describing "quality" of movement, personal observations, feelings and thoughts)

quality of movement
a body and movement concept; quality of movement relates to the characteristics (i.e. qualities) of a movement (e.g. speed, effort, force, accuracy, level of effort, etc.)

quantitative analysis
a type of analysis that focuses on data that can be recorded in numbers (e.g. measuring and analysing aspects of performance such as heart rate, stride length, distance covered, time spent in the air, total force, momentum and impulse, or effectiveness of performance through GPAIs etc.)

R

random practice
when several different sets of skills are practised in an order that is constantly changing

reciprocal inhibition
a process during which the muscle (or muscles) on one side of a joint relax in order to accommodate the muscle (or muscles) on the other side of that joint that are contracting

relatedness
a person's need to feel a sense of belonging by interacting with others and feeling part of a group or community

relationships
a body and movement concept; relationships relates to the objects (i.e. the people and equipment) that an athlete interacts with during the performance of the skill

relaxation and energiser techniques
a range of different techniques aimed at optimising athletes' arousal levels

relevant cues
essential (important) information that an athlete needs to focus on

response execution
the third stage of the information processing model; the stage when the learner produces a response or action by implementing a developed motor program

response selection
the second stage of the information processing model; the stage when the learner makes a decision by comparing information in stored memory

resultant force
the sum of lift force and drag force added together

S

sagittal plane
one of the three planes of movement; movements in this plane are forwards and backwards. A forward lunge is an example of movement along this plane

second-class lever
a type of lever in which the load (resistance) is positioned between the effort (force) and the pivot point (fulcrum)

secondary data
any data that you do not collect yourself, but which offers information about effective technique (e.g. video footage or photographs of elite athletes, information on how to perform a skill, performance data for other athletes)

selective attention
the ability to process and react to certain stimuli selectively (when several stimuli occur simultaneously)

self-belief
an athlete's trust in their ability to succeed, regardless of their previous achievements and competencies

self-confidence
an athlete's conviction that they have the skills and abilities to succeed

self-determination theory (SDT)
a theoretical framework used to analyse human behaviour and explain what motivates people

self-determined motivation
a type of motivation that is controlled by the individual

self-efficacy
an athlete's belief in their ability to perform a particular task

self-organisation
a term used to describe a process in which many different systems and organs in the body interact with each other in order to achieve a task and establish a movement pattern that is stable

self-talk
words and thoughts directed towards yourself

serial motor skills
skills that are made up of a group (series) of different, discrete skills linked together to create a more complex movement sequence (e.g. a floor routine in gymnastics)

serial practice
when a set of skills is performed in a set sequence

serial processing
the act of processing one piece of information at a time

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sesamoid bones
bones that are small and develop in tendons where pressure develops

sex
the biological and physical characteristics of males and females (i.e. their genitalia and genetic differences); either of the two main categories, male and female, into which humans and most other living things are divided on the basis of their reproductive functions

short bones
bones that are often cube shaped for strength

sidespin
when an object (i.e. projectile) rotates sideways, causing it to curve left or right during flight

skeletal muscle
a type of muscle that is usually attached to bones and is responsible for moving the skeleton; it is a striated (i.e. striped), voluntary muscle (i.e. one that we have control over)

skeletal system
a body system consisting of bones that gives the body its structure and supports and protects internal organs; provides attachment for muscles

skeleton
the internal framework of the body, which is made up of around 206 bones in adults

SMARTER principle
an acronym that athletes can use to remember all the elements required for effective goal setting – SMARTER goals are Specific, Measurable, Achievable, Relevant, Time-bound, Evaluated, Recognised and rewarded

smooth muscle
a type of muscle that is found in the walls of our internal structures (such as the stomach, blood vessels and intestines); it is non-striated (i.e. not striped), involuntary muscle (i.e. one that we have no control over)

social cohesion
the degree to which team members like each other and interact together

social construction of gender
the idea that society and culture create gender roles and that these roles (and the behaviours associated with them) are prescribed as ideal or appropriate for individuals of a particular sex

social factors
a range of influences at a social level that can act as barriers or enablers to participation in sport and physical activities (e.g. influences at the community level such as the opinions of friends, parents, teachers and coaches, social expectations, gender roles, levels of diversity in the community)

social support
the feeling that one is cared for, has access to assistance if needed and is part of a strong social network

socialisation
the process of learning to behave in a way that is acceptable to other people in the society in which we live

somatic anxiety
anxiety felt as a physical response

somatotype
a term used to help describe and classify human body shape and physique type

space awareness
a body and movement concept; space awareness relates to the relationship between the body and its surroundings (i.e. how the athlete can move in the available space)

specialised movement sequence
a combination of fundamental movement skills (and movement elements) that enables the body to move in response to a stimulus

specificity of practice
when skills are practised in an environment that is as close to match conditions as possible and allow for the gathering of highly relevant afferent feedback.

speed
a measure of the distance an object travels over time (e.g. 30 kilometres per hour)

speed multipliers
levers that can increase the speed of or distance travelled by an object

speed of release
the speed at which an object is travelling at the moment it is launched into the air

spongy bone
a lightweight mass filled with marrow, nerves and blood vessels; this forms the soft spongy centre of most bones

sponsorship
the act of providing money (i.e. to an athlete, club or sport) in exchange for the opportunity to promote or advertise the brand, product or service of a company (i.e. the sponsor)

sport psychology
a field of science that investigates how an athlete's mental processes (e.g. their thoughts and emotions) influence their participation and performance in sport and physical activity; the discipline of sport psychology aims to assist athletes to achieve optimum mental health and to improve performance

sports marketing
the action or business of promoting and selling sports-related products or services (including market research, sponsorship and advertising)

stabiliser
a muscle that supports movement by promoting the same movement as the agonist or by reducing unnecessary movement (or undesired action)

stability
the ability of an individual to control the influence of internal and external factors on their performance of a motor skill

stage model of motor learning
a theory developed by Fitts and Posner in 1967 that explains the process of learning a motor skill in three stages – cognitive, associative and autonomous

state anxiety
situation-based anxiety

static balance
a term used to describe the ability of a person or thing to maintain balance when stationary (e.g. a gymnast holding a position on a balance beam)

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stereotype
a widely held but fixed and oversimplified image or idea of a particular type of person or thing

stimulus identification
the first stage of the information processing model; the stage when the learner recognises and identifies the input

sub-routine
a simple motor skill that – when combined with a number of other simple motor skills and sequenced in a specific order – is part of a motor program

summation of forces
a term used to describe the sequential combination of forces produced by different parts of the human body acting together to maximise force production

sutural bones
small bones that are located between the joints of cranial bones in the skull; also known as Wormian bones

synovial joints
where the bones have a joint cavity and are held together by ligaments and separated by synovial fluid in the joint cavity

T

task cohesion
the ability to identify closely with the group's goals and to experience success in achieving those goals

task constraint
any aspect of a task that an athlete needs to overcome or adapt to (e.g. rule of a game)

team dynamics
the relationships between all the different members of a group (who are working together to achieve a common goal)

tendon
a flexible but inelastic cord of strong, fibrous collagen tissue attaching a muscle to a bone

third-class lever
a type of lever in which the effort (force) is positioned between the load (resistance) and the pivot point (fulcrum)

topspin
when an object (i.e. projectile) rotates forwards, causing it to drop sharply during flight

trait anxiety
personality-based anxiety

trajectory
the line along which a projectile travels

U

under-arousal
a state of arousal generally considered too low for optimum performance

V

variability of practice
when skills are practised in conditions that differ from normal match play

varied practice
when practice sessions incorporate a variety of movement options and context changes

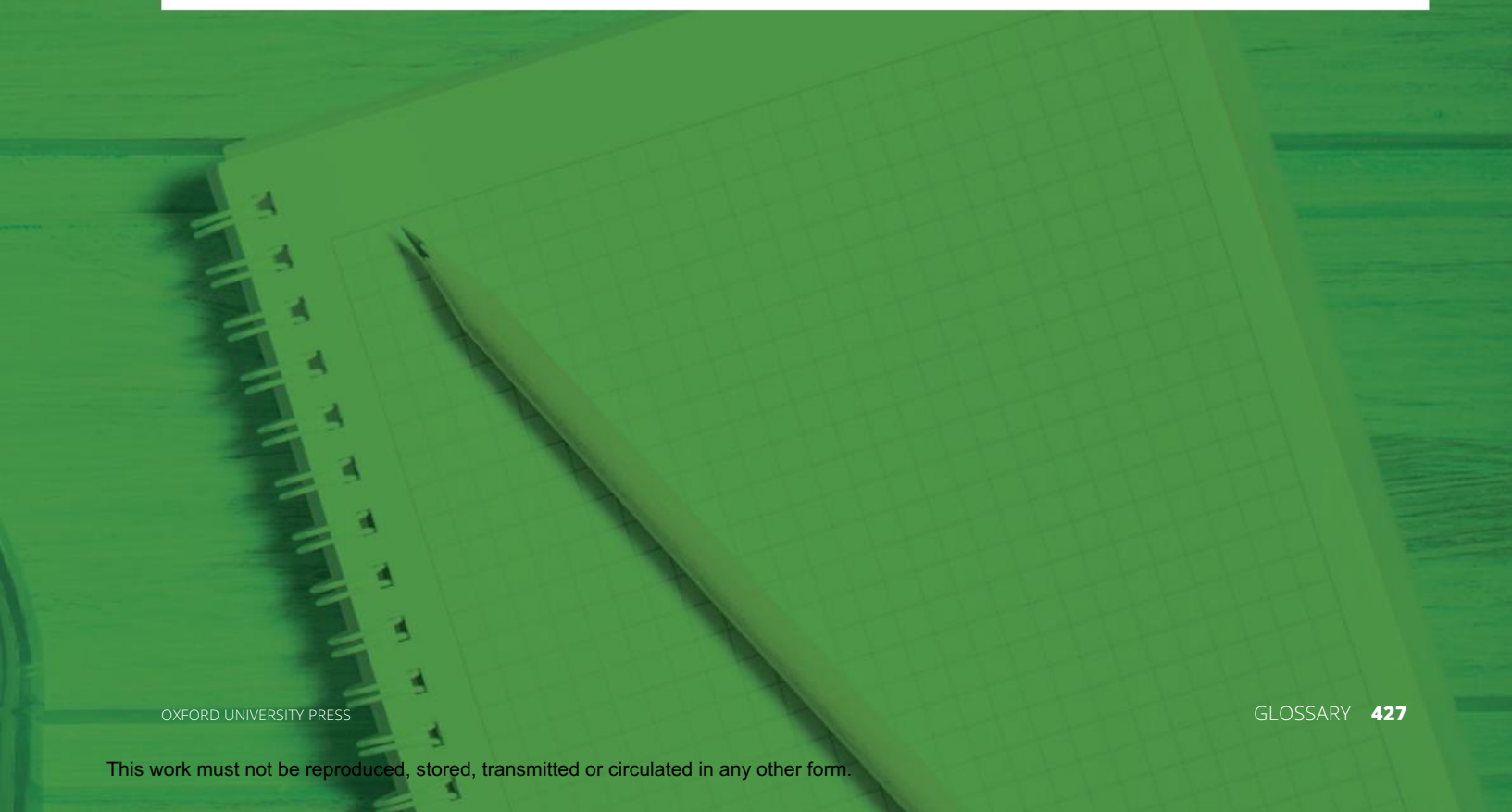
velocity
a measure of the distance and direction an object travels over time taken (e.g. 30 kilometres per hour north)

visualisation
a mental rehearsal technique where the athlete creates still and moving images of aspects of their performance in their minds

W

weight
a measure of how much gravitational force is pulling on a body or object

whole practice
when a skill is practised as a whole (i.e. in its entirety)



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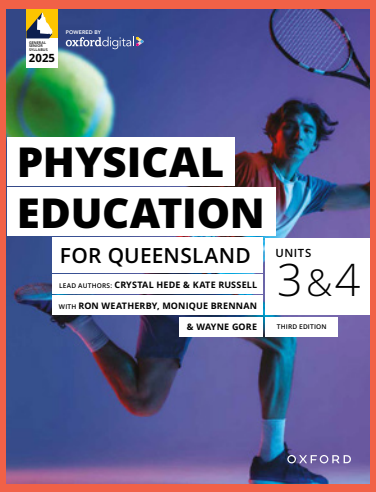
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