UNITS 3&4

PHYSICAL EDUCATION FOR QUEENSLAND

CRYSTAL HEDE | KATE RUSSELL | RON WEATHERBY | MONIQUE BRENNAN | WAYNE GORE | BEN WILLIAMS

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CONTENTS

RESEARCH	This section is supported by an integrated research activity known as a Skill drill.
PERFORMANCE	This section is supported by an integrated physical activity known as a Skill drill.

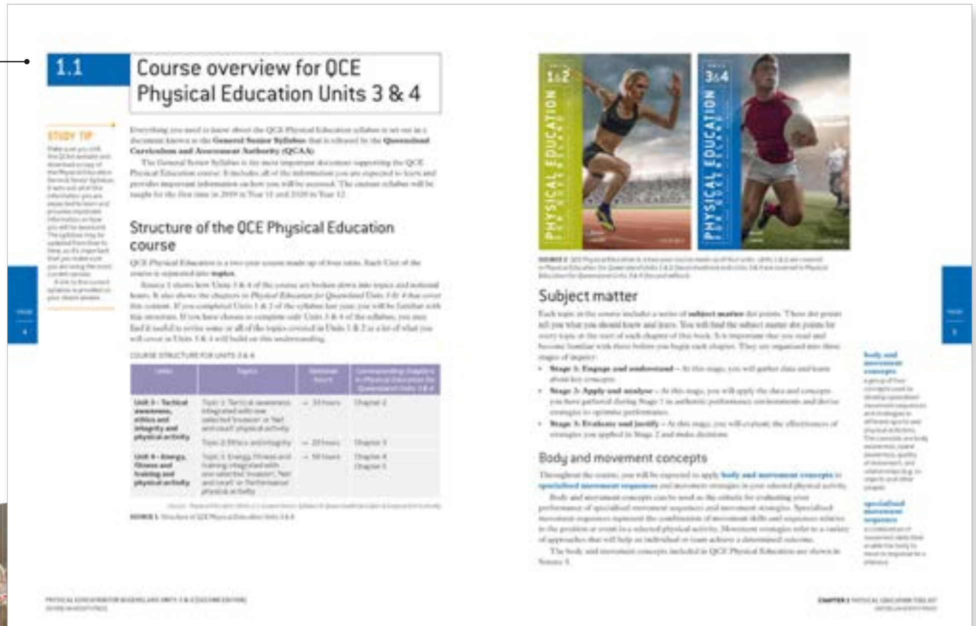
Using *Physical Education for Queensland Units 3 & 4*

Physical Education for Queensland has been purpose-written to meet the requirements of the QCAA Physical Education General Senior Syllabus.

Key features of the Student book

Physical Education toolkit
The Student book begins with a stand-alone reference chapter that includes:

- an overview of the QCAA Physical Education syllabus
- tips for success on assessment tasks
- advice on understanding cognitive verbs
- a summary of the importance of data in the QCE Physical Education course.



Chapter openers
Each chapter begins with a chapter opener that includes:

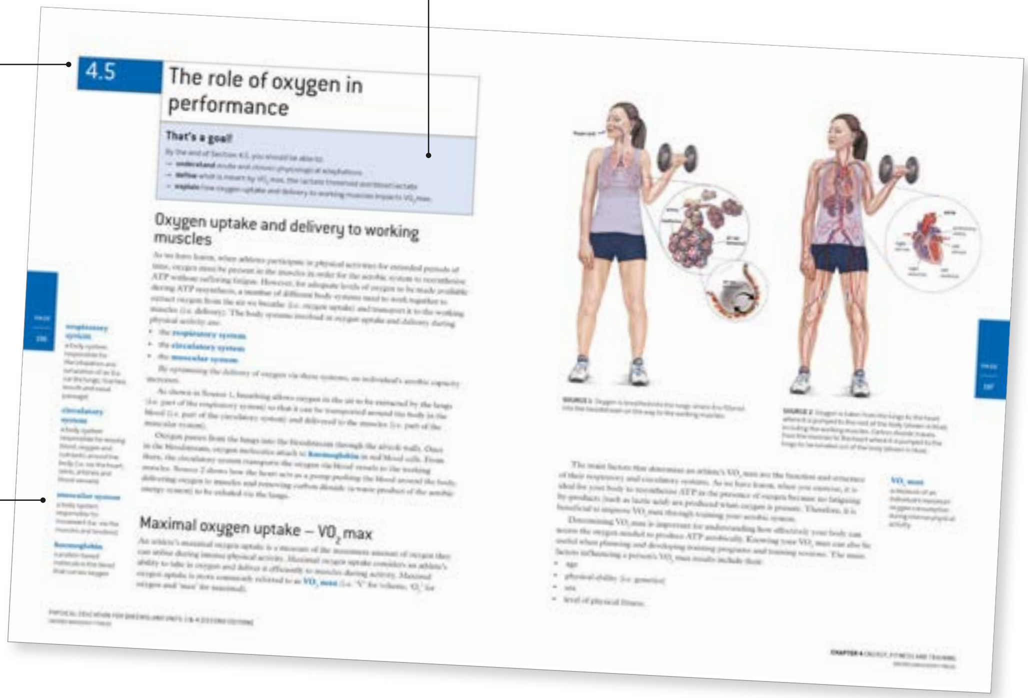
- key terms from the syllabus
- an inspirational quote to spark discussion
- links to relevant digital resources provided on the obook assess
- a content grid that shows the coverage of all subject matter from the syllabus.

Unit openers
Each unit begins with a unit opener that includes:

- **unit objectives** from the syllabus
- an **overview of notional hours** and **topics** in the unit.

That's a goal! – a set of clear **learning objectives** from the syllabus

Section-based approach
Content throughout the Student book is presented in clearly structured **sections**. Each section:
- is clearly labelled and numbered to help navigation
- ranges in length from 2–10 pages.


4.5 The role of oxygen in performance

That's a goal!

Oxygen uptake and delivery to working muscles

Maximal oxygen uptake – VO_2 max

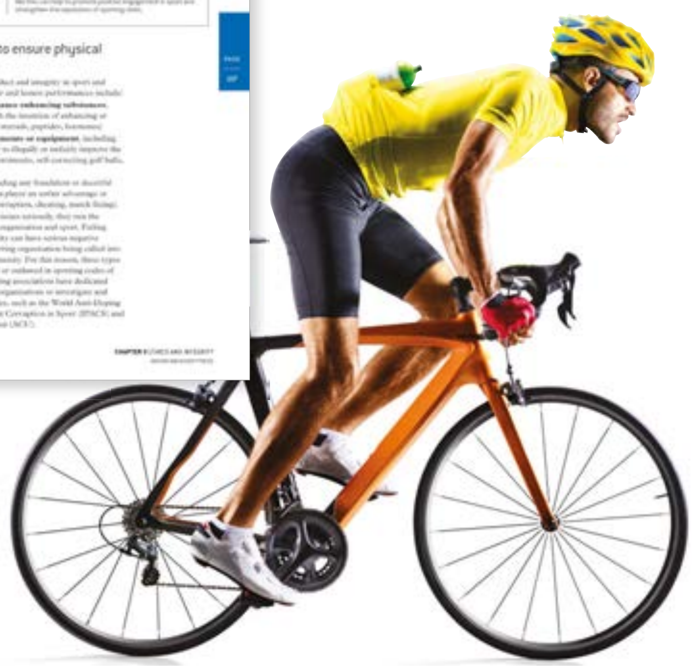
Margin glossary – key terms bolded in text and defined on the page


Theory in action How community partnerships promote positive engagement

How ethics and integrity can help to ensure physical performances are fair and honest

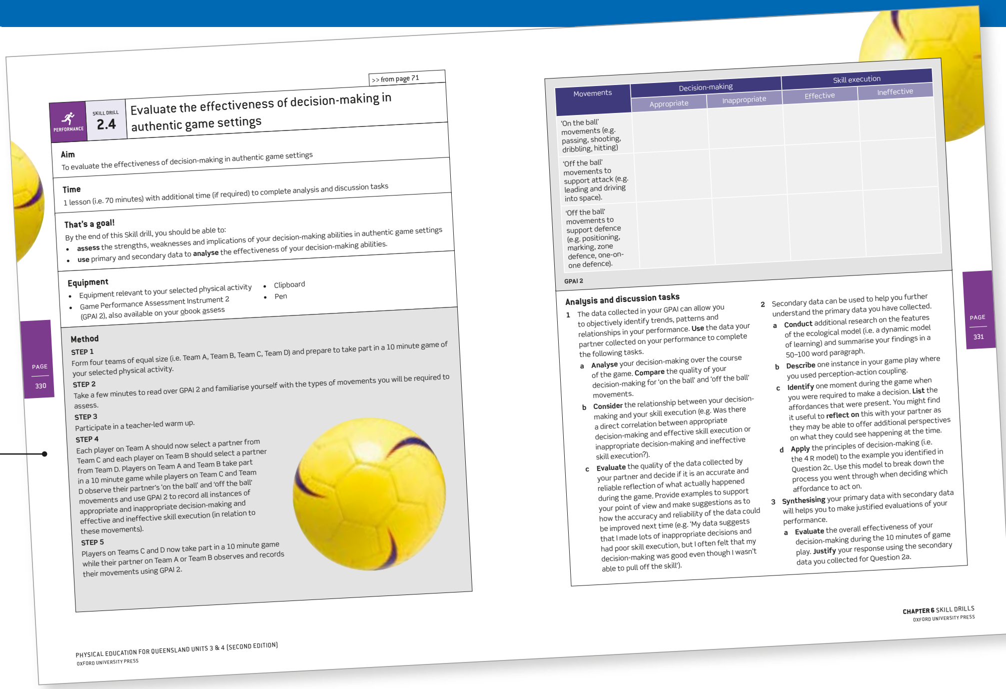
Ben Barba sacked from Cowboys after 'domestic violence incident' at Townsville casino

Theory in action – real-life examples and **case studies** to illustrate theoretical points being explained in the text



For the record! – fun, interesting and quirky facts related to key subject matter

In the news – relevant issues and examples being reported and debated in the media



>> from page 71

PERFORMANCE

SKILL DRILL 2.4

Evaluate the effectiveness of decision-making in authentic game settings

Aim

To evaluate the effectiveness of decision-making in authentic game settings

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **assess** the strengths, weaknesses and implications of your decision-making abilities in authentic game settings
- **use** primary and secondary data to **analyse** the effectiveness of your decision-making abilities.

Equipment

- Equipment relevant to your selected physical activity
- Game Performance Assessment Instrument 2 (GPAI 2), also available on your obook assess
- Clipboard
- Pen

Method

STEP 1

Form four teams of equal size (i.e. Team A, Team B, Team C, Team D) and prepare to take part in a 10 minute game of your selected physical activity.

STEP 2

Take a few minutes to read over GPAI 2 and familiarise yourself with the types of movements you will be required to assess.

STEP 3

Participate in a teacher-led warm up.

STEP 4

Each player on Team A should now select a partner from Team C and each player on Team B should select a partner from Team D. Players on Team A and Team B take part in a 10 minute game while players on Team C and Team D observe their partner's 'on the ball' and 'off the ball' movements and use GPAI 2 to record all instances of appropriate and inappropriate decision-making and effective and ineffective skill execution (in relation to these movements).

STEP 5

Players on Teams C and D now take part in a 10 minute game while their partner on Team A or Team B observes and records their movements using GPAI 2.

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PHYSICAL EDUCATION FOR QUEENSLAND UNITS 3 & 4 (SECOND EDITION)
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Movements	Decision-making		Skill execution	
	Appropriate	Inappropriate	Effective	Ineffective
'On the ball' movements (e.g. passing, shooting, dribbling, hitting)				
'Off the ball' movements to support attack (e.g. leading and driving into space).				
'Off the ball' movements to support defence (e.g. positioning, marking, zone defence, one-on-one defence).				

GPAI 2

Analysis and discussion tasks

1 The data collected in your GPAI can allow you to objectively identify trends, patterns and relationships in your performance. **Use** the data your partner collected on your performance to complete the following tasks.
   a **Analyse** your decision-making over the course of the game. **Compare** the quality of your decision-making for 'on the ball' and 'off the ball' movements.
   b **Consider** the relationship between your decision-making and your skill execution (e.g. Was there a direct correlation between appropriate decision-making and effective skill execution or inappropriate decision-making and ineffective skill execution?).
   c **Evaluate** the quality of the data collected by your partner and decide if it is an accurate and reliable reflection of what actually happened during the game. Provide examples to support your point of view and make suggestions as to how the accuracy and reliability of the data could be improved next time (e.g. 'My data suggests that I made lots of inappropriate decisions and had poor skill execution, but I often felt that my decision-making was good even though I wasn't able to pull off the skill').

2 Secondary data can be used to help you further understand the primary data you have collected.
   a **Conduct** additional research on the features of the ecological model (i.e. a dynamic model of learning) and summarise your findings in a 50–100 word paragraph.
   b **Describe** one instance in your game play where you used perception-action coupling.
   c **Identify** one moment during the game when you were required to make a decision. **List** the affordances that were present. You might find it useful to **reflect on** this with your partner as they may be able to offer additional perspectives on what they could see happening at the time.
   d **Apply** the principles of decision-making (i.e. the 4 R model) to the example you identified in Question 2c. Use this model to break down the process you went through when deciding which affordance to act on.

3 **Synthesising** your primary data with secondary data will helps you to make justified evaluations of your performance.
   a **Evaluate** the overall effectiveness of your decision-making during the 10 minutes of game play. **Justify** your response using the secondary data you collected for Question 2a.

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CHAPTER 6 SKILL DRILLS
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Skill drills

Each chapter contains a range of practical activities to reinforce theoretical aspects of the syllabus. These activities have a clear Research or Performance focus and are identified as such. They are flagged in relevant sections and cross-referenced to a stand-alone Skill drill section at the end of the Student book. Each Skill drill features:

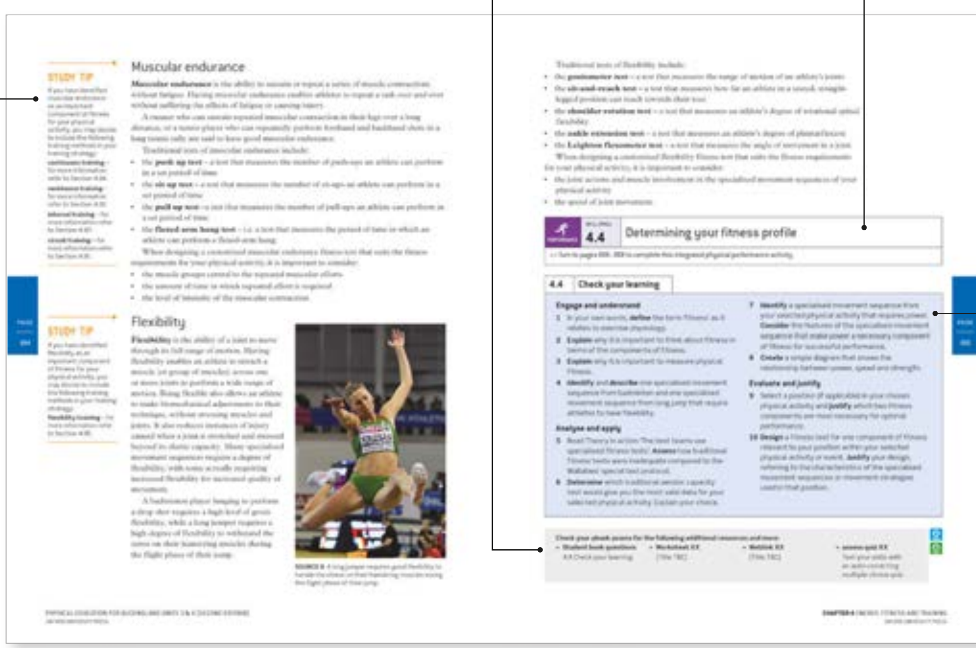
- an **integrated** and **personalised task**
- links to **subject matter** coverage
- a consistent experiment-style layout
- a range of **Game Performance Assessment Instruments (GPAIs)** and **Data Collection Instruments (DCIs)** to support the collection of primary data
- a range of analysis and discussion tasks.

Skill drill links – direct links to practical activities (provided in a handy reference section at the back of the Student book)

Links to supporting digital resources – additional student and teacher resources offered on obook assess

Check your learning – activity boxes with questions and tasks organised according to Marzano's taxonomy and using cognitive verbs

Study tip – practical advice to help students improve their performance in assessment tasks



Chapter reviews

Each chapter concludes with a chapter review that includes:

- a **summary of key learning** (with links back to relevant sections in the Student book for targeted revision)
- revision questions in the form of a **sample exam**
- a **sample assessment task with ISMG**.

Integrated digital teaching and learning support

Oxford's award-winning digital platform – obook assess – provides secondary school students and teachers with access to a huge range of additional resources to support and enhance teaching and learning.

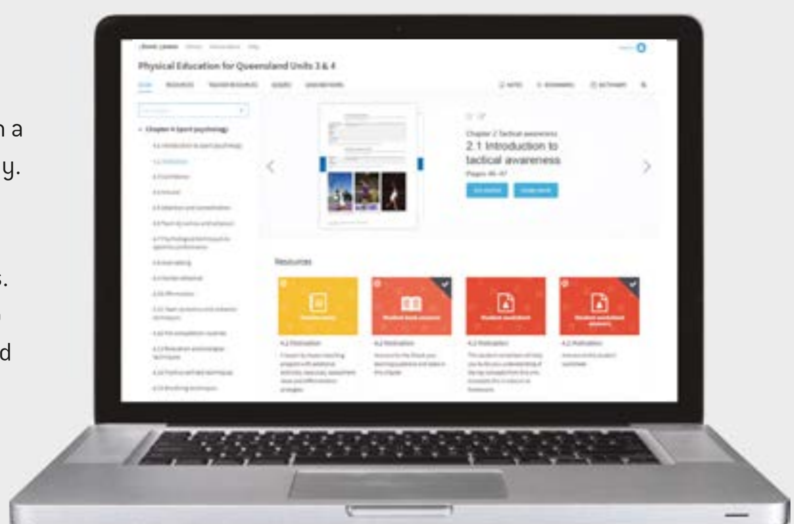
Student obook assess

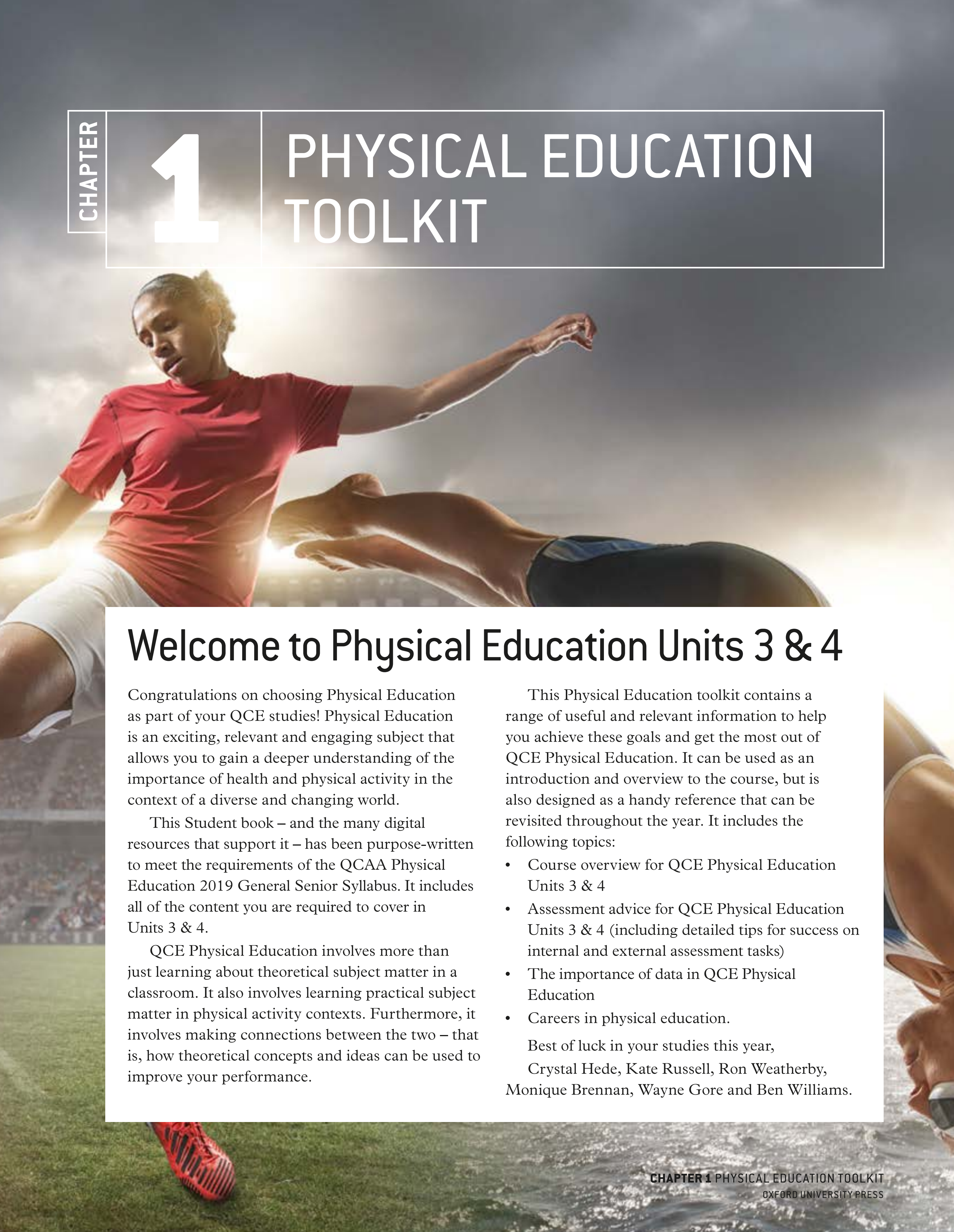
Student obook assess provides a fully interactive digital experience for students that is compatible with laptops, iPads, tablets and IWBs. Access to content is available online and offline.

- obook is an interactive digital version of the Student book with note-taking, highlighting and dictionary support included. Every obook contains links to additional resources, such as videos, worksheets, weblinks, interactive modules and assessment support.
- assess is an online assessment platform that provides access to hundreds of additional auto-correcting questions designed to support student understanding and progression across all subjects.

Teacher obook assess

Teacher obook assess supports teachers with a range of additional resources and functionality. Access detailed teacher notes, planning and assessment advice, answers to all activities, class tests, videos and additional worksheets. **Teacher obook assess** also allows teachers to assign work electronically, track progress, and manage results and assessment.





CHAPTER 1 PHYSICAL EDUCATION TOOLKIT

Welcome to Physical Education Units 3 & 4

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.

This Student book – and the many digital resources that support it – has been purpose-written to meet the requirements of the QCAA Physical Education 2019 General Senior Syllabus. It includes all of the content you are required to cover in Units 3 & 4.

QCE Physical Education involves more than just learning about theoretical subject matter in a classroom. It also involves learning 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 is also designed as a handy reference that can be revisited throughout the year. It includes the following topics:

- Course overview for QCE Physical Education Units 3 & 4
- Assessment advice for QCE Physical Education Units 3 & 4 (including detailed tips for success on internal and external assessment tasks)
- The importance of data in QCE Physical Education
- Careers in physical education.

Best of luck in your studies this year,

Crystal Hede, Kate Russell, Ron Weatherby, Monique Brennan, Wayne Gore and Ben Williams.

1.1 Course overview for QCE Physical Education Units 3 & 4

STUDY TIP

Make sure you visit the QCAA website and download a copy of the Physical Education General Senior Syllabus. It sets out all of the information you are expected to learn and provides important information on how you will be assessed. The syllabus may be updated from time to time, so it's important that you make sure you are using the most current version.

A link to the current syllabus is provided on your obook assess.

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 of 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 2019 in Year 11 and 2020 in Year 12.

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**.

Source 1 shows how Units 3 & 4 of the course are broken down into topics and notional hours. It also shows the chapters in *Physical Education for Queensland Units 3 & 4* that cover this content. If you completed Units 1 & 2 of the syllabus last year, you will be familiar with this structure. If you have chosen to complete only Units 3 & 4 of the syllabus, you may find it useful to revise some or all of the topics covered in Units 1 & 2 as a lot of what you will cover in Units 3 & 4 will build on this understanding.

COURSE STRUCTURE FOR UNITS 3 & 4

Units	Topics	Notional hours	Corresponding chapters in *Physical Education for Queensland Units 3 & 4*
Unit 3 – Tactical awareness, ethics and integrity and physical activity	Topic 1: Tactical awareness integrated with one selected 'Invasion' or 'Net and court' physical activity	→ 33 hours	Chapter 2
	Topic 2: Ethics and integrity	→ 22 hours	Chapter 3
Unit 4 – Energy, fitness and training and physical activity	Topic 1: Energy, fitness and training integrated with one selected 'Invasion', 'Net and court' or 'Performance' physical activity	→ 55 hours	Chapter 4 Chapter 5

Source: *Physical Education 2019 v1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

SOURCE 1 Structure of QCE Physical Education Units 3 & 4

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

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 chapter of this book. It is important that you read and become familiar with these before you begin each chapter. They are organised into three stages of inquiry:

- **Stage 1: Engage and understand –** At this stage, you will gather data and learn about key concepts.
- **Stage 2: Apply and analyse –** At this stage, you will apply the data and concepts you have gathered during Stage 1 in authentic performance environments and devise strategies to optimise performance.
- **Stage 3: Evaluate and justify –** At this stage, you will evaluate the effectiveness of strategies you applied in Stage 2 and make decisions.

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 represent 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 will help an individual or team achieve a determined outcome.

The body and movement concepts included in QCE Physical Education are shown in Source 3 on the next page.

body and movement concepts
a group of four concepts used to develop specialised movement sequences and 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 sequences
a combination of fundamental movement skills (and movement elements) that enable the body to move in response to a stimulus

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: *Physical Education 2019 v1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

SOURCE 3 Body and movement concepts

SOURCE 4 In Units 3 & 4 of QCE Physical Education you will be required to select a physical activity from three categories – Invasion (e.g. soccer), Net and court (e.g. tennis) and Performance (e.g. swimming).

Categories of physical activity

Over the course of your studies in Physical Education this year, you will be required to participate in a number of different physical activities and integrate these into your theoretical learning. You and your teacher may select physical activities from the categories shown in Source 5.

Category	Physical activities	Unit 3 (select one)	Unit 4 (select one)
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		•

SOURCE 5 Specifications for selecting physical activities

When selecting the physical activities that you will study this year, you must take care to follow these guidelines:

- In Units 3 & 4, physical activities must be selected from particular categories in order to be eligible for assessment tasks:
  - **In Unit 3 – Topic 1**, you must select **one physical activity** from either the 'Invasion' or 'Net and court' categories only
  - **In Unit 4 – Topic 1**, you must select **one physical activity** from one of the 'Invasion', 'Net and court' or 'Performance' categories only.
- **Attention:** The physical activity you select in Unit 4 **must be from a different category** to the physical activity you select in Unit 3.

Check your obook assess for the following additional resources and more:

» **Chapter glossary**
A printable and editable list of key terms to learn in Chapter 1

» **Flashcard glossary**
A digital interactive to help you test your knowledge of key terms in Chapter 1

» **Weblink**
A link to the QCAA Physical Education General Senior Syllabus

1.2 Assessment overview for QCE Physical Education Units 3 & 4

During Units 3 & 4 of the QCE Physical Education course, you will be required to complete a total of four assessments (three internal and one external) that will count towards your final QCE mark. These assessments are listed in Source 1.

All of the assessments you complete in Units 3 & 4 will be **summative**. This means that they will be submitted at the end of each Topic or Unit of the course, and will be designed to assess how well you have mastered the subject matter in that Topic or Unit.

ASSESSMENT STRUCTURE FOR UNITS 3 & 4

Assessment	Unit 3	Unit 4
Summative internal assessment 1	**Project – folio (25%)** Completed as part of Topic 1: Tactical awareness integrated with one selected 'Invasion' or 'Net and court' physical activity	
Summative internal assessment 2	**Investigation – report (20%)** Completed as part of Topic 2: Ethics and integrity	
Summative internal assessment 3		**Project – folio (30%)** Completed as part of Topic 1: Energy, fitness and training integrated with one selected 'Invasion', 'Net and court' or 'Performance' physical activity
Summative external assessment		**Examination – combination response (25%)** Completed as part of Topic 1: Energy, fitness and training integrated with one selected 'Invasion', 'Net and court' or 'Performance' physical activity

Source: *Physical Education 2019 v1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

SOURCE 1 Structure of assessment for QCE Physical Education Units 3 & 4

STUDY TIP

The assessment advice in this section was correct at the time this Student book went to print; however, the QCAA may make updates from time to time that affect the structure of your assessment. Speak to your teacher to make sure you are using the most current version of the syllabus.

A link to the current syllabus is provided on your obook assess.

Details of summative assessments in Units 3 & 4

As shown in Source 1, over the course of Units 3 & 4 you will be expected to complete:

- three summative internal assessments
- one summative external assessment.

Summative internal assessments

- The three summative internal assessments that you will submit as you complete Units 3 & 4 will be developed by your teacher or school. Each of these will be based on the subject matter described in the syllabus.
- The three summative internal assessments will be endorsed and the results confirmed by the QCAA.
- The three summative internal assessments will be assessed using a tool known as an **instrument-specific marking guide (ISMG)**. The syllabus contains an ISMG for each of the three internal assessments.
- Each ISMG describes the characteristics evident in your responses and aligns them with the identified assessment objectives. Each ISMG groups assessment objectives into criteria and outlines how marks will be allocated for each one.
- To perform well in internal assessment tasks, it is crucial that you read and understand the assessment objectives of the task and ensure that your work meets the characteristics provided in the ISMG (in order to receive the maximum possible marks).
- More specific details about these assessments are provided in Section 1.2A Tips for success on the Project – folio and Section 1.2B Tips for success on the Investigation – report.
- In total, the three summative internal assessments will contribute 75% towards your final result in Physical Education.

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



SOURCE 2 Over the course of Units 3 & 4 of the QCE Physical Education, you will be required to complete a total of four assessments – three internal and one external. These will take the form of a Project – folio, an Investigation – report, and an Examination – combination response.

Summative external assessment

- The summative external assessment that you will sit at the completion of Unit 4 – Topic 1 will be:
  - common to all schools
  - administered under the same conditions at the same time and on the same day
  - developed and marked by the QCAA according to a commonly applied marking scheme.
- More specific details about this assessment are provided in Section 1.2C Tips for success on the Examination – combination response.
- In total, the summative external assessment will contribute 25% towards your final result in Physical Education.

1.2A Tips for success on the Project – folio

As part of your assessment for Physical Education Units 3 & 4, you will be required to complete and submit two Project – folios. These are known as:

- **Summative internal assessment 1,** which is completed as part of Unit 3 – Topic 1: Tactical awareness integrated with one selected 'Invasion' or 'Net and court' physical activity. This assessment will contribute 25% towards your overall mark.
- **Summative internal assessment 3,** which is completed as part of Unit 4 – Topic 1: Energy, fitness and training integrated with one selected 'Invasion', 'Net and court' or 'Performance' physical activity. This assessment will contribute 30% towards your overall mark.

QCAA ASSESSMENT ADVICE ON SUMMATIVE INTERNAL ASSESSMENT 1: UNIT 3 – TOPIC 1 (25%)

Description
This assessment focuses on an inquiry process that requires the application of a range of cognitive and technical processes and skills, and conceptual understandings. Students document the iterative process of demonstrating and applying conceptual understandings through the psychomotor domain to devise a personal training strategy. Students evaluate the effectiveness of the personal training strategy and movement strategies and justify using primary and secondary data. The multimodal response is a coherent work that includes visual and written or spoken modes. This assessment occurs over an extended and defined period of time. Students may use class time and their own time to develop a response.
Assessment objectives
This assessment technique is used to determine student achievement in the following objectives: 1 **recognise** and **explain** constraints, principles of decision making, and body and movement concepts about specialised movement sequences and movement strategies 2 **demonstrate** specialised movement sequences and movement strategies in authentic performance environments 3 **apply** concepts to specialised movement sequences and movement strategies in authentic performance environments 4 **analyse** and **synthesise** data to devise a tactical strategy for optimising performance of one movement strategy 5 **evaluate** a tactical strategy and movement strategies relevant to the selected physical activity 6 **justify** a tactical strategy and movement strategies relevant to the selected physical activity 7 **make decisions** about and use language, conventions and mode-appropriate features to **communicate** information about strategies to a technical audience.
Specifications
The project focuses on Unit 3 – Topic 1 concepts and principles about tactical awareness and one selected physical activity. You must select one physical activity from either the 'Invasion' or 'Net and court' categories (see Source 5 on page 7). Students will demonstrate and apply body and movement concepts to the specialised movement sequences and two movement strategies for one position or event in the selected physical activity. Individual student performance in authentic performance environments is provided by the school as supporting visual evidence.

In the folio, you will focus on the specialised movement sequences for one movement strategy to devise a personal tactical strategy. For complete details of the assessable evidence you will be required to submit as part of the assessment, download the Physical Education General Senior Syllabus. A link to the current syllabus is provided on your obook assess.
Supporting evidence
Your individual performance in an authentic performance environment needs to be supported by visual evidence. Visual evidence will need to show: → demonstration of specialised movement sequences and two movement strategies from two different principles of play → application of quality of movement and one other body and movement concept to the performance of specialised movement sequences and two movement strategies from two different principles of play.

Conditions

Time	**Length**	**Other**
Approximately 5 hours of the time allocated to Unit 3	Folio: 9–11 minutes Supporting evidence: 2–3 minutes	Schools implement authentication strategies that reflect QCAA guidelines for ensuring student authorship. Examples of multimodal presentations include: → a pre-recorded presentation submitted electronically → 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.

Summary of the instrument-specific marking guide (ISMG)

The following table summarises the criteria, assessment objectives and mark allocation for the folio.
To view the complete ISMG for this assessment, download the Physical Education General Senior Syllabus. A link to the current syllabus is provided on your obook assess.

Criterion	Objectives	Marks
Explaining	1	3
Demonstrating and applying	2 and 3	8
Analysing	4	4
Evaluating and justifying	5 and 6	7
Communicating	7	3
Total		25

Source: *Physical Education 2019 v.1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

SOURCE 3 Guidelines for summative internal assessment 1 (to be completed as part of Unit 3 – Topic 1)

QCAA ASSESSMENT ADVICE ON SUMMATIVE INTERNAL ASSESSMENT 3: UNIT 4 – TOPIC 1 (30%)

Description
This assessment focuses on an inquiry process that requires the application of a range of cognitive and technical processes and skills, and conceptual understandings. Students document the iterative process of demonstrating and applying conceptual understandings through the psychomotor domain to devise a personal training strategy. Students evaluate the effectiveness of the personal training strategy and movement strategies and justify using primary and secondary data. The multimodal response is a coherent work that includes visual and written or spoken modes. This assessment occurs over an extended and defined period of time. Students may use class time and their own time to develop a response.
Assessment objectives
This assessment technique is used to determine student achievement in the following objectives: 1 **recognise** and **explain** energy, fitness and training, and body and movement concepts and principles about specialised movement sequences and movement strategies 2 **demonstrate** specialised movement sequences and movement strategies in authentic performance environments 3 **apply** concepts to specialised movement sequences and movement strategies in authentic performance environments 4 **analyse** and **synthesise** data to devise a training strategy for optimising performance of the specialised movement sequences and one movement strategy 5 **evaluate** a training strategy and movement strategies relevant to the selected physical activity 6 **justify** a training strategy and movement strategies relevant to the selected physical activity 7 **make decisions** about and use language, conventions and mode-appropriate features to **communicate** information about strategies to a technical audience.
Specifications
The project focuses on Unit 4 – Topic 1 concepts and principles about energy, fitness and training and one selected physical activity. You must select a physical activity from one of the 'Invasion', 'Net and court' or 'Performance' categories (see Source 5 on page 7). Students will demonstrate and apply body and movement concepts to specialised movement sequences and two movement strategies for one position or event in the selected physical activity. Individual student performance in authentic performance environments is provided by the school as supporting visual evidence. In the folio, you will focus on the specialised movement sequences for one movement strategy to devise a personal training strategy. For complete details of the assessable evidence you will be required to submit as part of the assessment, download the Physical Education General Senior Syllabus. A link to the current syllabus is provided on your obook assess.

Supporting evidence
Schools' judgments about individual student performance in authentic performance environments are required to be supported by visual evidence. The school selects one physical activity from either the 'Invasion', 'Net and court' or 'Performance' categories of physical activity. Visual evidence will illustrate: → demonstration of specialised movement sequences and two movement strategies (from two different principles of play for physical activities from the 'Invasion' or 'Net and court' categories) → application of quality of movement and one other body and movement concept to the performance of specialised movement sequences and two movement strategies (from two different principles of play for physical activities from the 'Invasion' or 'Net and court' categories).

Conditions		
Time Approximately 5 hours of the time allocated to Unit 4	**Length** Folio: 9–11 minutes Supporting evidence: 2–3 minutes	**Other** Schools implement authentication strategies that reflect QCAA guidelines for ensuring student authorship. Examples of multimodal presentations include: → a pre-recorded presentation submitted electronically → 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.

Summary of the instrument-specific marking guide (ISMG)
The following table summarises the criteria, assessment objectives and mark allocation for the folio. To view the complete ISMG for this assessment, download the Physical Education General Senior Syllabus. A link to the current syllabus is provided on your obook assess.

Criterion	Objectives	Marks
Explaining	1	4
Demonstrating and applying	2 and 3	10
Analysing	4	5
Evaluating and justifying	5 and 6	8
Communicating	7	3
Total		30

Source: *Physical Education 2019 v.1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

SOURCE 4 Guidelines for summative internal assessment 3 (to be completed as part of Unit 4 – Topic 1)

Tips for planning and structuring your Project – folio

Before beginning work on your Project – folio, it is vital that you refer directly to the Physical Education General Senior Syllabus. This document contains all of the specifications and ISMGs for this assessment and will help guide your planning, research and presentation.

The assessment advice provided in this section was correct at the time this book went to print, however, the QCAA may make changes to the syllabus from time to time. These changes may affect the structure of this assessment or the way in which it is marked. Check with your teacher to make sure you are using the most recent specifications for the task.

multimodal presentation
a presentation comprising more than one media or component

The Project – folio requires you to create a **multimodal presentation**. This presentation can take a number of different forms, including:

- a pre-recorded presentation submitted to your teacher electronically
- a presentation you give in front of an audience (e.g. 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 (e.g. *verbal narration* combined with *visual images* or *written text* combined with *video footage*). According to the guidelines released by the QCAA, you will be required to create a presentation that is between 9–11 minutes long (with a further 2–3 minutes for you to provide supporting evidence).

Each of the units you will study in Physical Education is structured according to three stages of inquiry:

- **Stage 1: Engage and understand –** At this stage, you will learn the knowledge, skills and concepts associated with the theoretical and practical subject matter of the unit.
- **Stage 2: Apply and analyse –** At this stage, you will use the knowledge, skills and concepts you have learnt in Stage 1 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.
- **Stage 3: Evaluate and justify –** At this stage, you will judge how well your strategy worked and reflect on how it could be improved.

The sequencing of these stages is important because each stage builds on the one before. The relationship between these three stages also has implications for how you will be assessed in your Project – folio, and it affects how you should respond to the task.

Project – folio assignments will always ask you to **evaluate** the effectiveness of the strategy you devised and implemented during the unit, and to **justify** your evaluation using the data you gathered during the unit as evidence. In other words, they will direct you to create a presentation primarily about the subject matter of Stage 3. 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 Stage 1 and Stage 2 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 strategy did you devise and implement?
2. Why did you devise and implement your strategy in this way?
3. Which parts of your strategy were effective?
4. How do you know these parts of your strategy were effective?

5 Which parts of your strategy were ineffective?
6 How do you know these parts of your strategy were ineffective?
7 How would you change your strategy if you were to repeat the process?
8 Why would you make these changes?

The advantage of being guided by questions like those above is that you will respond to all elements of the assessment task. For example, Questions 3, 5 and 7 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 Section 1.3.

SOURCE 5 The Project – folio requires you to create a multimodal presentation (i.e. it must combine **at least two** modes of communication) that is generally between 9–11 minutes in length.

STUDY TIP

Data is key to your success!
In order 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 Section 1.3 on pages 28–35.

Tips for 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.

For more advice and practical tips on how to capture video data and use it to create and present your Project – folio, complete the Skill drills on your obook assess.

RESEARCH | SKILL DRILL 1.2A

Plan, create and present a Project – folio

Refer to your obook assess to complete this integrated research activity.

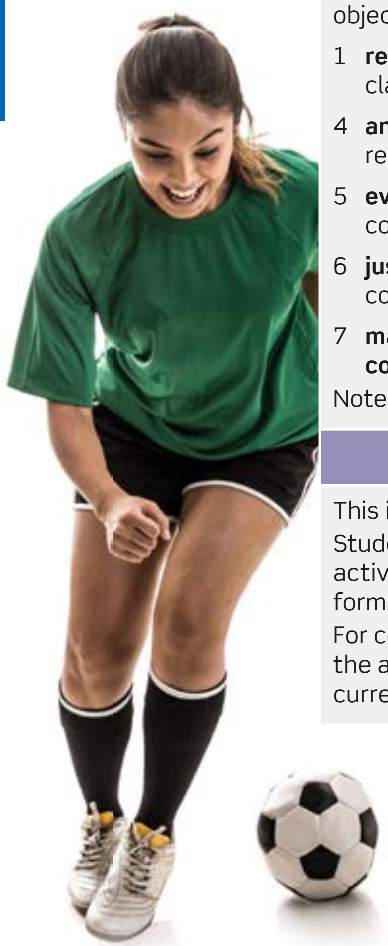
1.2B Tips for success on the Investigation – report

As part of your assessment for Physical Education Units 3 & 4, you will be required to complete and submit one Investigation – report. This is known as:

- Summative internal assessment 2, which is completed as part of Unit 3 – Topic 2: Ethics and integrity. This assessment will contribute 20% towards your overall mark.

QCAA ASSESSMENT ADVICE ON SUMMATIVE INTERNAL ASSESSMENT 2: UNIT 3 – TOPIC 2 (20%)

Description
This assessment requires students to research an ethical dilemma through collection, analysis and synthesis of primary data and secondary data. The investigation uses research or investigative practices to assess a range of cognitions in a class, school or community physical activity context. Research or investigative practices include locating and using information beyond students' own knowledge and the data they have been given. Research conventions (e.g. citations, reference lists or bibliographies) must be adhered to. This assessment occurs over an extended and defined period of time. Students may use class time and their own time to develop a response.
Assessment objectives
This assessment technique is used to determine student achievement in the following objectives: 1 **recognise** and **explain** concepts and principles about ethics and integrity relevant to a class, school or community physical activity context 4 **analyse** and **synthesise** data to **devise** an ethics strategy about an ethical dilemma relevant to a class, school or community physical activity context 5 **evaluate** an ethics strategy relevant to a class, school or community physical activity context 6 **justify** an ethics strategy relevant to a class, school or community physical activity context 7 **make decisions** about and use language, conventions and mode-appropriate features to **communicate** information about a strategy to inform a technical audience. Note: Objectives 2 and 3 are not assessed in this instrument.
Specifications
This investigation will focus on Unit 3 – Topic 2 Ethics and integrity. Students will investigate one ethical dilemma in a class, school or community physical activity context to devise an ethics strategy. The student response is presented in a report format. For complete details of the assessable evidence you will be required to submit as part of the assessment, download the Physical Education General Senior Syllabus. A link to the current syllabus is provided on your obook assess.



Supporting evidence		
Conditions		
Time Approximately 5 hours of the time allocated to Unit 3	**Length** 1500–2000 words	**Other** The reference list, title page and table of contents are not included in the word count schools implement. Authentication strategies should reflect QCAA guidelines for ensuring student authorship.
Summary of the instrument-specific marking guide (ISMG)		
The following table summarises the criteria, assessment objectives and mark allocation for the folio. To view the complete ISMG for this assessment, download the Physical Education General Senior Syllabus. A link to the current syllabus is provided on your obook assess.		

Criterion	Objectives	Marks
Explaining	1	4
Analysing	4	6
Evaluating and justifying	5 and 6	7
Communicating	7	3
Total		20

Source: *Physical Education 2019 v.1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

SOURCE 6 Guidelines for summative internal assessment 2 (to be completed as part of Unit 3 – Topic 2)

Tips for planning and researching your Investigation – report

Before beginning work on your Investigation – report, it is vital that you refer directly to the Physical Education General Senior Syllabus. This document contains all of the specifications and ISMGs for this assessment and will help guide your planning, research and presentation.

The assessment advice provided in this section was correct at the time this book went to print, however, the QCAA may make changes to the syllabus from time to time. These changes may affect the structure of this assessment or the way in which it is marked. Check with your teacher to make sure you are using the most recent specifications for the task.

The Investigation – report requires you to research and investigate an ethical dilemma by collecting, analysing and synthesising primary and secondary data. In Unit 3 – Topic 1, you will be required to investigate one ethical dilemma in a class, school or community physical activity context to devise an ethics strategy. Your research and findings will be presented in a report format. To help you plan and complete the Investigation – report, it can be helpful to break it into two stages:

- **Stage 1 –** Research an ethical dilemma by collecting, analysing and synthesising primary and secondary data
- **Stage 2 –** Present your findings in report format.

Both stages of the task will be assessed and marked against the assessment objectives contained in the instrument-specific marking guide (ISMG). This means that all parts of the task must be completed in order to maximise your chances of success.

Tips for creating and presenting your Investigation – report

The Investigation – report requires you to follow a specific format. 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 (e.g. the physical activity you are studying in the unit or topic and the setting in which the unit is taking place).
Discussion	In this section you should: → 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 7 Sections to include in the Investigation – report

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

Tips for 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 of the sources you have used. Step-by-step information on how to cite secondary sources is provided on page 35.

Crediting and acknowledging secondary data sources is 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 examiner 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.

For more information about primary and secondary data, and to find out how you can best incorporate data into your Investigation – report, go to Section 1.3.

For more advice and practical tips on how to create and present your Investigation – report, complete the Skill drill on your obook assess.

STUDY TIP

Data is key to your success!
In order 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 Section 1.3 on pages 28–35.

PAGE
19

SOURCE 8 There are many different types of primary and secondary data all around you, so every time you make a claim in your report, you should support it with an in-text citation.

RESEARCH	SKILL DRILL **1.2B**	Create and present an Investigation – report
Refer to your obook assess to complete this integrated research activity.		

1.2C Tips for success on the Examination – combination response

As your final assessment for Physical Education Units 3 & 4, you will be required to complete an Examination – combination response. This is known as:

- Summative external assessment, which is completed as part of Unit 4 – Topic 1: Energy, fitness and training. This assessment will contribute 25% towards your overall mark.

SOURCE 9 The Examination – combination response is an external examination completed by all Physical Education students across Queensland. It will be taken under supervised conditions.

QCAA ASSESSMENT ADVICE ON SUMMATIVE EXTERNAL ASSESSMENT: UNIT 4 – TOPIC 1 (25%)

General information
The summative external assessment is developed and marked by the QCAA. In Physical Education, it contributes 25% to a student's overall subject result. The external assessment in Physical Education is common to all schools and administered under the same conditions, at the same time, on the same day.
Description
The examination assesses the application of a range of cognitions to multiple provided questions. Student responses must be completed individually, under supervised conditions and in a set timeframe.

Assessment objectives
This assessment technique is used to **determine** student achievement in the following objectives: 1 **recognise** and **explain** energy, fitness and training concepts and principles about movement 4 **analyse** and synthesise data to **devise** strategies about energy, fitness and training 5 **evaluate** training strategies about movement 6 **justify** training strategies about movement 7 **make decisions** about and use mode-appropriate features, language and conventions to **communicate** meaning to inform a technical audience. Note: Objectives 2 and 3 are not assessed in this instrument.
Specifications
The examination requires students to respond to unseen questions about subject matter from Unit 4 – Topic 1. This examination will be a single assessment instrument with multiple parts, which may include: → multiple-choice questions – students will respond to multiple-choice questions based on subject matter from Unit 4 → short-response questions – students will respond to short-response questions based on subject matter from Unit 4 → extended response to stimulus – students will respond to an unseen question or statement and stimulus, based on subject matter from Unit 4. For complete details of the assessable evidence you will be required to submit as part of the assessment, download the Physical Education General Senior Syllabus. A link to the current syllabus is provided on your obook assess.

Conditions		
Time 2 hours plus 15 minutes perusal time	**Length** 800–1000 words in total, including: → short paragraph response items of 150–250 words per item → an extended response to stimulus of 400 words or more.	**Other** The reference list, title page and table of contents are not included in the word count schools implement. Authentication strategies should reflect QCAA guidelines for ensuring student authorship.

Instrument-specific marking guide (ISMG)
No ISMG is provided for the external assessment.

Source: *Physical Education 2019 v. 1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

SOURCE 10 Guidelines for summative external assessment (to be completed as part of Unit 4 – Topic 1)

STUDY TIP

Cognitive verbs are important!

- In order to perform well in your examination, you will need to understand the meaning of a number of congnitve verbs.
- For more information about cognitive verbs, go to Section 1.2D on pages 25–27.

Tips on the structure of the Examination – combination response

Before you begin revising and preparing for the Examination – combination response, it is important that you refer directly to the most recent version of the Physical Education General Senior Syllabus. This document contains all of the specifications and instructions for this assessment.

The assessment advice provided in this section was correct at the time this book went to print, however, the QCAA may make changes to the syllabus from time to time. These changes may affect the structure of exam, the number or type of questions on it, or the way in which it is marked. Check with your teacher to make sure you are using the most recent specifications for the task.

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 a number of short-response questions. Your task will be to answer each question in around 150–200 words.
- **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 a written response of 400 words or more in response to the stimulus.

Tips on the 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 15 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.

In Units 1 & 2, examinations will be developed by your teacher. They will be marked internally at your school. In Units 3 & 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.

Tips on the importance of cognitive verbs in the Examination – combination response

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

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:

> **Analyse** the data provided to explore the relationship between the task, the player's results, and the feedback strategy they implemented.
>
> Source: *Physical Education 2019 v.1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

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.

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 aimed to improve their performance in the task.

SOURCE 11 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.

Tips on 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 don't 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 …)
  - judgement phrases (e.g. Choose the **most correct** answer …).
- **Beware of distractors**. It's common for multiple-choice questions to contain a number of distractors (i.e. incorrect options). In Physical Education examinations, it's unlikely that you will see any distractors that are obviously wrong. Instead, it's 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.
- **Don't 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're not completely sure of the answer, make an educated guess.

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

- **Pay attention to the suggested word limits**. You should pay attention to the suggested word limits for each question and take care to follow them. If the suggested word limit for a question is 150 words and you find yourself writing 400 words, there is a good chance that you are not on the right track. Avoid writing everything you know about a topic. Instead, look at what has been asked of you and provide a clear, concise response.
- **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.
- **Don’t just list facts**. Responses that include a long string of facts will not necessarily 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 the Skill drill on your obook assess.

SOURCE 12 One of the best ways to prepare for the short-response and extended response to stimulus questions on the examination is to practise!

RESEARCH	SKILL DRILL **1.2C**	Develop skills to improve your results on the Examination – combination response
Refer to your obook assess to complete this integrated research activity.		

1.2D Understanding cognitive verbs

In all of the assessments you are asked to complete throughout Units 3 & 4, it's 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. a doing word that describes a particular mental process or procedure). In simple terms, cognitive verbs are words that tell you what to do in order to demonstrate your understanding of the subject matter in the syllabus.

Some cognitive verbs are simple to understand and master (e.g. define), while others are more challenging to understand and will take time and practice to master (e.g. synthesise). The table below lists the most 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. A complete list of all cognitive verbs is provided on your obook assess.

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.
apply	use knowledge and understanding in response to a given situation or circumstance; carry out or use a procedure in a given or particular situation	**Apply** spatial awareness to effectively use court space in netball.
assess	measure, determine, evaluate, estimate or make a judgment about the value, quality, outcomes, results, size, significance, nature or extent of something	**Assess** the validity and reliability of data gathered from online tests and suggest how these factors might be improved.
classify	arrange, distribute or order in classes or categories according to shared qualities or characteristics	**Classify** the following movement sequences according to level of difficulty.
compare	display recognition of similarities and differences and recognise the significance of the similarities and differences	**Compare** the three main types of muscle tissue in the human body.
consider	think deliberately or carefully about something, typically before making a decision; take something into account when making a judgment; view attentively or scrutinise; reflect on	Based on your research, **consider** whether you think a player may be at different stages of learning for different skills.
contrast	display recognition of differences by deliberate juxtaposition of contrary elements; show how things are different or opposite; give an account of the differences between two or more items or situations, referring to both or all of them throughout	**Contrast** the differences between jumping into a striking action and hitting from a stationary position.
create	bring something into being or existence; produce or evolve from one's own thought or imagination; reorganise or put elements together into a new pattern or structure or to form a coherent or functional whole	Using what you have learnt, **create** your own pre-competition routine for your selected physical activity.
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'.

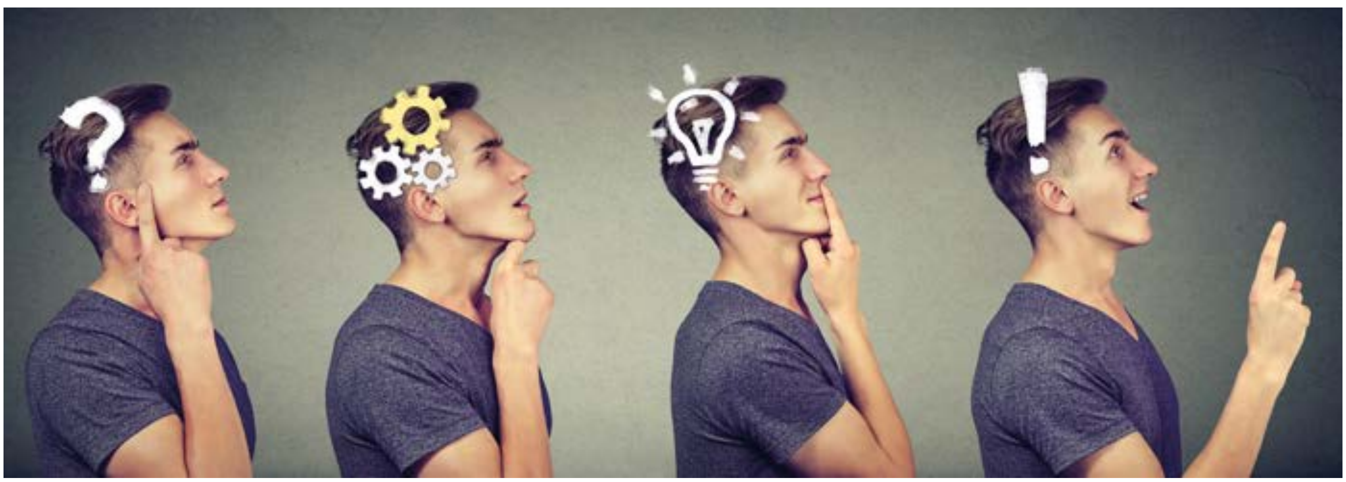
SOURCE 13 Cognitive verbs and some examples of them in use. *(Continues next page)*

Term	Explanation	Example of question/task using cognitive verb
demonstrate	prove or make clear by argument, reasoning or evidence, illustrating with a practical example; show by example; give a practical exhibition	**Demonstrate** how to set up an attack by forcing your opponent to the baseline or the corners of the court in tennis.
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.
design	produce a plan, simulation, model or similar; plan, form or conceive in the mind	**Design** a training program for your selected physical activity.
devise	think out; plan; contrive; invent	**Devise** a biomechanical strategy to optimise your demonstration of the freestyle stroke in swimming.
differentiate	identify the difference/s in or between two or more things; distinguish or discriminate; recognise or ascertain what makes something distinct from similar things	**Differentiate** between 'barriers' and 'enablers' to physical activity.
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.
examine	investigate, inspect or scrutinise; inquire or search into; consider or discuss an argument or concept in a way that uncovers the assumptions and interrelationships of the issue	**Examine** the key facts presented in the article and make a recommendation about the best way to reduce injuries in rugby.
explain	make an idea or situation plain or 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.
explore	look into closely and broadly; scrutinise; inquire into or discuss something in detail	**Explore** the components of projectile motion in the javelin throw.
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.
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.

Term	Explanation	Example of question/task using cognitive verb
make decisions	select from available options; weigh up positives and negatives of each option and consider all the alternatives to arrive at a position	**Make decisions** about whether to present your sprinting speed, velocity and acceleration data in a table or a graph.
predict	give an expected result of an upcoming action or event; suggest what may happen based on available information	**Predict** how demographic change in Australia over the next 50 years will affect participation rates in club sports.
recall	remember; present remembered ideas, facts or experiences; bring something back into thought, attention or into one's mind	**Recall** the four body and movement concepts.
recognise	identify or recall particular features of information from knowledge; identify that an item, characteristic or quality exists; perceive as existing or true; be aware of or acknowledge	**Recognise** the concept of motivation as a continuum from extrinsic to intrinsic.
reflect on	think about deeply and carefully	**Reflect on** the primary data you gathered about your implemented equity strategy.
summarise	give a brief statement of a general theme or major point(s); present ideas and information in fewer words and in sequence	**Summarise** the main points of the newspaper article in your response.
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.
use	operate or put into effect; apply knowledge or rules to put theory into practice	**Use** the written language features of a report when presenting the findings of your research.

Source: *Physical Education 2019 v.1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

SOURCE 13 Cognitive verbs and some examples of them in use. *(Continued)*



SOURCE 14 A cognitive verb is a doing word that describes a particular mental process or procedure that you are required to demonstrate.

Check your obook assess for the following additional resources and more:

- » **Skill drill worksheet** 1.2A Plan, create and present a Project – folio
- » **Skill drill worksheet** 1.2B Create and present an Investigation – report
- » **Skill drill worksheet** 1.2C Develop skills to improve your results on the Examination – combination response
- » **Weblink** 1.2D A complete glossary of cognitive verbs from the QCAA website

1.3 The importance of data in QCE Physical Education

data
information collected for reference, analysis and evaluation

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 3 & 4. This means that throughout your studies this year, you will be required to gather, record, analyse, evaluate, synthesise and reflect on a number of 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?

Defining data

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:

Primary and secondary data

- Primary data includes 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 includes any data that you did not collect or record yourself. Secondary data may still relate directly to your performance, but it 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, performance data for other athletes published in newspapers, books, magazines or journals, or even information you find in this textbook.

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 includes 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 includes any type of data that can be recorded in **numbers**. Examples of quantitative data in Physical Education include measuring aspects of performance such as heart rate, weight, 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.

Assessing the quality of your data

Data can be found all around us, but not all of it is good quality. In order 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. 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)
- **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).

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

1.3A Putting data to use in Physical Education

Key stages of data analysis

There are three key steps to follow to ensure that you have the data you need to devise strategies about body and movement concepts and that will optimise your performance and engagement. These are outlined in Source 2. If you follow these steps, you will have good quality data to incorporate into your assessments in Physical Education this year and maximise your chance of performing well in the subject.

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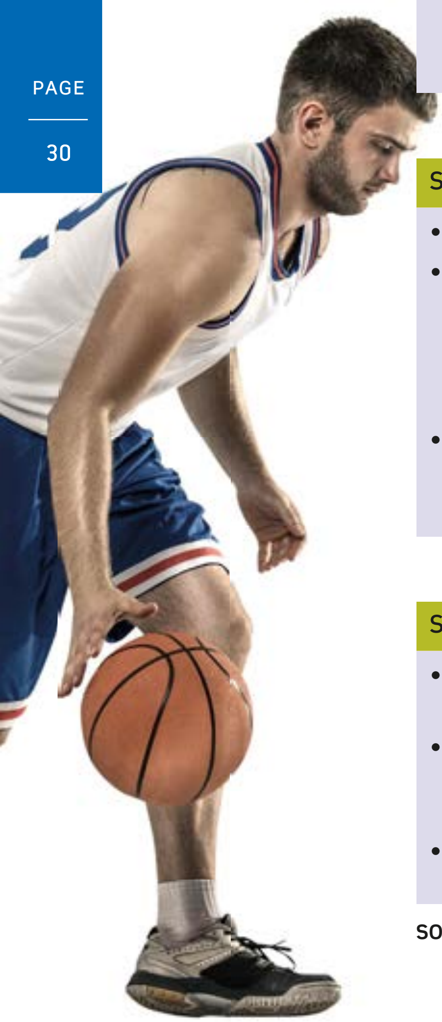

STEP 1 – Gather, record and organise data

- Before you begin gathering your data, you need to be sure about what you need it for. Ask yourself what you need it for, what you want or need 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 all of your data collected and recorded, it can be helpful to organise it. To organise your data, you can group it 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. You want 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 of the smaller pieces of data together and draw conculsions 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 clearly and effectively get your message across in a way that engages your audience.

SOURCE 2 The key stages of data analysis

Gathering primary data

There are a number of 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 (see below) are the most common and useful way 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 provided on your obook assess.
- 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 provided on your obook assess.

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. 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 smart phones, digital cameras, GoPro, etc.
- **Continuous high-speed photography** – This can include smart phone 'burst' mode or digital cameras.
- **Video analysis apps** – This can include apps such as Coach's Eye, Spark Motion, Coach My Video, Dartfish.
- **Camera drone** – This can include a mobile drone fitted with video camera to capture game play from above.

RESEARCH | SKILL DRILL **1.3A** | **Capture and analyse video footage of physical performances**

Refer to your obook assess to complete this integrated research activity.

Personal reflection

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 include more than just your thoughts and feelings. It should include information about the context, a review of your performance and information about the playing conditions, team dynamics, your mood and physical condition.

Useful tools for gathering personal reflections

- **Personal journal** – A journal is the best way to record your reflections (see Source 3). A template will help you to record important aspects of your performance and keep your notes consistent. 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 have lots of great data to include in your assessments. A template that you can use to create a personal journal is provided on your obook assess.

JOURNAL TEMPLATE – COMPLETED	
Name: Crystal Hede **Date:** 28/09/2020 **Physical activity:** Badminton **Topic:** Motor learning	**Dependent variable: Performance summary (Link to data collected if available)** ☐ Excellent ☑ Good ☐ Okay ☐ Poor My performance today was mostly good. I played 4 games of singles and 2 doubles. I won 3 out of 4 effectively but my net kills were particularly good. My GPAI shows that of the 23 net kill opportunities I had in my matches, 48 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 relevant of the information)**
Lesson experiences	We played a round robin in both singles and doubles. I was paired with Kate Russel for doubles. She 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 of the 6 matches (the 'bad' end has windows right behind the back of the opponent's court making it hard to see the shuttle).
Position played	NA
Mood (arousal, motivation, confident, 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 3 An example of an entry from a personal journal

Interviews and surveys

Interviews and surveys are another great way 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 (e.g. 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 (in order to get the best information possible).
- **Surveys** (also known as questionnaires) include 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's important that your questions are clear and cannot be misinterpreted. A weblink to help you write good survey questions is provided on your obook assess.

Useful tools for interviews and surveys

- **Online surveys –** Websites such as SurveyMonkey and Typeform offer a free and easy way of gathering larger numbers of responses in a shorter 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.

RESEARCH | SKILL DRILL **1.3B** | Conduct a survey and present the results

Refer to your obook assess to complete this integrated research activity.

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Gathering secondary data

There are a number of different ways of gathering and recording secondary data. These are described in the following sections.

Published sources

Published secondary sources include things like textbooks, newspapers, magazines, government reports, TV 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.

In order 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 other similar research
- check that the author is qualified, credible and not associated with any commercial company (i.e. is 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.

Useful tools for gathering data from online sources

- **Search engines –** Search engines such as Google and Google Scholar are useful research tools, but much of the material found using these tools may not be reliable and may contain inaccuracies, false and misleading information, or material that is out of date. When using search engines like Google or Yahoo, be sure to define your search using keywords.
- **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 if 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 4, 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 reliable.
.gov	The site is linked to a government institution. These sites are generally reliable.
.net	This site is linked to a commercial organisation or network provider. Anyone is able to 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	This 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 they have 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	This 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 4 Domain name descriptions

RESEARCH

SKILL DRILL
1.3C

Use the internet to find relevant, credible and reliable sources

Refer to your obook assess to complete this integrated research activity.

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 (i.e. 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).

SOURCE 5 The internet is a useful tool to find relevant, credible and reliable sources.

Example:

Hede, C., Russell, K., Weatherby, R. & Williams, B., 2018, *Physical Education for Queensland Units 1 & 2 Second 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 2018, <www.psychology.org.au/for-the-public/about-psychology/types-of-psychologists/Psychologists-with-an-Area-of-Practice-Endorsement/Sport-and-exercise-psychology>.

For more advice and practical tips on how to evaluate the reliability and validity of online sources, complete the Skill drill on your obook assess.

Check your obook assess for the following additional resources and more:

- **Skill drill worksheet** 1.3A Capture and analyse video footage of physical performances
- **Skill drill worksheet** 1.3B Conduct a survey and present the results
- **Skill drill worksheet** 1.3C Use the internet to find relevant, credible and reliable sources

1.4 Careers in physical education, sport and fitness

The sport and recreation industry makes a significant contribution to the Australian economy. According to Sport Australia's current national sport plan, *Sport 2030*, the industry delivers economic, health and educational benefits to the tune of $83 billion each year. Approximately 3.2 million Australians are involved in non-playing roles within organised sport and physical activity programs, almost half of whom identified as coaches, instructors or teachers. Currently, around 222 000 Australians are employed in the sport and recreation industry and 1.8 million Australians volunteer within the sector. One segment of this sector that has boomed in recent years is the fitness industry. As Australians have become more and more health conscious, demand for fitness products and services like gym memberships, fitness equipment and personal trainers has increased. Based on data presented in documents like *Sport 2030* and the CSIRO's *The Future of Australian Sport*, the Australian sport and recreation industry is likely to continue being a prominent feature of our society and our economy for some time to come.

The Australians employed within the sport and recreation industry possess a variety of different qualifications, knowledge and skills. Physical Education can help you develop these knowledge and skills. It can also help you pursue the pathways of further study that lead to these qualifications. Within universities, Physical Education provides the basis for undergraduate and postgraduate studies in fields like sport and exercise science, physiotherapy, health and physical education teaching, sports development, sports journalism, sports marketing, leisure tourism and sports coaching. Australian universities are regarded as some of the best in the world in these areas, particularly the sport and exercise sciences. Physical Education also establishes a foundation for pursuing certificate-level qualifications within the vocational education and training system, such as the Certificate II in Sport and Recreation and the Certificate III in Fitness.

In addition to the sport and recreation industry, Physical Education is also suited to students thinking about pursuing a career in the health industry. As Australia's population ages and increasing emphasis is given to population-level and individually targeted preventive health efforts, the country's health industry is predicted to be one of its largest areas for new employment. Studying Physical Education can provide a platform for further studies in health sciences, public health, health education, allied health, nursing and medicine.

SOURCE 1 While many people who choose to study Physical Education go on to work in the sport and fitness industry, this is certainly not the only career path available. In fact, a sound knowledge and understanding of the value of health and physical activity is highly valued in a range of different industries.

Career profile: Jack Diener

Jack Diener is 21 years old and lives on the Gold Coast. He is a former QCE Physical Education student who is currently completing a Bachelor of Exercise Science at Griffith University. While completing his studies, Jack is working part-time as a group fitness instructor and personal trainer.

We interviewed Jack to find out what he has been doing since completing his QCE and how he is using his knowledge of health and physical activity to start an exciting career in the sport and fitness industry.

Jack Diener, Group Fitness Instructor and Personal Trainer

How did you first become interested in sport, health and physical education?
I have been interested in sport for as long as I can remember and have played Rugby League, Athletics and junior Surf Life Saving from a very young age. I was introduced to team and individual sports by family and friends and was fortunate enough to live in an area where an active lifestyle was easily accessible. Starting my childhood off in such a way and continuing this through my adolescence led the development of my interest in learning about health and the human body, which has now led to my career pathway.

What did you enjoy about Physical Education at school?
Early on in primary school, PE for me was all about playing sport and doing the practical side of the subject. I loved, and still do enjoy, moving my body and competing with myself and trying to better my own ability and fitness. As I got older and moved into secondary school, I became more curious as to why and how the human body produces movement particularly. This left me with the desire to find out more about the function of the human body and I enjoyed the practical and theoretical sides of Physical Education pretty evenly.

What qualifications have you completed since finishing your QCE?
After finishing my QCE, I went straight into study at Griffith University on the Gold Coast, undertaking a Bachelor of Exercise Science. I recently graduated with this degree and continued on with postgraduate study in Exercise Physiology, which I will graduate later this year. This further study will allow me to prescribe exercise for individuals who are suffering from a range of chronic conditions.

What is a typical day at work like for you?
A typical day at work for me includes waking up at 4am to set up for my morning group sessions. I write and conduct high-intensity interval training (HIIT) group exercise sessions that last for 30 minutes. During a session, I lead a dynamic warmup, demonstrate and explain the exercises that I have included, and lead a static stretch for groups of up to 25 people. During the exercise session, I provide motivation and a high energy environment for people to try to improve and achieve their goals. I conduct five group classes in the morning and five in the afternoon, which leaves the middle of the day free for me.

What do you like best about your job?
What I enjoy the most about my job is being able to assist and guide people to achieving goals and improving their health and overall quality of life. This aspect is so rewarding for me, as someone who enjoys being healthy, because it makes me feel as though I have assisted the individual to make a willing change both mentally and physically in terms of their health. I also love the fact that my job actually keeps me moving and that I am not stuck behind a desk or computer for the majority of the day. On top of both of these things, the working hours are different to a regular job and are more flexible as well. One thing is always the same though – every day I get to help someone in need. It's an incredible feeling to go home with!

SOURCE 2 Career profile for Jack Diener

Check your obook assess for the following additional resources and more:

» **Weblink**
A guide to careers in the health and fitness industry

» **Weblink**
Starting your career in health and fitness

UNIT

3

TACTICAL AWARENESS, ETHICS AND INTEGRITY AND PHYSICAL ACTIVITY

UNIT 3 OBJECTIVES

In this unit you will:

- → recognise and explain tactical awareness and ethics and integrity concepts and principles about selected physical activities
- → demonstrate specialised movement sequences and movement strategies in the selected physical activity
- → apply concepts to specialised movement sequences and movement strategies in the selected physical activity
- → analyse and synthesise data to devise strategies about tactical awareness and ethics and integrity
- → evaluate tactical, ethics and movement strategies
- → justify tactical, ethics and movement strategies
- → make decisions about and use language, conventions and mode-appropriate features for particular purposes and contexts.

UNIT 3 TOPICS

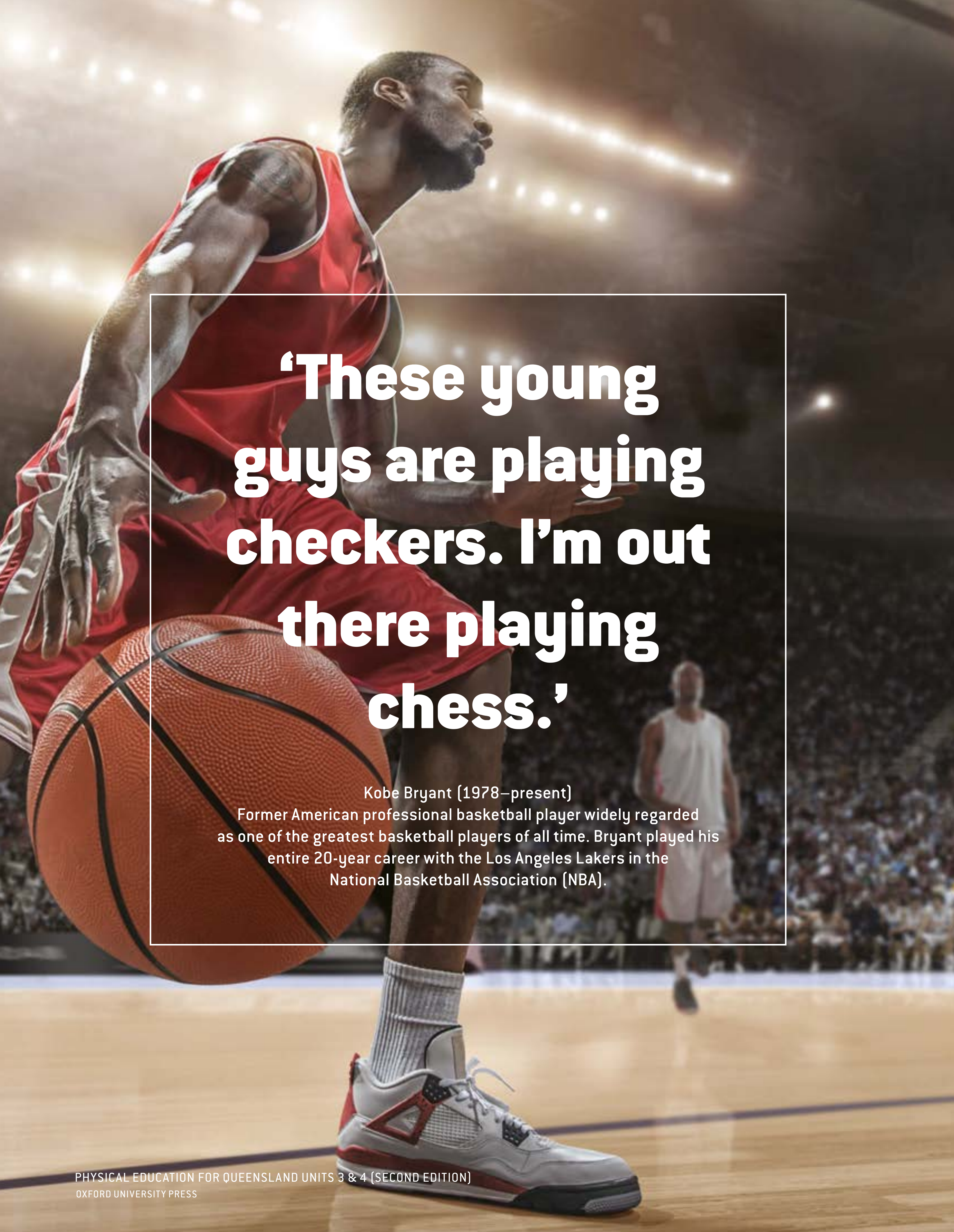
The learning for this unit has been divided into two topics. The table below shows how each topic aligns with the chapters in this book and lists the notional hours of teaching time for each.

Topic	Chapter	Notional hours
Topic 1 Tactical awareness — integrated with one physical activity from either the 'Invasion' or 'Net and court' categories	Chapter 2 Tactical awareness	33
Topic 2 Ethics and integrity	Chapter 3 Ethics and integrity	22

Note to teachers and students:

To enable the integration of the subject matter of Topic 1 – Tactical awareness, the selected physical activity must come from one of the 'Invasion' or 'Net and court' categories.

To engage with the subject matter of Topic 2 – Ethics and integrity, schools should provide opportunities for students to participate in a wide range of learning experiences across a variety of categories of physical activity. The integration of the subject matter with a range of physical activities will provide opportunities to explore diverse issues about ethics and integrity.



‘These young guys are playing checkers. I’m out there playing chess.’

Kobe Bryant (1978–present)
Former American professional basketball player widely regarded as one of the greatest basketball players of all time. Bryant played his entire 20-year career with the Los Angeles Lakers in the National Basketball Association (NBA).

CHAPTER

2 TACTICAL AWARENESS

KEY TERMS

By the end of this chapter, you should understand the meanings of the following key terms. They are defined throughout the chapter, as well as in the glossary. Use this handy checklist to test your understanding.

☐ affordances
☐ attunement
☐ body and movement concepts
☐ body awareness
☐ cognitive systems approach
☐ constraints
☐ constraints-led approach
☐ dynamic
☐ dynamic models of learning
☐ dynamic systems approach
☐ dynamic systems theory
☐ ecological model
☐ environmental constraints
☐ learner constraints
☐ motor control system
☐ motor learning
☐ movement strategies
☐ perception–action coupling
☐ principles of decision-making
☐ principles of play
☐ quality of movement
☐ rate limiters
☐ relationships
☐ self-organisation
☐ space awareness
☐ specialised movement sequences
☐ tactical awareness
☐ tactical strategy
☐ task constraints

SUBJECT MATTER OUTCOMES COVERED IN CHAPTER 2

All of the subject matter dot points you are required to cover in **Unit 3 – Topic 1** of the Physical Education General Senior Syllabus are included in this chapter. The tables below show you exactly where each subject matter dot point is covered.

Unit 3 – Topic 1: Tactical awareness integrated with one selected 'Invasion' or 'Net and court' physical activity

In Unit 3 – Topic 1, students engage in learning that involves the integration of Tactical awareness subject matter and the subject matter for a selected 'Invasion' or 'Net and court' physical activity.

Stage 1: Engage and understand

Subject matter	Section/s	Page/s
In this area of study, students will:		
→ recognise and explain that two major approaches to investigate motor learning have developed over time: cognitive systems and dynamic systems	2.2	50–53
– the cognitive systems approach, 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	2.2	51
– the dynamic systems 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 system	2.2	52–53
→ recognise and explain that tactical awareness is a personal response to the interaction of constraints of the learner, task and environment during goal-directed behaviour in a physical activity	2.1	46–49
→ recognise and explain the alignment of dynamic systems to the complex nature of authentic game play	2.4	64
→ identify and explore dynamic models of learning including dynamic systems theory and the ecological model	2.3	54–63
→ recognise and explain that dynamic systems theory views the learner as a complex movement system of many independent and interacting parts, and that this system self-organises in response to the constraints placed upon it. This includes the understanding that	2.2	52
– self-organisation involves the dynamic interaction of constraints on movement and, when specific constraints are present, the system organises into a specific yet stable state or preferred method of movement	2.3	58
– constraints are the boundaries within which learners can explore and search for movement solutions within a physical activity, including	2.3	55–57
■ task constraints – the characteristics of the task that can influence movement, e.g. number of players, rules and equipment	2.3	55

■ learner constraints – any personal characteristics of the learner that can influence movement, e.g. height, weight, body composition, motor skills and motivation	2.3	55
■ environmental constraints – any characteristics of the physical and social environment that can influence movement, e.g. playing surface, playing area, movement, noise, weather conditions, teacher, coach, peers and family	2.3	56
– movement changes and progressions are non-linear as they involve abrupt changes from one stable state to another, e.g. changing from walking to running when increasing the speed on a treadmill	2.2	52
→ recognise and explain that the ecological model focuses more on how the motor control system interacts with the environment and proposes that information to control action is consistently and directly available from our senses through a perception–action coupling. This includes the understanding that	2.3	59
– perception–action coupling provides a direct link between the process of interpreting or giving meaning to information from the environment and a specific action, e.g. perceiving the space between the defenders and responding with the action of running through the space	2.3	59–60
– perception can drive the action, but action can also drive the perception	2.3	59–60
– affordances are opportunities for action provided by the environment or task in relation to the learner's ability, e.g. a space between defenders affords the opportunity for exploitation by a performer with appropriate speed	2.3	60–61
– as a skill is learned, individuals become more attuned to the environment and the affordances that are available for movement. This enables the learner to identify opportunities for action from the environment, e.g. attune to the size of the space between the defenders	2.3	62
→ recognise and explain that a constraints-led approach to learning can be developed by combining understanding of the dynamic systems theory, which considers the constraints on the motor control system, and the ecological model, which considers how the system interacts with the environment	2.4	64–71
→ identify and explore a constraints-led approach to learning in the selected physical activity to allow opportunity for exploration of movement sequences and development of movement strategies through	2.5	72–79
– manipulation of task constraints, e.g. manipulating the scoring system, adapting specialised movement sequences	2.5	75–76
– consideration of variations among learners' personal constraints, e.g. considering strengths and limitations of teammates and opponents	2.5	77–79
– interaction with environmental constraints, e.g. varying dimensions within the area of play	2.2	72–73
→ recognise and explain the principles of decision-making in the selected physical activity including – reading play – recognising information and responding – reacting to implement movement – recovering with appropriate movements, e.g. recover with 'on the ball' and 'off the ball' movements	2.4	65

→ identify and explore the principles of play, which are fundamental movement strategies used by individuals or teams to effectively adapt to any tactical situation in authentic performance environments, including – setting up attack – defending against attack – creating, defending and exploiting space – attacking opposition space – scoring	2.4	66
→ investigate 'on-the-ball' and 'off-the-ball' movements and decision-making in authentic performance environments, using body and movement concepts as criteria. Examples include: – body awareness, e.g. movement execution, pass or shot selection – space awareness, e.g. movement pathways, use of space, when to run into space or when to pass – quality of movement, e.g. force development, efficiency and outcome – relationships, e.g. interaction with opponent and team members	2.5	73
→ gather primary data about the relationships between a constraints-led approach to learning, tactical awareness concepts and principles, and personal performance of specialised movement sequences and movement strategies in authentic performance environments	Skill drill 2.3 Skill drill 2.4 Skill drill 2.5	328–329 330–331 332–333
→ use secondary data to analyse how tactical awareness concepts and principles and a constraints-led approach to learning can influence performance in the selected physical activity.	Chapter 2	40–95

Stage 2: Analyse and apply

Subject matter	Section/s	Page/s
In this area of study, students will: → analyse and synthesise primary data and secondary data about the influence of the constraints-led approach to learning and tactical awareness concepts and principles on movement sequences and movement strategies in the selected physical activity	Skill drill 2.3 Skill drill 2.4 Skill drill 2.5	328–329 330–331 332–333
→ optimise performance in the selected physical activity by devising personal and team tactical strategies that consider the – manipulation of task, learner and environmental constraints as part of a constraints-led approach – relevant body and movement concepts, and specialised movement sequences – two different principles of play – determined outcomes of performance in the selected physical activity → implement tactical and movement strategies to gather primary data about the outcomes, implications and limitations of decision		
→ analyse primary data and secondary data to ascertain the relationships between tactical strategies, concepts and principles, and personal and team performance.		

Stage 3: Evaluate and justify

Subject matter	Section/s	Page/s
In this area of study, students will: → reflect on primary data and secondary data to evaluate the effectiveness of tactical strategies to achieve a determined outcome, for example – meeting the performance requirements of the physical activity – manipulating task, learner and environmental constraints as part of the constraints-led approach – optimising the performance of specialised movement sequences and movement strategies	Skill drill 2.3 Skill drill 2.4 Skill drill 2.5 Chapter 2 review – Practice assessment task	328–329 330–331 332–333 95
→ make decisions to maintain or modify the tactical and movement strategies to optimise performance in the selected physical activity		
→ justify the development of tactical and movement strategies using evidence from primary data and secondary data		
→ justify maintenance or modification of the tactical and movement strategies using evidence from primary data and secondary data		
→ make decisions about and use language, conventions and mode-appropriate features for particular purposes and contexts.		

Source: *Physical Education 2019 v1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

Check your obook assess for these additional resources and more:

» **Chapter glossary**
A printable and editable list of key terms to learn in Chapter 2

» **Flashcard glossary**
A digital interactive to help you test your knowledge of key terms in Chapter 2

» **Weblink**
A link to the QCAA Physical Education General Senior Syllabus

2.1 Introduction to tactical awareness

That's a goal!

By the end of Section 2.1, you should be able to:

→ **define** the term 'tactical awareness'

→ **understand** and **explain** why tactical awareness is an essential skill for athletes to develop (regardless of their chosen sport or physical activity).

Defining tactical awareness

tactical awareness
an athlete's ability to identify and interpret what is happening within a game situation to help them select, adapt and apply the best physical responses and increase their chances of success

Tactical awareness is the ability to identify what is happening in a game situation and use this information to select and implement the correct physical responses in order to increase the chances of a successful outcome. Physical responses may include knowing when and how to pass a ball in order to maintain possession, creating doubt in an opponent's mind by faking a pass, or isolating a defender to create a scoring opportunity.

However, being tactically aware involves much more than just identifying opportunities for yourself and taking advantage of them. It also involves having an awareness of:

- **the people around you –** being constantly aware of your position on the field or court in relation to other players; understanding the particular playing styles of your teammates and/or opponents; having the ability to identify the strengths and weaknesses of each player you are interacting with
- **the environment you are in –** understanding the playing conditions (e.g. quality of pitch/court), weather conditions (e.g. wind, rain, fog), equipment conditions (e.g. size, shape, age, weight, quality).

Athletes who are able to take all of this information into account during a game and process it quickly to make informed and accurate decisions and predictions about how to act, can significantly increase their chances of success, regardless of the sport they are playing.

The importance of tactical awareness in sport and physical activity

When we think of great athletes, names such as Michael Jordan, Serena Williams, Johnathan Thurston and Samantha Kerr come to mind. They each possess outstanding skill and technique, but it is more than this that makes them exceptional at what they do. What sets them apart from other athletes in their sport is their ability to read play and make informed predictions and decisions in the moment to achieve success for their team. In other words, they are able to consistently make the right decisions and execute the appropriate skills at the best possible time. This ability is exceptional tactical awareness.

When athletes are tactically aware, they are able to scan the environment and take in all of the relevant information, looking for the opportunities that provide them with the best chance to achieve success.

Athletes like NRL legend Johnathan Thurston are often credited with having great tactical awareness because they can predict how a game will unfold much faster and more accurately than other players on the field.

During his long and successful career, Thurston helped his team claim victory countless times. In 2015, he became the first ever player to win the Dally M Medal four times. Whether he was representing Australia, Queensland or the North Queensland Cowboys, Thurston's success can be attributed to his ability to select and implement the right skill at exactly the right time. For example, he often targeted slow defenders and performed side-steps on them, threw cut-out passes with just the right level of speed and precision, and anticipated passes from opponents in order to intercept them.

SOURCE 1 Great athletes like Michael Jordan, Serena Williams, Johnathan Thurston and Samantha Kerr possess outstanding talent, skill, and technique, but their ability to read play in order to make informed predictions and split-second decisions is what sets them apart. This ability is known as tactical awareness.

Tactical awareness in different categories of physical activity

In Unit 3 – Topic 1, you will be required to focus on the concepts and principles of tactical awareness in relation to **one** physical activity from **either** the 'Invasion' physical activities listed in Source 2 or the 'Net and court' physical activities listed in Source 3 on the following page.

Regardless of the physical activity you select, it is important to note that sports that have similar fundamental goals (e.g. setting up attack and defending against attack) also have similar ways (i.e. **movement strategies**) for achieving these goals. Such foundational goals are referred to as **principles of play**. We will explore principles of play in more detail in Section 2.4.

For example, when implementing the principle of play 'setting up attack', maintaining possession of the ball is a movement strategy common to all 'Invasion' physical activities. The movement solution to achieve this movement strategy involves successfully passing the ball to an open (i.e. unmarked) teammate. To do this the:

- teammate must move into open space
- player with control of the ball must select and execute the best method to ensure the ball is passed successfully.

movement strategies
a variety of approaches that assist a player or team to successfully achieve a movement outcome or goal (e.g. moving into space to receive a pass or hitting a ball away from opponents to make it difficult to retrieve or return)

principles of play
a set of movement strategies that can be used to help individual athletes or teams adapt to any tactical situation in performance environments

‘Invasion’ physical activities

To complete an ‘Invasion’ physical activity as part of your studies in Unit 3 – Topic 1, you may choose one of the following:

<table>
<tr><td>Australian football</td><td rowspan="7">More detail and background information on each of these physical activities is provided on your obook assess.</td></tr>
<tr><td>Basketball</td></tr>
<tr><td>Futsal</td></tr>
<tr><td>Netball</td></tr>
<tr><td>Soccer</td></tr>
<tr><td>Touch football</td></tr>
<tr><td>Water polo</td></tr>
</table>

SOURCE 2 ‘Invasion’ physical activities in the QCAA Physical Education General Senior Syllabus

‘Net and court’ physical activities

To complete a ‘Net and court’ physical activity as part of your studies in Unit 3 – Topic 1, you may choose one of the following:

<table>
<tr><td>Badminton</td><td rowspan="3">More detail and background information on each of these physical activities is provided on your obook assess.</td></tr>
<tr><td>Tennis</td></tr>
<tr><td>Volleyball</td></tr>
</table>

SOURCE 3 ‘Net and court’ physical activities in the QCAA Physical Education General Senior Syllabus

SOURCE 4 Although ‘Net and court’ physical activities have very different rules, the techniques used are similar (e.g. serving in tennis is similar to serving in volleyball and badminton).

Why study tactical awareness?

Developing tactical awareness is an essential skill for every athlete, regardless of their chosen physical activity. In sports requiring complex interactions between the team members and their environment – such as 'Invasion' and 'Net and court' physical activities – the development of skills alone is not enough to achieve success. In order to optimise performance and maximise the chances of a successful outcome, players need to be able to read the situation (i.e. identify what is happening around them) and use this information to select and implement the correct physical responses.

As is the case with most skills, techniques and abilities in the context of sport and physical activity, individual athletes naturally possess varying degrees of tactical awareness. For example, in the same team, a relatively new player may have a low degree of tactical awareness, while a more experienced player might possess a high level of tactical awareness. In contrast, a relatively new player (i.e. one with low technical skill and little knowledge of the game) may naturally possess a more developed degree of tactical awareness – or develop this over a much shorter period of time than a more experienced player.

Developing tactical awareness is a complex process that can take time to understand and master, but it is a skill that can be learnt. In fact, the experiences and training opportunities provided to learners can make a real difference to the way they acquire skills and develop tactical awareness.

Throughout this chapter, we will be exploring theories and models in order to understand the ways in which athletes develop tactical awareness. In order to do this, we will begin by developing a basic understanding of how people learn generally, and then look at how they learn (acquire) and remember (retain) the skills to perform the **specialised movement sequences** required for sport and physical activity. This field of science is known as **motor learning**.

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

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

2.1 Check your learning

Engage and understand

1 In your own words, **define** what is meant by the term 'tactical awareness'.

2 **Explain** why tactical awareness is an essential skill for every athlete to develop, regardless of their chosen sport or physical activity.

Analyse and apply

3 **Identify** a movement strategy in your selected physical activity and **consider** the skills (i.e. specialised movement sequences) that can be used to achieve this strategy.

4 Select one of the athletes shown in Source 1 and find video footage of them performing. **Analyse** this secondary data and **describe** a part of the footage in which they demonstrate a high degree of tactical awareness and hereby achieve a successful outcome.

Check your obook assess for the following additional resources and more:

» Student book questions
2.1 Check your learning

» Additional information
'Invasion' physical activities

» Additional information
'Net and court' physical activities

2.2 Approaches to motor learning and the development of tactical awareness

That's a goal!

By the end of Section 2.2, you should be able to:

→ **understand** and **define** the concept of 'motor learning'

→ **identify** two major approaches used to investigate motor learning (i.e. the cognitive systems approach and the dynamic systems approach)

→ **explain** why an understanding of motor learning is central to the development of tactical awareness.

The learning process – including the development of tactical awareness – is extremely complex and involves many different organs and systems in the body. For centuries, scientists have investigated the process of learning in an attempt to understand exactly how humans learn, remember and perform new skills. Over time, they have developed many different approaches (i.e. broad theoretical frameworks) that attempt to explain how humans learn and how we are able to remember the thousands of motor skills and specialised movement sequences we perform every day. This field of science is known as motor learning.

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 instructs the muscles to perform these actions in a linear order (i.e. step-by-step)

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

Defining motor learning

Motor learning seeks to study and explain many aspects of human movement. In particular, it aims to understand how humans learn (acquire) and remember (retain) the motor skills and motor programs required to perform specialised movement sequences (i.e. through practice, experience and/or feedback).

Motor learning researchers do this by:

- studying different organs and systems in the body (e.g. the nervous system and musculoskeletal system) in order to understand the relationship between them
- investigating the different processes that people go through in order to learn and master a new movement or skill.

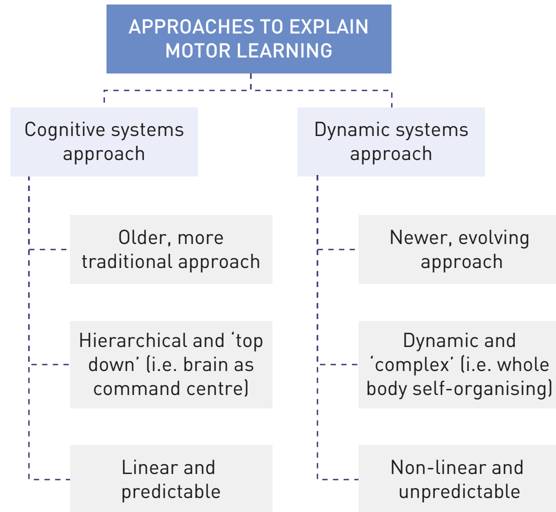
Major approaches to motor learning

In Unit 1 – Topic 1 of the QCAA Physical Education General Senior Syllabus (i.e. Motor learning integrated with a selected physical activity), you learnt about two of the major approaches that were developed to help explain the process of motor learning. These are known as:

- the **cognitive systems approach** – an older, more traditional approach to understanding motor learning
- the **dynamic systems approach** – a newer, evolving approach to understanding motor learning.

Although they are different in many ways, both of these approaches attempt to explain exactly how motor learning takes place. We will now briefly revisit both of these major approaches in order to:

- get a better understanding of how each one explains the process of learning
- learn more about the types of learning environments, training programs and coaching techniques that are most effective when it comes to helping learners develop particular skills and strategies in sport and physical activity.



SOURCE 1 Over time, two major approaches have been developed to help explain how the process of motor learning takes place: the cognitive systems approach and the dynamic systems approach.

The cognitive systems approach to motor learning

The basic idea behind the cognitive systems approach to motor learning is that the brain works like a computer that controls the body. According to this approach, a part of the brain (known as 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. For these reasons, the cognitive systems approach is often described as:

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

For example, according to the cognitive systems approach, to learn and perform a dig in volleyball, the brain creates an action plan (i.e. motor program). That action plan lists all of the necessary movements (i.e. sub-routines) required to complete the dig. 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.

This science has informed coaching practices for many years. Coaches using a cognitive-based approach tell their athletes what they need to do, and when and how they need to do it. For example, the set plays of a team are predetermined and skills are mostly taught in repetitive isolation (i.e. closed environments), based on the assumption that athletes will become technically proficient and tactically aware with time and experience, then apply their skills in authentic game play.

The benefits of a cognitive-based approach include:

- control over variables
- ease of planning
- convenient implementation.

SOURCE 2 The cognitive systems approach and the dynamic systems approach both aim to help explain the process of motor learning; for example, how we learn to return a serve in tennis.

STUDY TIP

It might help you to revisit and revise the key features of the cognitive systems approach and dynamic systems approach to motor learning that were covered in Unit 1 of the QCAA Physical Education General Senior Syllabus.

You can do this by referring to Section 2.3 (pages 46–55) and Section 2.4 (pages 56–61) of *Physical Education for Queensland Units 1 & 2*.

If you no longer have access to the printed Student book, you can still access a complete digital version online via your obook assess.

The dynamic systems approach to motor learning

Driven by a desire to explore new ideas and understand more, sports scientists continually challenge established ways of doing things. This process has led to the development of new approaches and theories about learning, such as the dynamic systems approach.

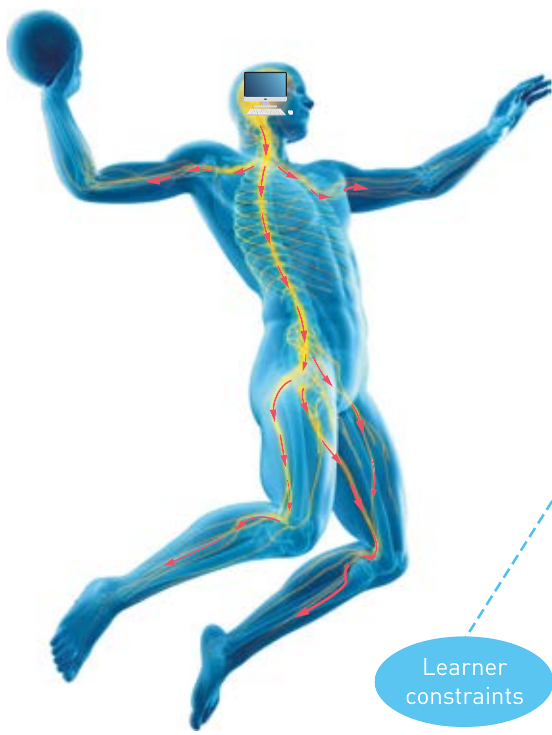
The basic idea behind the dynamic systems approach is that the body is a complex organism made up of many different systems and parts (e.g. nervous system, respiratory system, cardiovascular system, muscular system and skeletal system). Each individual system is further comprised of many components such as bone, muscle tissue, blood cells, oxygen molecules and enzymes.

According to the dynamic systems approach, each of these systems and all of its components are constantly interacting with each other and the outside world.

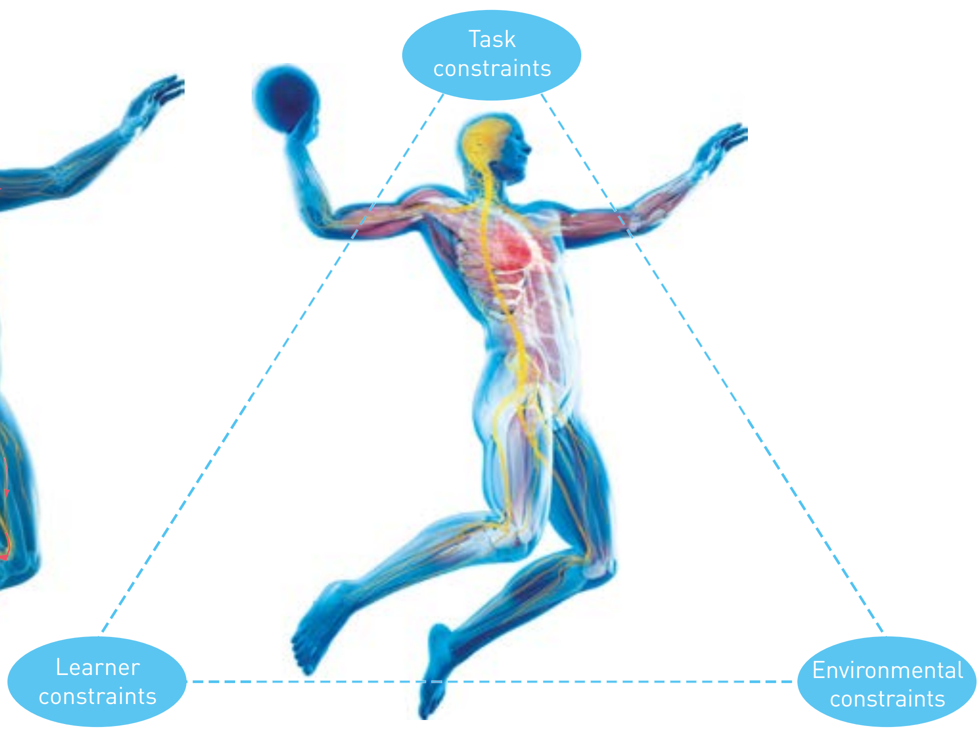
dynamic
a term used to describe a process or system that is constantly changing

Unlike the cognitive systems approach, which views motor learning as an organised process, the dynamic systems approach views motor learning as a much more complex, unpredictable and constantly changing process (hence the name '**dynamic**').

The dynamic systems approach does not suggest that our movements are coordinated exclusively by a single, centralised command centre (i.e. our brain). Instead, it suggests that our movements are coordinated and controlled through complex, non-linear interactions between all parts of the body – and that no single body system or part is more important than the other in the learning process.



SOURCE 3 According to the cognitive systems approach, the brain works like a computer to control the body. To learn and perform the throw shown here, the brain creates an action plan that lists all of the necessary movements required. It then sends each of these commands (in order) to the relevant body systems and muscles required to perform the skill.



SOURCE 4 According to the dynamic systems approach, the body is a complex organism made up of many different systems and component parts, each of which is constantly interacting with the others as well as the outside world. To learn and perform the throw shown here, all body systems are involved in a complex and dynamic interaction between the task, the learner and the environment.

The dynamic systems approach proposes that, with a favourable environment and a suitable task to perform, an individual will spontaneously and dynamically produce effective and efficient movement sequences over time. That is, movements emerge or self-organise through the dynamic interaction between the task being performed, the individual learner and the environment they are in. The complexity of this newer approach is useful when it comes to explaining how learning takes place in authentic game environments (i.e. open environments) that are similarly complex. It also highlights that a successful solution to a problem or challenge may not be limited to one specific skill. Instead, a successful outcome might be achieved by implementing one of many different strategies or skills, all with the same effect.

For the remainder of this chapter, we will investigate the dynamic systems approach to motor learning in greater detail. We will begin by exploring the central concepts of the approach and then investigate how an understanding of these concepts can inform teaching and learning strategies, looking specifically at the **constraints-led approach** to teaching and learning.

constraints-led approach
an approach to teaching and learning that involves manipulating constraints in authentic game situations so that learners are challenged to find their own movement solutions to the problems they face (or the goals they want to achieve); as opposed to more traditional coaching techniques that favoured coach-directed technical drills performed in isolation outside authentic game situations

2.2 Check your learning

Engage and understand

1 **Define** what is meant by the term 'motor learning' and **explain** why sports scientists might be interested in this field of study.

2 **Explain** the basic idea behind the cognitive systems approach to motor learning.

3 **Explain** the basic idea behind the dynamic systems approach to motor learning.

Analyse and apply

4 The dynamic systems approach proposes that movements emerge or self-organise through the dynamic interaction between: the task being performed; the individual learner; the environment they are in. **Analyse** Source 5 and identify which label relates to the task being performed, the individual learner and environmental they are in.

Evaluate and justify

5 **Compare** and **contrast** the information in Sources 3 and 4. Present your findings as two lists – one summarising each.

6 Think about a physical activity in which you consider yourself to be the most tactically aware. **Reflect on** your journey as a learner in that physical activity and **discuss** whether your coaches used a predominantly cognitive systems approach or dynamic systems approach when coaching you. Give examples where possible. Present your response in no more than 150–200 words.

7 The dynamic systems approach is described as 'evolving' in Source 1. **Evaluate** the effect this may have on the implementation of this approach in physical education.

SOURCE 5 Queensland player Kimberley Sue See during the 2016 State of Origin series

Check your obook assess for the following additional resources and more:

» Student book questions
2.2 Check your learning

» Student worksheet
Approaches to motor learning and the development of tactical awareness

» Weblink
Introduction to tactical awareness in sport

2.3 The dynamic systems approach and dynamic models of learning

That's a goal!

By the end of Section 2.3, you should be able to:

→ **identify** and **explain** the dynamic models of learning
→ **identify** and **explain** the key features of dynamic systems theory, including:
  – self-organisation
  – three types of constraints (i.e. task constraints, learner constraints, environmental constraints)
→ **identify** and **explain** the key features of the ecological model, including:
  – perception–action coupling
  – affordances
  – attunement.

In this section, we will explore features of the dynamic systems approach in more detail and begin to investigate how it can be used to understand the development of tactical awareness. Before we begin, it is useful to note that an 'approach' is a broad theoretical framework that has developed over time. Think of the dynamic systems approach as a 'big idea' that attempts to explain the entire process of learning. Within this approach or 'big idea' there are a number of smaller models (i.e. theories) that attempt to explain specific parts of the broader process of learning. These are referred to as **dynamic models of learning**.

Defining dynamic models of learning

Dynamic models of learning are theories (i.e. ways of thinking) that support the dynamic systems approach to motor learning. In other words, they attempt to explain in more detail how humans learn through a dynamic lens.

As shown in Source 1, there are two main dynamic models of learning:

- **dynamic systems theory** – this model views the learner as a complex movement system that self-organises in response to constraints placed upon it
- the **ecological model** – this model attempts to explain how the learner's **motor control system** interacts with the environment to simultaneously 'perceive and act' and 'act and perceive' in order to identify opportunities and produce movements that will maximise the chances of success.

Together, these models provide us with information that support the broad ideas proposed by the dynamic systems approach. They help us to understand how our minds and bodies work in order to develop technical skills – as well as tactical awareness – in a dynamic and complex way. They also tell us why we should predominantly learn in authentic and dynamic contexts. In short, these models guide us to explore the way we develop learning experiences.

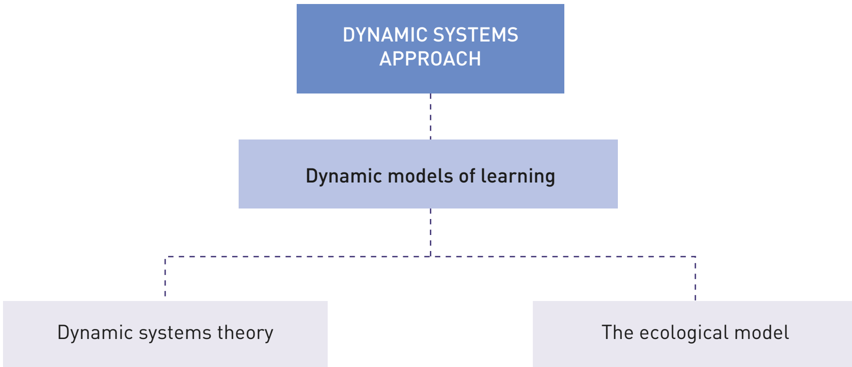
Although the ideas presented in these models are closely related and sometimes overlap, we will now explore each idea separately and in more detail.

dynamic models of learning
theories that sit within the broader theoretical framework of the dynamic systems approach and explain and predict how certain aspects of motor learning and movement take place

dynamic systems theory
a dynamic model of learning that focuses on how a learner's motor control system interacts with the environment and produces movements that will maximise the chances of success

ecological model
one of two main dynamic models of learning used to explain and predict how certain aspects of motor learning and movement take place; the ecological model focuses on how a learner's motor control system interacts with the environment to simultaneously 'perceive and act' and 'act and perceive' in order to identify opportunities and produce movements that will maximise the chances of success

motor control system
a term used to describe a range of body systems that work together in order to regulate the production of movements (i.e. nervous system, muscular system, skeletal system, etc.)



SOURCE 1 Think of the dynamic systems approach as a 'big idea' that attempts to explain the entire process of learning. Within this broad approach there are two dynamic models of learning that attempt to explain smaller, more specific aspects of the larger process. These are known as dynamic systems theory and the ecological model.

Dynamic systems theory

The first dynamic model of learning is known as dynamic systems theory. This model proposes that a learner will adapt dynamically and create movement solutions in response to the situation they find themselves in. It views the learner as a complex movement system that self-organises in response to constraints placed upon it. Two concepts that are central to dynamic systems theory are:

- **constraints** – any internal or external variable (e.g. an athlete's strength, the weather, the rules of a game) that has an impact on an athlete's implementation of movement strategies and specialised movement sequences
- **self-organisation** – a process in which stable movement patterns emerge in response to a range of internal or external variables known as constraints.

Constraints

In 1986, a motor learning researcher by the name of Karl Newell developed the Theory of Constraints. He proposed that a number of variables, which he termed '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. There are three categories of constraints and all are central to dynamic systems theory:

- **task constraints** – the characteristics of the task that need to be overcome or adapted to (e.g. the rules of a game, the time permitted, the number of players, the shape and weight of equipment, the size and shape of the playing surface)
- **learner constraints** (also known as 'individual constraints' or 'player constraints') – the characteristics of the individual that need to be overcome or adapted to. According to Newell's theory, learner constraints can be organised into two sub-groups:
  - structural learner constraints – constraints relating to physical aspects of the learner (e.g. height, weight, physical strength, fitness, speed, stamina)
  - functional learner constraints – constraints relating to psychological or behavioural aspects of the learner (e.g. confidence, motivation, fear, arousal, attention, concentration)

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

self-organisation
a process in which many different systems and organs in the body interact dynamically with each other (in response to constraints) to achieve a goal or establish a movement pattern that is stable

task constraints
any characteristic of a task that an athlete needs to overcome or adapt to (e.g. the rules of a game, the size or shape of the equipment, the size and shape of the playing surface)

learner constraints
any characteristic of the individual (i.e. personal attribute) that an athlete needs to overcome or adapt to; they can include structural learning constraints (e.g. height, weight, physical strength, fitness level) and functional learner constraints (e.g. confidence, motivation, concentration, anxiety)

environmental constraints
any characteristic of the environment that an athlete needs to overcome or adapt to; they can include physical environmental constraints (e.g. weather, light, noise) and social environmental constraints (e.g. parents, peers, coaches, cultural norms)

- **environmental constraints** – the characteristics of the environment that need to be overcome or adapted to. Environmental constraints can be organised into two sub-groups:
  – physical environmental constraints – constraints relating to the physical aspects of the environment (e.g. weather, light, noise)
  – social environmental constraints – constraints relating to the social aspects of the environment (e.g. parents, peers, coaches, cultural norms).

Constraints such as rules, field size and an individual's height generally remain consistent from game to game. A learner must work with, or overcome, these constraints in their pursuit of optimising performance. However, there are many other constraints that can vary from game to game, such as the weather, opponents and an individual's fitness. The unpredictable and ever-changing nature of such constraints suggests that learning environments should be similarly unpredictable to facilitate the development of adaptability in learners. Constraints can be manipulated to provide the boundaries within which learners can explore and search for movement solutions. Working with constraints in this way prepares players for the dynamic conditions they face during competition.

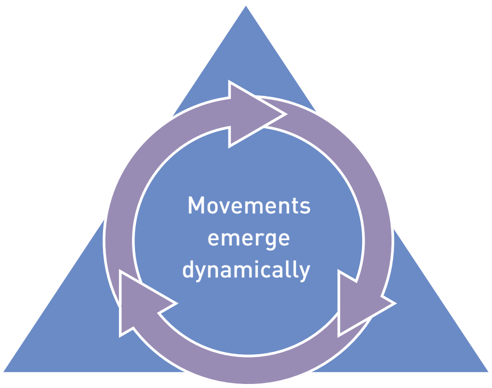
Source 2 illustrates Newell's Theory of Constraints and provides examples for each type of constraint. Although Newell's theory is generally accepted, some experts disagree on exactly how some constraints are categorised.

Task constraints (Characteristics of the task)	Learner constraints (Characteristics of the individual)	Environmental constraints (Characteristics of the physical and social environment)
• Rules of the game • Game/task/position objectives • Number of players • Time restrictions • Size, shape and weight of equipment • Size and shape of playing surface • Teammates • Opposition players	Structural learner constraints: • Height • Weight • Body composition • Endurance • Flexibility • Strength • Speed • Technique Functional learner constraints: • Motivation • Confidence • Learning style • Tactical knowledge	Physical environmental constraints: • Weather conditions • Temperature • Noise level • Light level • Gravity • Number of spectators • Mood of spectators (e.g. hostile/ supportive) Social environmental constraints: • Parents • Peers • Coaches • Cultural norms

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

SOURCE 2 Newell's Theory of Constraints proposes that a number of internal and external characteristics (i.e. constraints) can affect an athlete's motor development.

According to Newell's theory, constraints do not exist in isolation (i.e. separately). He conveyed the interdependent relationship between the three types of constraints by representing them as equal corners of a triangle (see Source 3). This shows that the interaction between all three constraints is essential for learning to take place. If we were to remove one type of constraint (e.g. task constraints) from the learning process, so that an individual is learning and practising skills in the absence of any of the game rules and/or objectives, the resulting skills would not be useful or transferrable when the learner re-entered an authentic game environment.



SOURCE 3 According to dynamic systems theory, movements emerge or self-organise dynamically through the interaction of task constraints, learner constraints and environmental constraints.

Working with constraints

It's important to remember that – despite the name – constraints are not always negative or restrictive. In fact, they can do one of three things:

- compel an athlete to respond or react in a certain way (e.g. swing a racquet during a game of tennis to hit the ball)
- cause an athlete to modify their movements (e.g. sliding when playing on a clay court)
- restrict an athlete's movements (e.g. a shoulder injury that prevents the use of a top spin backhand).

Some constraints do have a negative effect on the learning process and restrict performance. In this case, they are referred to as **rate limiters**. Rate limiters help to explain why an individual may have difficulty completing a skill, despite a concerted effort. 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 their physical strength and the size of their hands negatively impacts their ability to execute the skills. In this case, the child's lack of strength is a rate limiter, as is the size of their hands.

Constraints produce movement responses in learners, so it is possible to purposefully manipulate constraints in order to amplify a movement solution in players. For example, if a badminton player is relying too heavily on the forehand shot and not implementing a range of effective shots, a coach might manipulate the rules of the game to ban the use of forehand shots, forcing the player to come up with other ways to return the shuttlecock across the net.

rate limiters
types of constraints that have a negative effect on the development of motor skills in an individual and may restrict performance; rate limiters can be related to the task, the learner or the environment

SOURCE 4 Some constraints – known as rate limiters – have a negative effect on the learning process and restrict performance. For example, a young child will struggle to develop basketball skills with a ball that is too large or heavy for them because their physical strength and the size of their hands negatively impacts their ability to execute the skill.

Self-organisation

Self-organisation is another key concept of dynamic systems theory. It is a term used to describe the many large and small movement adjustments that a learner is constantly making to their body in response to the dynamic interaction with constraints. Through self-organisation, the body can find a movement solution to achieve a goal without the need for explicit direction or instruction. In other words, it is not necessary to have a pre-existing blueprint for such movement solutions; instead, they emerge through the dynamic interaction of the task being performed, the individual and the environment.

Self-organisation occurs because the human body always strives to maintain equilibrium (i.e. balance), right down to the cellular level. When the body self-organises, it is trying to establish a movement pattern that is stable and balanced. Dynamic systems theory 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.

Russian neurophysiologist Nikolai Bernstein (1967) proposed a model called the 'degrees of freedom problem', which explains that the body moves through three stages in order to achieve stability when executing specialised movement sequences for movement strategies. These stages are:

- freezing – fewer body parts are used to simplify the action
- releasing – actions become more fluid as extra body parts are used
- exploiting – skills are easily repeated, which allows an athlete to try different techniques.

Working with self-organisation

To help you visualise how self-organisation can work, let's consider this example: imagine stepping onto a tennis court for the first time as a beginner. Say your coach hands you a racquet and presents you with the task objective of hitting a ball he has thrown to you back over the net, using only your racquet. Despite the limited instruction, your arms, legs and torso would naturally move in response to the task objective of hitting the ball with the racquet, and you would most likely produce a movement sequence somewhat resembling an actual tennis stroke. You may not actually make contact with the ball on the first attempt, but each time the ball is thrown towards you, your body will self-organise until you hit the ball.

SOURCE 5 According to dynamic systems theory, when running down a steep hill our bodies self-organise in real time to task constraints, learner constraints and environmental constraints, causing our 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.

In this example, hitting the ball over the net with a racquet is a task constraint that results in a level of instability that needs to be overcome. To do this, learners must make adjustments to their feet, arms and other body stabilisers. The body is capable of dynamically refining these movements over time to produce the most efficient technique for hitting a tennis ball over the net.

Self-organisation is something that athletes experience constantly, regardless of their skill or experience level. The ability to respond effectively to instability is an important skill – especially when it comes to the unpredictable nature of 'Invasion' and 'Net and court' physical activities – as learners are constantly required to adapt to changing situations around them. The change from instability to stability is usually more obvious in beginner performers as they refine their movement patterns and develop their tactical strategies over time. However, even elite performers are required to make minute adjustments to their movement patterns in response to the task and environment each and every time they produce a movement response.

To optimise training experiences and achieve success through the dynamic systems approach, it's important that learners are exposed to a wide range of learning situations that create instability and force them to find the movement solutions dynamically (i.e. a personal **tactical strategy** that works for them in that moment).

tactical strategy
an approach that assists a player or team to successfully optimise performance through the application of specialised movement sequences and movement strategies

perception–action coupling
a process that involves interpreting or giving meaning to information from the environment (i.e. perception) and linking this with a specific movement (i.e. action). This concept suggests that perceiving information and producing an action is a simultaneous two-way relationship (i.e. action influences perception at the same time as perception influences action)

The ecological model

The second dynamic model of learning is known as the ecological model (or ecological psychology or ecological dynamics). This model proposes that the dynamic relationship between the learner and the environment is the main driver of the movements we make during physical performance. In other words, this model focuses specifically on *how* our complex motor control system interacts with the environment and proposes that every organism (including humans) adapts to the environment in which it finds itself, through an intricate sensory network.

There are three concepts that are central to the ecological model:

- **perception–action coupling** – a process that explains how perception and action are connected through an ongoing loop whereby receiving and interpreting information from the environment (perception) drives a movement response (action), which similarly drives perception
- **affordances** – opportunities for action provided by the environment or task in relation to the learner's ability
- **attunement** – the process of becoming increasingly aware of affordances.

affordances
opportunities for action that present themselves to athletes in a performance environment. Affordances are provided by the environment or the task – but the ability to take advantage of them depends on the ability of the learner

Perception–action coupling

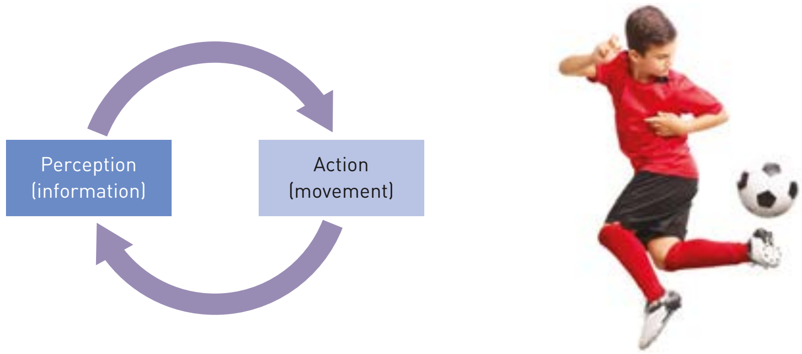
Perception–action coupling is the first concept central to the ecological model. It describes the intertwined nature of perceiving and acting, suggesting that perception can drive action and action can drive perception in an ongoing loop (see Source 6). Put simply, the information we perceive (become aware or conscious of) from the environment compels us to respond in a certain way but, in responding, we are compelled to perceive new information and react accordingly.

An American psychologist by the name of James Gibson (1904–1979) was one of the most important contributors to the field of visual perception. According to Gibson, 'We must perceive in order to move but we must move in order to perceive.'

For example, during a soccer match, a player perceives information as he looks for opportunities to progress towards his goal. He notices a space open up and responds by

attunement
the ability to perceive information in a performance environment and use it to identify available affordances

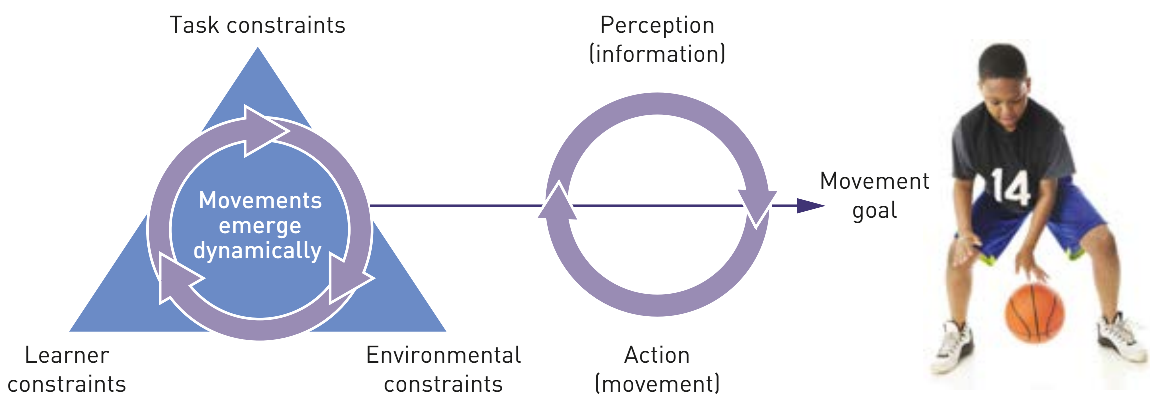
running towards it. As he starts running, he is compelled to perceive new information: his teammate is in a better position and more likely to receive the pass. He reacts to this information by changing the direction he is running in so that he can provide an opportunity for his teammate to pass to him.



SOURCE 6 According to the concept of perception–action coupling, perception drives action but action also drives perception.

Perception–action coupling occurs continuously throughout an athlete's participation in authentic performance environments as they take in, and act upon, information presented to them. This information may include:

- the action and position of their teammates
- the position of the ball
- their proximity to the goal
- the action and position of the opposition
- what they know about their teammates' capabilities
- what they know about the opposition players' capabilities.



SOURCE 7 To perform a motor skill such as dribbling a basketball, an athlete must continuously perceive information from the environment (e.g. the speed, force, height and direction of the bounce) and act (e.g. apply more or less force, correct changes in direction) in order for the activity to continue.

Affordances

Affordances is the second concept central to the ecological model. Put simply, affordances are opportunities for action that present themselves in a performance environment. They are provided by the environment and the task, but the ability to take advantage of them depends on the ability of the learner to perceive and act. In short, an affordance is anything that 'affords' (i.e. provides or supplies) a player or team with an opportunity to act.

SOURCE 8 An affordance provides a player or team with an opportunity to act. An empty space on the opposing side of the net is an affordance that provides this tennis player with an opportunity to attack that area.

In real terms, this means that at any time during a physical performance, the environment and the task are providing information to the players that can be taken advantage of and acted upon. Some examples of affordances include:

- a tennis player's opponent approaching the net provides an opportunity to perform a lob shot
- a basketball player breaking free from their defence provides their teammate with an opportunity to pass to them
- a high cross in soccer provides an opportunity for the goalkeeper to run forward and catch the ball.

It is important to note that affordances are always there, regardless of the sport or the skill level of the athlete or team. Whether or not an athlete notices (i.e. perceives) an affordance and has the ability to act is another matter. Athletes are said to have high degrees of tactical awareness when they can detect multiple affordances in short amounts of time and take advantage of the best one to achieve their goal.

Let's continue with the soccer example from the section on perception–action coupling to explain this idea. Imagine that the player being passed the ball misses it and the ball sails into the space in front of another team member. The team member must now abandon his original idea and respond to the new affordances presented, for example:

- the goalkeeper running out of the goal box to chase the ball
- another teammate in an open position behind him.

The player acts to exploit the first affordance, determining that they will get to the ball before the goalkeeper and chip it over the goalkeeper's head into the goal.

A less tactically aware soccer player may have seen the goalkeeper come forward but not perceived the space behind him as an opportunity to exploit, resulting in a lost affordance. Repeated immersion in authentic performance environments increases the opportunities for learners to detect and act on affordances.

Attunement

Attunement is the third concept central to the ecological model. Attunement is closely related to affordances. It is the ability to evaluate all of the information in a performance environment and use it to identify all the available affordances. In the simplest terms, attunement is the ability to perceive affordances.

As with any skill, attunement can be acquired, developed and refined over time. In order to encourage the development of attunement, coaching and practice sessions need to be authentic or closely represent what is expected of learners during competition. This means that the tasks need to be designed to mimic the complexity of an activity and expose learners to the full range of information (i.e. affordances) they will be exposed to during authentic game play.

By comparison, practising skills or strategies in isolation does not expose athletes to the types of situations they will encounter during performance. For example, if a water polo goalkeeper practises making saves by repeatedly defending shots thrown by a centre forward positioned directly in front of goal, the opportunities they will have to practise attuning to affordances will be very limited. Compare this learning experience to one in which the same goalkeeper is able to practise attuning to the affordances provided when multiple players pass the ball around in front of the goal looking to break through the defence. In this case, the opportunities for learning are significantly improved.

Similarly, if a coach intervenes and explicitly directs the same goalkeeper to look for a specific type of affordance, this can actually have a negative effect on his development. This is because it can interfere with the goalkeeper's natural inclination to scan the environment more broadly looking for affordances and instead encourage him to focus on one specific area – meaning that other relevant affordances may be missed.

SOURCE 9 When players are exposed to the types of situations they will encounter in game play, they are given the opportunity to become better attuned to the available affordances.

PERFORMANCE

SKILL DRILL

2.3

Devise a personal tactical strategy

>> Turn to pages 328–329 to complete this integrated physical performance activity.

2.3 Check your learning

Engage and understand

1 **Identify** the two dynamic models of learning that form part of the dynamic systems approach. **Summarise** the key features of each in a paragraph of 150 words.

2 **Define** the terms 'constraint', 'self-organisation', 'perception–action coupling', 'affordances' and 'attunement'.

3 **Identify** the three types of constraints that are central to the dynamic systems approach. Provide one example for each type.

4 **Explain** why constraints should not be considered 'negative' or 'restrictive'.

Analyse and apply

5 **Reflect on** your selected physical activity and complete the table below by identifying three possible affordances and three corresponding specialised movement sequences that could be applied for each affordance. An example has been completed for you.

Possible affordance	Specialised movement sequence to take advantage of affordance
A middle blocker slow to move to block outside	Cross court spike through the gap
1	
2	
3	

6 **Apply** the concept of perception–action coupling to the physical activity you are currently studying by describing a situation in which you have perceived information and acted, and then perceived new information because of your action.

7 **Reflect on** the performance of an athlete you consider to be tactically aware and comment on their level of attunement. Give specific examples where possible.

Evaluate and justify

8 'Performing closed drills in isolation provides learners with the opportunity to develop key technical skills without the stress of game day.'
Discuss this statement in a written response of 250 words. In your answer, make specific reference to the following concepts to support your position:
- the cognitive systems approach
- the dynamic systems approach
- dynamic systems theory and the ecological model
- tactical awareness.

9 Alim is a beginner at the sport of futsal. During games, her teacher stands on the sideline and yells instructions at her. **Evaluate** the outcomes, implications and limitations of this approach, in terms of Alim's ability to develop tactical awareness.

10 **Justify** why developing the 'perfect technique' is not encouraged by advocates of the dynamic system approach. Use examples from your selected physical activity to support your answer.

Check your obook assess for the following additional resources and more:

» Student book questions
2.3 Check your learning

» Video
Dynamic systems theory

» Video
Ecological model (perception–action coupling, affordances and attunement)

» Student worksheet
The dynamic systems approach and dynamic models of learning

2.4 Introduction to a constraints-led approach to teaching and learning

That's a goal!

By the end of Section 2.4, you should be able to:

→ **describe** the constraints-led approach to teaching and learning
→ **define** the four principles of decision-making
→ **define** the four principles of play
→ **explain** how manipulation of task constraints can allow for the exploration of movement sequences and development of movement strategies.

Defining a constraints-led approach to teaching and learning

A constraints-led approach to teaching and learning is a teaching and coaching method based on the dynamic systems approach to motor learning and the dynamic models of learning that are part of it (i.e. dynamic systems theory and the ecological model).

As the name suggests, a constraints-led approach to teaching and learning is an approach that encourages learners to work within a range of constraints. It enables athletes to develop their own movement solutions (known as personal tactical strategies), rather than being explicitly told what to do by a coach. In this way, a constraints-led approach to teaching and learning encourages learners to participate in complex and authentic performance environments in order to teach new skills (as opposed to more traditional methods of teaching and coaching that have often used inauthentic environments and isolated drills to teach new skills).

The use of constraints-led activities promotes and enhances the acquisition of a whole range of skills, including tactical awareness.

Key principles of a constraints-led approach

There are two key principles that help to inform a constraints-led approach to teaching and learning and will help you understand and apply the constraints-led approach to a range of sports and physical activities. These include:

- **principles of decision-making** – a set of guidelines that can be used to help individual athletes or teams make the best and most appropriate decisions
- **principles of play** – a set of **movement strategies** that can be used to help individual athletes or teams adapt to any tactical situation in performance environments. Principles of play can also be used to help coaches and teams focus their objectives and evaluate their performance.

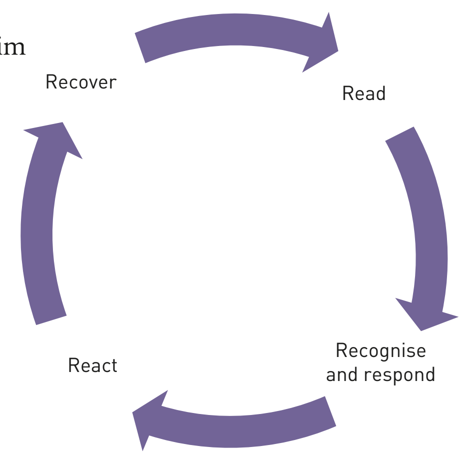
Principles of decision-making

Decision-making is a fundamental aspect of all sports and physical activities. The ability to make informed decisions in short periods of time – and act on them appropriately – is a skill that can mean the difference between success and failure. It is also the essence of what makes athletes more or less tactically aware.

In simple terms, decision-making is the process that the learner experiences in order to reach an outcome. It requires them to consider a range of information in their environment, weigh their options, decide on a course of action and carry it out. In a sporting context, decision-making is crucial because all sports and physical activities require athletes to choose:

- **what** specialised movement sequences and movement strategies they need to perform (also referred to as 'on-the-ball' skills)
- **when** they need to perform the specialised movement sequences and movement strategies
- **how** they should perform the specialised movement sequences and movement strategies
- **where** they should position themselves to support others (referred to as 'off-the-ball' skills).

In 2003, an associate professor of physical education by the name of Dr Tim Hopper developed the 4 R model (see Source 1). The model helps athletes make better decisions in performance environments, enhance their technical skills and improve their tactical awareness. The steps included in this model are known as the principles of decision-making.



SOURCE 1 The 4 R model of decision-making is continuous and allows individuals to read the game.

According to the principles of decision-making, when play begins an athlete should:

- **READ** the play, gathering relevant information to help inform their course of action
- **RECOGNISE** affordances and **RESPOND** by moving to the best position and selecting the best skill or movement sequence for the situation
- **REACT** to the finer details detected as the ball enters the player's area (e.g. force, spin, direction, speed) and make adjustments before executing the skill or movement sequence
- **RECOVER** with appropriate movements and set up for the **READ** phase again.

Unlike traditional cognitive approaches to decision-making – which proposed a linear and hierarchical approach that was controlled by the brain – the principles of decision-making supports a more dynamic, non-linear view. While the principles can be used as a guide, they do not prescribe a particular course of action or response in any given situation. During all phases, movements emerge dynamically in response to the information perceived in relation to the task, the environment and the learner. The better attuned an athlete is to themselves and their surroundings, the better they can become at making decisions and being tactically aware.

Having a clear understanding of the principles of decision-making will help the coach to provide a more detailed analysis and description of how effectively affordances are perceived and acted on in authentic performance environments. In other words, they can use a more forensic process to focus on exactly where the learner's decision-making strengths and weaknesses lie. Some reflections from the application of decision-making principles might include:

- ‘I need to focus on recovering as video analysis shows that I am not ready to read the next phase of play.’
- ‘I can read play and decide where to position myself, but my recognition and response to cues is weak as I rely on waiting to hear an instruction from the coach or my teammates about where to move to.’
- ‘I am getting better at reacting to the finer details once the ball enters my side of the court. For example, I am detecting the type of spin placed on the ball and adjusting my stance before executing an appropriate specialised movement sequence.’

Principles of play

Principles of play are a set of fundamental movement strategies that can be used to help individual athletes or teams adapt to any tactical situation during a game. Principles of play can also be used by coaches and/or teams to help them focus their objectives and evaluate their performance. The principles of play include:

- **setting up an attack –** a movement strategy designed to **maximise a team’s opportunity to score** (e.g. to gain possession of the ball, to break through defence, to control the ball, to force opposition to make an error)
- **defending against an attack –** a movement strategy designed to **limit an opposing team’s opportunity to score** (e.g. to deny space or apply pressure to regain possession, to delay their attack, to limit options for passing, to push an opponent out of position)
- **creating, defending and exploiting space –** a movement strategy designed to **open or deny space in response to a specific goal** (e.g. to move an opponent to the court extremities, to use the full width of a field)
- **attacking opposition space and scoring –** a movement strategy designed to **take advantage of scoring opportunities** (e.g. using a kill or ‘smash’ shot, drawing defenders away from scoring areas to attack).

How a constraints-led approach can support the development of tactical awareness

As athletes, we know that when we enter an authentic performance environment, we are faced with a wide range of challenges and opportunities that we cannot always predict or prepare for. The fundamental idea behind the constraints-led approach is to expose learners to teaching and learning experiences that closely resemble these environments – and by manipulating different constraints, encourage and support learners to develop individual movement solutions (i.e. personal tactical strategies) that work for them.

This process of allowing the learner to practise in the unpredictability of an environment that closely represents true game play, is sometimes referred to as ‘repetition without repetition’. In other words, without instructing a learner to produce repetitive movements in a controlled environment one after the other, constraints are used to create a representative (modified) environment and allow repetition with unpredictable responses. Once the coach has set the necessary constraints based on their view of the learner’s needs, they can allow the learner autonomy to develop movement strategies themselves. This repetition without repetition better prepares the learner for the dynamic requirements of the game.

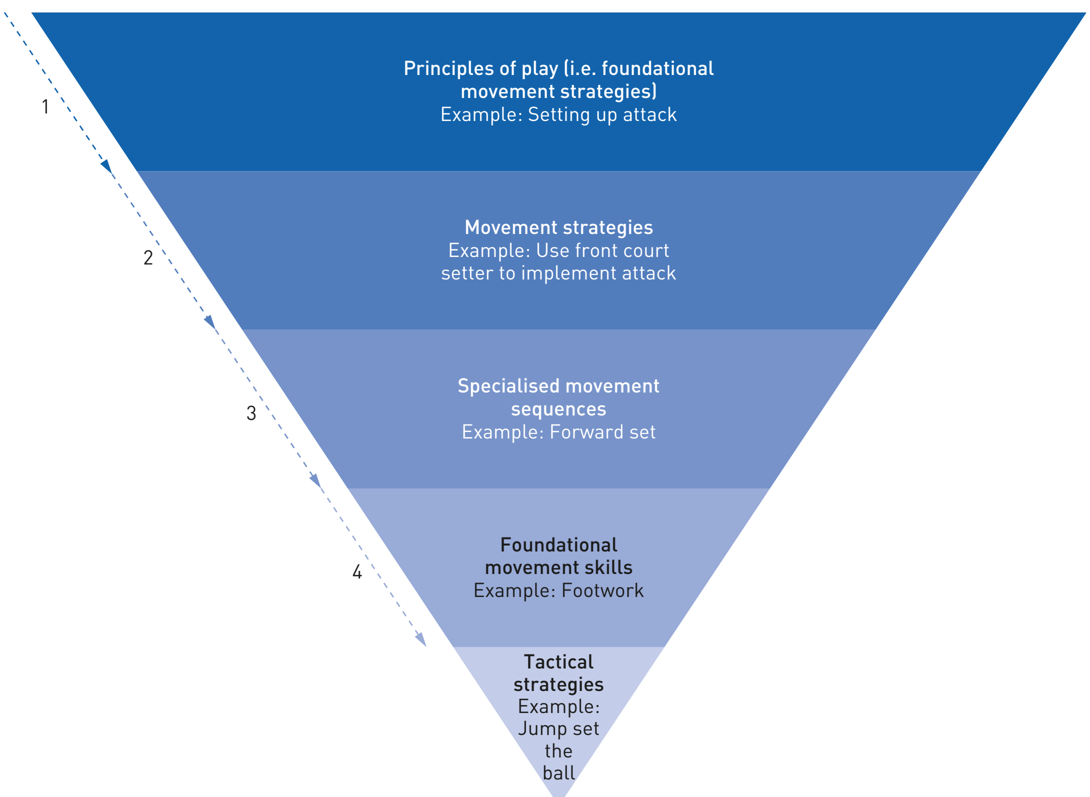
Traditional models of learning recommended that athletes practise techniques for skills until they were refined and 'perfected', often in isolation and away from authentic game environments. The constraints-led approach to learning is different because it proposes that humans learn dynamically, and it is based on the assumption that if learners are presented with learning activities that carefully manipulate constraints, they can develop their own specialised movement sequences and tactical strategies that will assist them to successfully optimise their performance.

STUDY TIP

In Unit 3 you will be required to devise a range of personal tactical strategies to optimise your performance. Personal tactical strategies are movement solutions that emerge to optimise your performance through the implementation of a constraints-led approach. You will be required to explore, evaluate and justify one of these personal tactical strategies in Summative internal assessment 1: Project – folio. Detailed support for this assessment is provided in Section 2.6.

When conducting an analysis of your personal tactical strategy, you will be required to refer to the specific area of your game it relates to. You will need to understand which principle of play, movement strategies and specialised movement sequences your tactical strategy has emerged from.

Source 2 shows the relationship between these factors, using volleyball as an example. You can see that, for the principle of play – setting up attack – a player could implement the movement strategy of using a front court setter. To complete this movement strategy, the setter uses the 'forward set' specialised movement sequence, which requires some fundamental movement skills such as footwork to complete. In response to the task, learner and environmental constraints, the player might jump set the ball. The jump set is an example of a personal tactical strategy for that player.



SOURCE 2 When analysing the emergence of a tactical strategy in volleyball, four factors must be considered.

STUDY TIP

It is important to note that constraints-led activities are not the same as modified games. Coaches use modified games that change parameters (e.g. player numbers, field size, equipment) to allow students to practise skills in environments that are more representative of competition. A constraints-led activity differs from a modified game because the manipulation of constraints has a specific purpose and is related to a clearly identified and communicated problem.

Features of a constraints-led approach to teaching and learning

Activities designed through the constraints-led approach to teaching and learning have a number of key features. Constraints-led activities:

- are learner-centred (i.e. designed in consultation with the learner and taking their wants and needs into account)
- do not have a goal of producing textbook, or ideal, technique or movement patterns; instead, they encourage self-organisation in each learner (i.e. there are multiple ways in which to achieve the same outcome or goal and 'ideal' is whatever works in the moment)
- are representative of authentic performance environments. They can be simplified versions of authentic game play (i.e. shorter playing periods, fewer players, different rules, etc.), and they should not require learners to practise technical skills in isolation or in a 'deconstructed' manner (i.e. practising a specific motor skill from a broader specialised movement sequence)
- use constraint manipulation to encourage learners to hone in on identified problem areas in performance. Task constraints can be manipulated in many different ways to allow movement solutions to emerge that are individual to the learner. Following observation, constraint manipulation will sometimes need to be refined to direct learners to modify technique and/or detect alternative affordances
- use repetition without repetition. Learners are put in authentic environments and asked to achieve the same goal each time. With a dynamic performance environment, learners are forced to search for movement solutions that consider a wide variety of unpredictable variables. This replicates what they are required to do in their matches.

Source 3 compares the key features of a more traditional (i.e. cognitive) approach to teaching and learning with a more contemporary (i.e. constraints-led) approach in order to demonstrate how they differ.

Cognitive approach to teaching and learning	Constraints-led approach to teaching and learning
• Practice is mostly performed in inauthentic performance environments (i.e. drills) • Drills are designed and presented as the solution (i.e. the 'correct' course of action) • The coach finds solutions to problems • The coach takes a hands-on approach, directing the learner and proposing solutions to their problems	• Practice is mostly performed in authentic performance environments • Activities use thoughtful constraints manipulation to amplify opportunities for learners to identify movement solutions • Learners find their own movement solutions (through self-organisation and attunement) • The coach assumes a supportive role as facilitator, providing measured feedback with enough information for learning (without prescribing a right way versus a wrong way)

SOURCE 3 One way to understand the constraints-led approach to learning is to compare it to a more traditional approach to teaching and coaching.

The role of the coach in the constraints-led approach

While the constraints-led approach encourages learners to discover their own movement solutions, the coach plays a crucial role in supporting the skill and tactical development of these learners. The coach's role includes:

- identifying technical and tactical problems in athletes
- considering learner constraints, manipulating task constraints and interacting with environmental constraints to amplify movement solutions for the problem area
- communicating the problem and purpose of the activity without telling learners the solution to the problem (e.g. identifying that an opponent is comfortably retrieving most of the learner's shots from the middle of the court so suggesting an activity to allow them to explore options for moving their opponent around)
- providing measured feedback that offers enough information to empower the learner to work towards their own movement solution.

Source 4 helps us to get a clearer sense of how the role of the coach varies between cognitive-based approaches to teaching and learning, and the constraints-led approach.

	Cognitive approach to teaching and learning	Constraints-led approach to teaching and learning
Problem	• The coach (or learner) identifies a problem or a need (e.g. their touch team's attack is too slow; they are passing the ball too far behind the line, meaning that they can't gain field position).	• The coach (or learner) identifies a problem or a need (e.g. their touch team's attack is too slow; they are passing the ball too far behind the line, meaning that they can't gain field position).
Typical responses of coach	• The coach explains what it is they should be doing (i.e. the movement solution). • The coach designs a drill to fix the problem (e.g. players are given a skill or tactical drill to practise the solution to the problem; usually in isolation in an inauthentic environment). • The coach describes the drill to learners (e.g. 'I want you to line up along the halfway line. I am going to give a ball to the winger who is going to pass it down the line as you all run towards the try line. The aim is to keep passes as flat as possible and complete the drill at speed.'). • Throughout the drill process, the coach supports learners to implement the drill and gives technical advice and feedback when an error is identified. • The coach modifies the drill, if required (e.g. if it is too easy or too hard).	• The coach communicates the problem and purpose to one or more players (e.g. 'We aren't gaining much field position in our rucking so we are going to do an activity that allows you to find ways to increase your speed moving forward.'). • The coach designs a constraints-led activity in consultation with players by manipulating task constraints (e.g. a 4v2 game on a smaller field with the additional constraint that when players make their passes, they must only look straight ahead, relying on their peripheral vision). • The coach explains the task (including the constraints) to the learners, clearly communicating the goal and why this goal is relevant and important to their success (without suggesting a solution). • Throughout the process, the coach supports players by offering feedback and encouragement, and by observing their progress towards meeting the goal. • The coach modifies the activity to suit a learner's progress.

SOURCE 4 The approach to teaching and learning has a direct impact on the role that the coach plays.

The In the news below provides an example of how the emergence of a movement solution was encouraged through a non-traditional, constraints-led approach to coaching. It shows how Steve Smith was able to work with (and enhance) his natural 'flow' to come up with a personal tactical strategy that worked for him, with incredible success.

In the news

Just like the Don: Why Steve Smith's batting method is masterful

JAMES BUCKLEY, THE SYDNEY MORNING HERALD, 1 DECEMBER 2017

Steve Smith is the closest thing to Sir Donald Bradman we have ever seen.

Smith's superb innings last week, which produced a 21st Test century and boosted his average to 61.23, prompted ex-first class cricketer-turned-journalist Simon Hughes to vocalise the comparison with Bradman on his podcast The Analyst.

"I looked at his method and there is this thing called the rotation method, which he's famous for – it gave him flow. By taking the bat out to third slip or gully and then bringing it round in a semi-circle, it gave the whole body a kind of rhythm that he then brought into the stroke.

"It's uncanny the resemblance. Somebody wrote once that Smith's bat flaps around like a palm tree in a gale and in the bat lift it does waft around a bit more than Bradman's did, but when it comes down, it's exactly the same."

The beauty of Smith's batting is in its intrinsic and natural technique.

So many young batsmen are taught to take the bat back towards the wicketkeeper, keep the elbow high and then play through the line of the ball.

But Smith was never coached like that. He was always allowed to pursue his natural bat lift, and from there his game prospered.

And it's getting better with age. On home soil over the past three years he boasts an astronomical batting average of 93.5.

"Steve always had it, it was always there and I reckon it's become more obvious and more ingrained as his natural style because he scores runs," Smith's former batting coach Trent Woodhill said.

"He literally does not care how he looks, it's all about the contest each ball and that's what separates him from the others. Steven enjoys batting, each ball is a gift whereas for others, the result is a gift or the score is a gift.

"He wouldn't then look at Bradman and see what he can mirror with his technique, he'd look at Bradman and see what he can mirror with his performance, or once again his commitment to each ball."

Often it's the sportsmen who don't mirror the traditional teachings who enjoy the most success.

SOURCE 5 Steve Smith in action

SOURCE 6 Teaching and learning activities that have been designed in accordance with a constraints-led approach replicate more complex and authentic game environments. Which of the following learning activities do you think better reflects a constraints-led approach?

PERFORMANCE | SKILL DRILL **2.4**

Evaluate the effectiveness of decision-making in authentic game settings

>> Turn to pages 330–331 to complete this integrated physical performance activity.

2.4 Check your learning

Engage and understand

1 **Define** a constraints-led approach to teaching and learning.

2 **Describe** the type of communication a coach might provide to athletes when implementing a constraints-led activity. Provide an example.

Analyse and apply

3 In a written response of 150–200 words, **compare** and **contrast** the traditional cognitive approach to teaching and learning with the constraints-led approach to teaching and learning.

4 Refer to the In the news 'Just like the Don' on page 70 and **analyse** the following quote: 'The beauty of Smith's batting is in its intrinsic and natural technique.' **Apply** your knowledge to argue why this statement suggests Smith's batting aligns with the intentions of the dynamic systems approach.

Evaluate and justify

5 When a badminton player performs massed practice of the badminton smash in a closed environment, she can consistently execute the shot with power and precision. However, whenever she plays in an authentic performance environment, she struggles to achieve the same result. Use your knowledge of the dynamic systems approach and the constraints-led approach to learning to **propose** an explanation for the player's performance. Present your response in 150–200 words.

Check your obook assess for the following additional resources and more:

» Student book questions
2.4 Check your learning

» Video
How a constraints-led approach can support the development of tactical awareness

» Student worksheet
Introduction to a constraints-led approach to teaching and learning

2.5 Planning, designing and implementing a constraints-led approach

That's a goal!

By the end of Section 2.5, you should be able to:

→ **identify** and **explain** how a constraints-led approach to teaching and learning can be implemented for a selected 'Invasion' or 'Net and court' physical activity by:
  - manipulating task constraints (e.g. modifying a rule)
  - considering learner constraints (e.g. considering the learner's level of fitness)
  - interacting with environmental constraints (e.g. changing the learner's training environment)

→ **explain** the importance of body and movement concepts when making judgements about on-the-ball and off-the-ball movements and decision-making in authentic performance environments.

How to plan a constraints-led approach

body and movement concepts
a group of four concepts used to guide the development and judge the effectiveness of specialised movement sequences and movement strategies in different sports and physical activities

A constraints-led approach to teaching and learning provides a framework to help coaches and athletes (i.e. learners) design training activities that promote and enhance the acquisition of skills.

Implementing a constraints-led approach to teaching and learning in any sport or physical activity can be a new and challenging experience and one that will take time to master. The process requires coaches and learners to experiment with new techniques that may not always have the immediate desired outcome, and will involve some trial and error over an extended period of time.

To successfully plan and implement a constraints-led activity, coaches must:

- understand the needs of the learner
- apply the **body and movement concepts**
- apply the principles of decision-making.

We will now look at these factors in more detail.

STUDY TIP

The QCAA syllabus provides a thorough breakdown of the foundational movement skills, specialised movement sequences, movement strategies and principles of play for every physical activity available for study.

Understand the needs of the learner

To plan a constraints-led approach to teaching and learning, the coach must understand the learner's physical performance and ability to perceive and act. A strong knowledge of the objectives, rules, movement strategies, specialised movement sequences, and principles of play (discussed in Section 2.4) underpinning the learner's selected physical activity is therefore essential. To understand the needs of the learner, a coach must gather performance data using a GPAI or DCI. The data gathered needs to specifically identify the learner's ability to:

- execute specialised movement sequences for movement strategies with accuracy, fluency, speed, etc.
- tune in to affordances (i.e. attunement).

Performance data must then be analysed to further understand the learner's needs in skill execution and/or decision-making. It is also necessary to analyse the area of game play that relates to the learner's needs. For example, does the learner struggle to perform specific specialised movement sequences and make effective decisions throughout their entire performance, or does it mainly occur when they are in defence? Having a clear understanding of the learner's needs will help the coach to plan relevant and appropriate constraints-led activities.

Apply the body and movement concepts

To plan a constraints-led approach to teaching and learning, the coach must apply body and movement concepts to help support the learner's needs, and facilitate the teaching and learning of specialised movement sequences and movement strategies.

Body and movement concepts include a number of approaches that can help learners to become more aware of their bodies and adapt their movements to address specific needs and goals.

The theory was developed in the early 1900s by a Hungarian dance artist and theorist by the name of Rudolf Laban. Laban proposed that there are four body and movement concepts:

- **body awareness** – the sense (or consciousness) we have of our own body when performing a skill
- **space awareness** – the relationship between the body and its surroundings (i.e. the space around it)
- **quality of movement** – the characteristics (i.e. qualities) of a movement (e.g. speed, effort, force, accuracy, level of effort)
- **relationships** – the objects (i.e. the people and equipment) that an athlete interacts with during the performance of the skill.

Having a clear understanding of body and movement concepts will help the coach to make judgments about the effectiveness of the learner's performance. Each concept is broken down into more detailed subparts, so this can direct the coach to identify very specific aspects for improvement. See Section 2.7 of *Physical Education for Queensland Units 1 & 2* for further information about body and movement concepts.

Apply the principles of decision-making

To plan a constraints-led approach to teaching and learning, the coach must apply the principles of decision-making. The **principles of decision-making** (discussed in Section 2.4) break down the process of perceiving and acting (i.e. perception–action coupling, discussed in Section 2.3) into four 'concrete' stages. The coach can use these stages to make more informed judgments about where problems in the learner's decision-making processes lie (e.g. attunement).

SOURCE 1 Body and movement concepts were first developed by Hungarian dance artist and theorist Rudolf Laban.

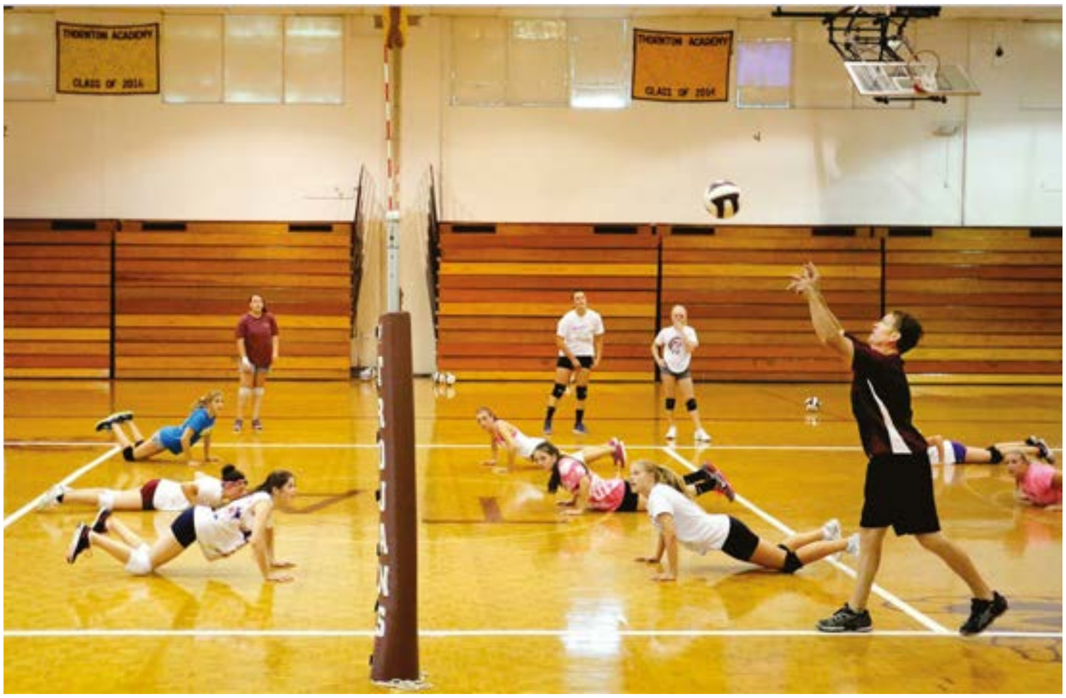
body awareness
a body and movement concept; body awareness relates to the sense (or consciousness) we have of our own body when performing a skill

space awareness
a body and movement concept; space awareness relates to the relationship between the body and its surroundings (i.e. the space around it)

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.)

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

principles of decision-making
a set of guidelines (i.e. cognitive processes) that can be used to help individual athletes or teams make the best and most appropriate decisions in performance environments



SOURCE 2 A constraints-led approach requires the full commitment of learners, coaches and teachers to embrace more autonomous, learner-centred activities rather than falling back on the standard drills like the one shown here.

How to design and implement a constraints-led approach

Once a coach has clear understanding of the learner's needs – and how body and movement concepts and the principles and decision-making apply to these needs – the process of designing and implementing a constraints-led activity can begin.

It is important for constraints-led activities to be tailored to the needs of different learners. This takes time and effort, as well as a high degree of skill. In order to be successful, every constraints-led teaching and learning activity needs to have a clear, established and well-communicated purpose.

When designing and implementing a constraints-led approach for any sport or physical activity, it is important to carry out and complete the process using a number of steps. Following these steps provides the best chance of achieving a successful outcome. The steps for designing and implementing a constraints-led approach include:

Designing	Step 1 – Select the technical and/or tactical problem to address
	Step 2 – Design the constraints-led activity
Implementing	Step 3 – Implement the constraints-led activity
	Step 4 – Review and revise

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

Step 1 – Select the technical and/or tactical problem to address

All athletes have areas of their performance that can be improved. As previously discussed, sometimes these problem areas are technical (i.e. technique-related) and sometimes they are tactical (i.e. affordance-related). Furthermore, the problem area could be related to 'on-the-ball' or 'off-the-ball' movements or decision-making.

In offensive plays, movement can take place:

- '**on-the-ball**' – when players move with the ball and execute responses such as passing, controlling the ball, evading and scoring
- '**off-the-ball**' – when players position themselves to receive passes, create space or threaten the goal or line.

In defensive plays, movement may occur:

- '**off-the-ball**' – when players apply pressure to the ball carrier and execute responses such as clearing or blocking the ball or passage of play, or making body contact
- '**off-the-ball**' – when players move to mark or guard their opponents, restrict space for opponents to run into, or intercept the ball.

The coach must use the data gathered in planning the constraints-led activity to select the technical and/or tactical problem to address. It is important to be clear about why the problem is occurring. For example, a netball goal shooter may be struggling to score goals. The reason for her problem may be her lack of concentration and ability to be easily distracted by opponents. This is an example of a technical problem (see Source 3 – left).

Another netball goal shooter may be struggling to take possession of the ball. The reason for the problem may be that the ball is intercepted by the defender. This is an example of a tactical problem (see Source 3 – right).

STUDY TIP

Additional technical and tactical information specific to each 'Invasion' and 'Net and court' physical activity is available in Section 6 of Physical Education General Senior Syllabus. This includes a thorough breakdown of:

- specialised movement sequences
- the foundational movement skills
- movement strategies from principles of play
- body and movement concepts.

SOURCE 3 Athletes' problem areas can be technical (i.e. technique-related) or tactical (i.e. affordance-related).

Step 2 – Design the constraints-led activity

When designing the constraints-led activity, the coach must think about what the optimal technical or tactical performance might look like. The coach then decides how they could manipulate task or environmental constraints to address the selected technical and/or tactical problem (i.e. the coach highlights the affordances they want the learner to become attuned to).

For example, the movement solution the coach would like to see in the netball shooter is for her to move into space to receive the pass. A possible constraint manipulation is to play a half-court game with a rule change that prevents the attacking players being allowed to receive a pass when they are behind their respective defender (i.e. breaking this rule would result in a turnover).

	Physical activity	Identified technical or strategic problem	Type of task constraint	Example manipulation
'Invasion' physical activities	Australian football	• Can only handball or kick from one side (left or right)	• Rules	• Players must not use their dominant side to pass the ball.
	Basketball	• Beginner player is unable to see open teammates when dribbling	• Rules	• Impose a vision occlusion (e.g. the athlete may not look at the ball when they are dribbling).
	Futsal	• Players take too long to execute a pass	• Rules	• During a reduced court size possession game, players can have no more than two consecutive quick touches of the ball. (As players improve, reduce to one touch and/or manipulate number of players.)
	Netball	• Low conversion of scoring shots	• Rules	• To score a goal, the GA or GS must press the ball against the goal post.
	Soccer	• Players take shots too early and from too far away from goal	• Scoring methods	Players receive: • 5 points for a header • 3 points for a goal within the 6 yard box • 2 points for a goal scored from within the 18 yard box • 1 point for any other goals.
	Touch football	• Players can't break through defence because they are not drawing the defence before making the pass	• Number of players • Field size	• Play 2v1: 2 attackers, 1 defender in a 10 m square grid. Attackers must get the ball over the line without getting touched. Note: Reducing the width of the field size will further amplify the need to draw out the defender before making the pass.
	Water polo	• Shots at goal are easily read by the goalkeeper	• Rules	• When successfully scoring from an outside water shot, players score a bonus point if they can immobilise or misdirect the goalkeeper before releasing the ball.
'Net and court' physical activities	Badminton	• Players make their shot selection obvious	• Rules	• The court is divided into 6 zones and the coach calls out which zone to hit the shuttlecock to. As the players improve, the call can be delayed.
	Volleyball	• Players use the same attacking options every time	• Designated spaces and boundaries	• The court is divided into specific segments. The team cannot make consecutive shots into the same zone on the opponent's court.
	Tennis	• Player 'air swings' (i.e. they are unable to make contact with the ball)	• Equipment	• Change the ball from an official match ball to a larger, less bouncy training ball.

SOURCE 4 Examples of task constraints that can be manipulated in different physical activities to promote the emergence of a particular movement solution

Step 3 – Implement the constraints-led activity

Once the coach has planned and designed the constraints-led activity, he or she is ready to implement it. The coach needs to ensure that the learner knows why they are participating in the activity (i.e. understand the problem the coach has identified and why it is a problem).

It is important that the goal or reason for the task is made clear to the learner, but that the movement solutions are not provided. It is far more valuable for learners to have the solution emerge through their own experiences with the task.

For example, a soccer coach has identified that the ball keeps getting intercepted because a number of players are losing possession of the ball due to a lack of control (i.e. their first touch is poor). This is preventing the player from passing to a teammate, so the coach is going to implement an activity to help the learner explore options to be available to receive a pass.

Source 6 provides an example of a constraints-led activity designed for a group of beginner soccer players. The activity features a high degree of task manipulations in order to focus on the problem area identified.

SOURCE 5 A soccer coach has identified that the ball keeps getting intercepted because certain players on his team are inexperienced and keep losing possession of the ball due to a lack of control. To address this, the coach may design a constraints-led activity to address this technical problem.

<table>
<tr><th colspan="4">Physical activity: Soccer</th></tr>
<tr><th colspan="3">Planning for constraints-led activity</th><th>Implementation</th></tr>
<tr><th>Identified technical or strategic problem</th><th>Task constraints to be manipulated</th><th>Communication of problem and purpose</th><th>The task (including set up and manipulation details)</th></tr>
<tr><td>The ball carrier loses possession of the ball due to a lack of control (i.e. their first touch is poor).</td><td>• Number of players
• Field size
• Scoring method
• Rules</td><td>'I have noticed that you (the ball carrier) are frequently losing possession of the ball due to a lack of ball control on your first touch, so we are going to do this activity to allow you to look for ways to improve your first touch.'</td><td>Set up and equipment:
• 20 m x 20 m field marked with cones
• 3 m goals marked with cones
Constraint manipulations:
• 3v3 player game
• Five consecutive passes must be made before a shot is made on goal.
• If you use more than two touches your team loses possession of the ball.</td></tr>
</table>

SOURCE 6 Example of a learning activity with a high degree of task manipulation, designed for beginner soccer players

Source 7 on the next page provides an example of a constraints-led learning activity designed for a group of proficient soccer players. The activity features a low degree of task manipulation in order to focus on the development of a broader range of skills (e.g. a game with one manipulation). You will notice that the problem and purpose is still communicated to the players.

Physical activity: Soccer			
Planning for constraints-led activity			Implementation
Identified technical or strategic problem	Task constraints to be manipulated	Communication of problem and purpose	The task (including set up and manipulation details)
The players are crowded in the middle of the field during play.	• Designated playing space	'I have noticed that we are crowding the middle of the field when bringing the ball up, so we are going to do this activity to help you find alternative pathways for bringing the ball up the field.'	**Set up and equipment:** • Normal soccer set up **Constraint manipulations:** • Normal rules will be applied, with one exception – the ball may not enter the centre circle when crossing the halfway line.

SOURCE 7 Example of a learning activity with a low degree of task manipulation, designed for proficient soccer players

STUDY TIP

Remember to journal every activity you do in this Unit. Make careful notes about the ways in which the task constraints were manipulated. You will need to couple this information with a performance evaluation using the body and movement concepts to determine what movement solutions emerged and whether the performance technically improved. GPAIs and DCIs can be found in your obook assess to support you with the gathering of this data.

Step 4 – Review and revise

During the constraints-led activity, the role of the coach is to determine if progress and improvements are being made. If the movement solutions (i.e. personal tactical strategies) that emerged were not effective, it may be necessary to provide more specific feedback.

However, by encouraging learners to find solutions on their own, there is a greater chance that they will continue developing these solutions during game play, especially when they are prevented from stopping play to seek intervention and instructions from the coach.

For example, rather than telling the learner they need to be on their toes using pitter-patter steps to move more quickly and get into position earlier, the feedback given by the coach should specify that by the time the learner has reacted to the affordance, the opportunity has been missed. Hereby, the coach has not told the learner what the movement solution should be but the learner has been given some information that they can use to search for a movement solution that will help them solve the problem.

If there is no noticeable progress or improvement, the task may need to be modified or replaced. This may mean changing task constraints, adding additional task constraints or releasing previously imposed constraints.

For example, the coach might add a constraint that no attacking player is permitted to be standing still at any given time to have them explore being on their toes and developing their own pitter-patter movement solution.

2.5 Check your learning

Engage and understand

1 **Explain** why the body and movement concepts and principles of decision-making should be used by an athlete or coach to evaluate the effectiveness of the performance before they plan and implement a constraints-led activity.

2 **Identify** the four steps for designing and implementing a constraints-led approach.

3 **List** four possible task constraint manipulations.

4 **Explain** what a coach implementing a constraints-led activity should do if the activity is not resulting in an athlete's improvement or progress.

Analyse and apply

5 **Identify** the issue with the following communication of problem and purpose for touch football: 'Your goal for completing this activity is to take a side-step to evade the oncoming defender when they are 1 m away from you.'

6 The table below shows segments from a deconstructed constraints-led activity in volleyball. **Analyse** the information in each box and use your knowledge of constraints-led activities to assign the following codes to each one:

IP	Identified problem (technical or strategic)
TC	Task constraints to be manipulated
PP	Communication of problem and purpose
T	Task

Spikes are being easily retrieved by the opposition as they are too predictable. This activity aims to put variation into the shot repertoire.
Set up and equipment: • Use witches hats to make a 2x2 m exclusion zone in position 5 of the volleyball court Constraint manipulation details:
• Normal rules will be applied, with one exception – the ball may not be hit into the exclusion zone Outside hitters always spike to position 5 on the volleyball court (which is the back right corner as the hitter sees it).
Designated attacking space

Evaluate and justify

7 One of the most common issues with the design of a constraints-led activity is that the manipulated task constraints do not amplify the identified problem. For example, a winger in touch football might never get a chance to address their problem of poor passing because the ball never gets to them. **Reflect on** this issue.

8 After identifying that her basketball shooting is a problem area, Gisele participates in several constraints-led activities that focus on the principle of play 'attacking opposition basket and scoring'. An analysis of GPAI data reveals that she only scores when performing a lay-up. All other shot attempts are ineffective.

a **Identify** possible task, learner and environmental constraints that could be impacting Gisele's performance.

b Use the table below to **design** a constraints-led activity for Gisele. In 150 words, **justify** how this activity will lead her to find a movement solution to overcome her inability to shoot when not performing a lay-up.

Physical activity: Basketball			
Planning			Implementation
Identified technical or strategic problem	Task constraints to be manipulated	Communication of problem and purpose	The task
			• Set up and equipment: • Constraint manipulations:

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Check your obook assess for the following additional resources and more:

» Student book questions
2.5 Check your learning

» Video
Designing a constraints-led activity

» Student worksheet
Implementing a constraints-led approach

» GPAIs and DCIs templates
A selection of handy GPAI and DCI templates

2.6 Assessment support – Summative internal assessment 1: Project – folio

That's a goal!

By the end of Section 2.6, you should be able to:

→ **devise** a tactical strategy
→ **evaluate** and **justify** a personal tactical strategy
→ **understand** how to record, evaluate and justify your personal performance
→ **create** a video of supporting evidence of your personal performance.

Overview of summative internal assessment 1: Project – folio

As part of your assessment for Unit 3 of the QCE Physical Education syllabus, you will be required to complete a Project – folio. The Project – folio is a complex task with many different parts.

This section of the chapter is designed to support you as you complete your own Project – folio. 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 Project – folio is made up of two sections. We will work through these sections now in order to model one possible approach for completing the task. Model one possible approach for completing the task.

- **Section 1 – Folio**
  - Devise, evaluate and justify your personal tactical strategy
  - Evaluate and justify the effectiveness of your personal performance using body and movement concepts.
- **Section 2 – Supporting evidence**
  - A video comprised of highlights of your physical performance. This component is independent of your folio (i.e. it provides additional, separate information).

Each of these parts of the task will be assessed and marked against the assessment objectives contained in the instrument-specific marking guide (ISMG). This means that all parts of the task must be completed in order to maximise your chances of success.

Section 1 – Folio

Section 1 of this task requires you to prepare and present a multimodal presentation. Examples of multimodal presentations include:

- a pre-recorded presentation submitted electronically
- 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.

Detailed information on how to structure, create and present your Project – folio is provided on pages 10–15 of Chapter 1 – Physical Education Toolkit as well as on the accompanying video tutorial (available on your obook assess). In addition to this, Skill drill 1.2A Planning, creating and presenting a Project – folio (available on your obook assess) provides a number of useful tips and instructions to help you.

Devise, evaluate and justify your personal tactical strategy

First, you are required to devise, evaluate and justify a personal tactical strategy for your position in your selected physical activity.

This is the largest and most significant part of the Project – folio. It requires you to apply the dynamic systems approach to the topic of tactical awareness. In other words, you will need to demonstrate your understanding of the following concepts:

- dynamic systems theory
- the ecological model
- a constraints-led approach to motor learning.

Devise your personal tactical strategy

Devising your personal tactical strategy requires considerable planning. As you have learnt in this chapter, it is possible for individuals to sit down with a pen and paper ahead of time to plan and devise strategies for specific performance situations; however, this method follows a cognitive systems approach to motor learning and could have an impact on your potential to develop a tactical strategy that best suits you as a learner in relation to the task and environmental constraints you are presented with.

Following a dynamic systems approach – and applying a constraints-led approach to teaching and learning – allows tactical strategies to emerge dynamically through self-organisation.

Source 1 outlines the steps you need to work through in order to devise your personal tactical strategy. The time needed to work through these steps may vary from a couple of lessons to several weeks. We will now explore each of these steps in more detail.

STEP 1	Identify an area for improvement (i.e. a problem) for one movement strategy for your position in your selected physical activity.
STEP 2	Participate in constraints-led activities
STEP 3	Gather data from your constraints-led activities and analyse changes in the specialised movement sequences of your selected movement strategy.
STEP 4	Describe the personal tactical strategy that has emerged.

SOURCE 1 The steps required to devise a personal tactical strategy

STUDY TIP

Detailed information on gathering data for the Project – folio is provided on pages 10–15 of Chapter 1.

This information includes links to a range of different Skill drills and printable templates that will help you gather and record data via:

- a personal journal
- GPAIs
- video recordings.

Be sure to read this information and download the relevant templates before you work through the rest of the information provided in this section.

Step 1 – Identify an area for improvement (i.e. performance problem) for one movement strategy for your position in your selected physical activity

The first step in devising your personal tactical strategy is to identify problems in your performance for which movement solutions need to be found. In your Project – folio, you need to identify problems presented during your performance of specialised movement sequences for one movement strategy.

The GPAI in Source 2 is a useful tool for helping you to identify problem areas specific to the performance of your position within your selected physical activity. Once you have established the areas in which you need improvement, you can choose a single problem area around which to construct constraints-led activities.

Part 1: Performance of specialised movement sequence

COMMON SPECIALISED MOVEMENT SEQUENCES		LEVEL OF EFFECTIVENESS		DECISION-MAKING	
		EFFECTIVE	INEFFECTIVE	APPROPRIATE	INAPPROPRIATE
Dribbling	Under pressure				
	No pressure				
Passing	Under pressure				
	No pressure				
Catching	Under pressure				
	No pressure				
Shooting	Under pressure				
	No pressure				

Part 2: Quality of 'on-the-ball' and 'off-the-ball' movements

	TOTAL TIMES THIS OCCURS	DOES THIS MOVEMENT CREATE AN OPPORTUNITY (FOR SELF OR OTHERS)?	
On-the-ball positioning		Yes	
		No	
Off-the-ball positioning		Yes	
		No	

Part 3: Reflective journal

INTERNAL FEEDBACK (WHAT YOU FELT AND NOTICED ABOUT YOUR OWN PERFORMANCE)	EXTERNAL FEEDBACK (WHAT YOUR TEACHER TOLD YOU, WHAT YOU NOTICED FROM WATCHING VIDEO RECORDING ETC.)

Note: Part 1 is designed to be used once or twice, early on in the unit. Parts 2 and 3 are designed to be used repeatedly over the course of the unit (during and after each constraints-led activity or competition) until you have determined which personal tactical strategy has emerged.

SOURCE 2 Performance analysis GPAI (designed to identify a performance problem)

Example

Sarah is a Year 12 PE student who has selected water polo as her physical activity in Unit 3. Sarah is a goalkeeper on her team. She has identified the following area for improvement (i.e. the problem):

'I opt for short passes out of the goal box because I struggle to make the long passes needed. This results in the ball taking too long to move into the attacking zone. This limits the time my teammates have to take effective shots at goal within the 30 second time limit (i.e. a rule of the game).'

FOR THE RECORD

While the basic functions of the goalkeeper in water polo have not changed much in the past 100 years, there have been changes affecting performance technique. In the 1940s, Hungary introduced the eggbeater kick, which is a technique that allows goalies to maintain a stable balance in the water.

Step 2 – Participate in constraints-led activities

Once you have identified an area for improvement (i.e. the problem), it is necessary to participate in a range of constraints-led activities designed to target your problem area. Constraints-led activities can be designed to encourage the emergence of possible movement solutions that will address the problem.

Participating in constraints-led activities designed to target your problem area will lead to changes in your performance of specialised movement sequences for a movement strategy. You might expect to see changes in:

- timing
- direction, frequency and intensity of movement
- technique
- decision-making.

It is important to be able to identify these types of changes in your performance because this process will ultimately enable you to determine what personal tactical strategy has emerged.

Example

Sarah may participate in the following constraints-led activity to address her performance problem (as outlined in the previous example):

A game with player numbers reduced to 4v4 and with the task constraint of having only 5 seconds for the ball to make it into the team's attacking half after a goal has been saved by the goalkeeper.

This constraints-led activity will force Sarah to search for a solution to make effective long passes.

Step 3 – Gather data from your constraints-led activities and analyse changes in the specialised movement sequences for one movement strategy

Participating in constraints-led activities will also give you the opportunity to gather and record a range of performance data relating to your identified performance problem.

There are a number of tools that you can use to gather data (i.e. evidence) relating to changes in your performance over time. These include:

- a personal journal
- GPAIs
- video recordings.

The GPAI shown in Source 3 is a useful tool to help you gather the data that you will need to analyse the changes in your specialised movement sequences for one movement strategy. A template for this GPAI is provided on your obook assess.

TIME	TIME PERIOD 1	TIME PERIOD 2	TIME PERIOD 3	TIME PERIOD 4	TIME PERIOD 5
Specialised movement sequence	Describe: • Timing • Technique • Movement patterns (direction, frequency, and intensity of movement) • Decision-making	Describe: • Timing • Technique • Movement patterns (direction, frequency, and intensity of movement) • Decision-making	Describe: • Timing • Technique • Movement patterns (direction, frequency, and intensity of movement) • Decision-making	Describe: • Timing • Technique • Movement patterns (direction, frequency, and intensity of movement) • Decision-making	Describe: • Timing • Technique • Movement patterns (direction, frequency, and intensity of movement) • Decision-making
1.					
2.					
3.					

Note: The time period can be over a 10 minute period (in 2 minute blocks) or over several days or weeks.

SOURCE 3 Performance analysis GPAI (designed to analyse changes in your specialised movement sequence)

Analysing data you have collected over time (i.e. journal entries, data from your GPAIs and visual evidence from video recordings) will help you detect any changes in your performance, especially the less obvious ones.

This data will be the key to your success in the Project – folio as it will help you determine the impact of the resulting tactical strategy on your performance and give you the primary data you need to justify your recommendations.

Example

Sarah has decided to gather data from constraints-led activities and analyse changes in the specialised movement sequences for one movement strategy in the following way:

'The data gathered when performing passes may initially show that I didn't get my body out of the water very far to make the longer passes, which impacted the effectiveness of my transition passes. After participating in constraints-led activities and responding to teacher feedback – which drew attention to the fact that my arm and shoulder were dragging through the water, limiting the speed and force I was able to generate through my arm – I was able to make changes to my performance. Upon analysing the video recordings collected, I observed that I began to force my body higher out of the water, using an explosive eggbeater kick. This enabled me to achieve longer passes that were more effective.'

STUDY TIP

The more data you can gather, the more valid and reliable your conclusions will be!

It is recommended that you complete a personal journal entry (see Source 4) and a GPAI (see Source 3) every time you participate in a constraints-led activity.

You should also try to record as much video footage of your performances as possible. This can increase the accuracy of your data capture because you can stop, start and record. It can also allow you to playback footage in slow or fast motion. Another benefit of gathering video footage is that it will form the visual mode of communication for your multimodal presentation (along with still images and supporting graphics, if you wish).

The combination of these three forms of data provides strong evidence on which to base your conclusions.

Step 4 – Describe and analyse the development of your personal tactical strategy

The unique personal movement solution that emerges during your participation in a range of constraints-led activities is known as your personal tactical strategy. You will need to analyse primary data and secondary data during the emergence of your personal tactical strategy to determine the relationships between the specialised movement sequences and movement strategy, the task, learner and environmental constraints, and the principles of decision-making. In other words, you need to demonstrate an understanding of how constraints and the applied principles of decision-making have impacted your performance of the specialised movement sequence for one movement strategy (i.e. your personal tactical strategy).

QUERY	RESPONSE
1 What problem was identified from your performance? • For what movement strategy within which principle of play did this relate to? • Which specialised movement sequences were involved?	
2 Describe the constraints-led activities that you participated in, in order to address this problem. For each, state the goal that was communicated to you. • List each activity (giving it a logical name). • In one sentence, provide a general overview of the activity. • Explain what constraints were manipulated. • State which goal was communicated to you for this constraints-led activity (e.g. 'The goal is for you to find the fastest way to get the ball into the opposition half.').	
3 What feedback did you receive during/after participating in these constraints-led activities (from yourself and from external sources)? • What did your teacher say? • What were your own observations? • What did your teammates say? • What did video analysis reveal?	
4 Over the course of the week, what changes did you notice in your: • timing? • direction, frequency and intensity of movement? • technique? • decision-making?	
5 From your analysis, can you conclude that specific movement solutions have emerged?	

Note: Complete this DCI at the end of each week by reflecting on the constraints-led activities you have participated in. Regular completion of this DCI might allow you to determine which tactical strategy has emerged over time.

SOURCE 4 Reflective journal DCI (designed to help identify the emergence of a tactical strategy)

This final step requires you to describe your personal tactical strategy as clearly and concisely as possible (noting the specialised movement sequences and associated movement strategy).

Example

In the sport of water polo, a goalkeeper may describe the personal tactical strategy that emerged in the following way: 'In my position as goalkeeper, the 5 second rule task constraint forced me to look further up the field, enabling me to detect new affordances, and therefore apply the principles of decision-making more effectively. When this rule was imposed, the personal tactical strategy that emerged for me was an explosive eggbeater kick for the movement strategy of optimising my team's opportunity to score. My fast and powerful legs were a learner constraint that enabled me to produce this movement solution.'

Evaluate your personal tactical strategy

Once you have devised your tactical strategy, you need to evaluate whether it has been effective or not. To make this judgment, you must consider how well you have worked with (or overcome) the task constraints, learner constraints and environmental constraints. You also need to appraise the outcomes, implications and limitations of these constraints and your application of the principles of decision-making.

To break this down, it is helpful to understand the terms 'appraising outcomes', 'appraising implications' and 'appraising limitations' in relation to constraints and the principles of decision-making. We can consider these terms by answering the questions listed in the following sections.

Appraising outcomes

- Did the tactical strategy optimise your performance?
- How effective was the tactical strategy at overcoming the task, learner and environmental constraints?
- Did your application of the principles of decision-making impact the outcome?

Example

Sarah writes: 'The use of an explosive eggbeater kick was successful in enabling a long pass, which allowed for improved opportunity for my team to attack the goal. Sometimes, when I implemented the strategy and produced a long pass, it was ineffective because my teammates were slow in transitioning. In other words, I was passing to no one, which indicates that the application of decision-making principles was not always appropriate.'

Appraising implications

- Did the tactical strategy affect other aspects of your game or create different/new opportunities for you?
- How did you apply the principles of decision-making and were there any constraints that affected this?

Example

Sarah writes: 'An interesting implication of my personal tactical strategy was that as I rose out of the water, I was able to see that the opponent's goal was open and take the shot. This can be explained through perception–action coupling (i.e. I perceive, I act – I act, I perceive). Another implication of my personal tactical strategy was that my teammates had to ensure they swam more quickly to their attacking half to receive my long passes. For some, this highlighted their personal fitness as a learner constraint. It also enabled a team strategy to emerge because the increased time my team has with the ball allows time to set up the mushroom formation, which provides greater affordances.'

Appraising limitations

- Was there anything that limited your ability to implement this tactical strategy optimally?
- Did your application of the principles of decision-making limit your development and implementation of the tactical strategy?

Example

Sarah writes: 'A limitation evident in my personal tactical strategy was centred on my personal fitness – a learner constraint. By the fourth quarter of most games, I found it very difficult to make the movements required to propel my body out of the water in order to make an effective long pass.'

Justify your personal tactical strategy

Once you have evaluated the outcomes, implications and limitations of your personal training strategy, you will need to justify whether your strategy, on balance, should be maintained or not. To do this you should consider which specific aspects of your training strategy should be maintained (i.e. are working and do not need refinement), which should be further developed (i.e. have potential but need refinement) and which should be completely modified (i.e. are not helping to optimise performance).

It is not enough to make a brief statement here as you are directed to *justify* your position (i.e. give reasons or evidence to support your conclusion). The best way to do this is to provide evidence from the data you have gathered (i.e. primary and secondary data). In other words, not only do you need to use data to determine which movement solutions emerged, and whether you made appropriate or inappropriate decisions, but you need to be able to combine that information with objective statistics about your performance to conclude whether your movement solutions and decisions improved or not.

Example

Sarah might conclude that the tactical strategy that emerged for her over the course of the term was to use an explosive eggbeater kick to achieve long passes and deliver the ball into the attacking zone in less time to increase scoring opportunities.

If the data collected shows that the strategy was successful in delivering the ball to the attacking zone faster, and that the team was able to successfully use the additional

STUDY TIP

Skill drill 2.6 Evaluate the effectiveness of a personal tactical strategy provides you with a GPAI to evaluate the outcome, implications and limitations of your personal tactical strategy. This GPAI is available on your obook assess.

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STUDY TIP

Revise the body and movement concepts that were covered in Unit 1 of the QCE Physical Education General Senior Syllabus by referring to Section 2.7 (pages 69–75) of *Physical Education for Queensland Units 1 & 2*.

If you no longer have access to the printed Student book, you can still access a complete digital version online via your obook assess.

time to create scoring opportunities, then this can be used to justify that the strategy should be maintained.

On the other hand, if his data shows that the team could not maintain possession from the long passes, then Sarah might argue that she needs more time (working with the right constraints-led activities) to refine the personal tactical strategy or for a better tactical strategy to emerge.

Evaluating and justifying your personal performance

Next, are required to evaluate your overall personal performance, with a focus on the specialised movement sequences for two movement strategies from two principles of play. To do this you will need to appraise the outcomes, implications and limitations of your personal performance. You may choose two principles of play from the list below:

- setting up attack
- defending against attack
- creating, defending and exploiting space
- attacking opposition space and scoring.

Your evaluation is required to consider two body and movement concepts in the evaluation of your performance – 'quality of movement' and one other. See Source 5 for a breakdown of each body and movement concept. To maximise your chances of success, your evaluation should reference all relevant criteria from each body and movement concept. In addition to your overall judgment of the effectiveness of your personal performance, you will need to justify which specific aspects of your performance should be maintained, which should be further developed and which should be completely modified. Ensure you use primary and secondary date to support your justifications. It is important to note that this evaluation is separate to the evaluation you made of your personal tactical strategy in Part A. You can use information gathered from the same GPAIs, but you do not need to include your personal training strategy in this evaluation.

Quality of movement	Body awareness
Criteria: • speed (e.g. fast, slow) • timing (e.g. in time, out of time) • accuracy (e.g. on target, off target) • effort (e.g. level of motivation) • force (e.g. strong, light) • fluency and flow (e.g. free, bound)	Criteria: • body parts (e.g. arms, legs, elbows, knees, head) • body shape (e.g. stretched, curled, wide, narrow, twisted, symmetrical, asymmetrical) • body action (e.g. flexion, extension, rotation, swing, push, pull, transfer of weight, stability)
Space awareness	**Relationships**
Criteria: • space (e.g. personal and general space) • pathways of movement (e.g. curved, straight, zigzag) • planes of movement (e.g. sagittal, frontal, horizontal) • direction (e.g. forwards, backwards, sideways, up, down) • levels (e.g. high, middle, low)	Criteria: • people (e.g. alone, with partner, with group) • equipment (e.g. bats, balls and other pieces of equipment; uniforms and supplies)

SOURCE 5 The four body and movement concepts

Source 6 provides an example of how a student studying Australian football has demonstrated specialised movement sequences for two movement strategies from two principles of play. It also shows how the student has applied the body and movement concepts to evaluate their performance.

You will be expected to provide the same level of evaluation for your selected physical activity for your Project – folio. A template for this DCI is provided on your obook assess.

<table>
<tr><td colspan="4">SUMMATIVE INTERNAL ASSESSMENT 1: Project – folio
PLANNING GUIDE</td></tr>
<tr><td colspan="2" rowspan="3">Category of physical activity:
☑ 'Invasion'
☐ 'Net and court'
Selected physical activity:
Australian football</td><td>Principle of play 1:
Setting up attack</td><td>Principle of play 2:
Attacking opposition goal and scoring</td></tr>
<tr><td>Movement strategy 1:
Break through the defence by knocking the ball forward, handballing, kicking and running to space</td><td>Movement strategy 2:
Move the football into opponent's defensive area to score</td></tr>
<tr><td>Specialised movement sequences:
Leading, marking, handballing and kicking</td><td>Specialised movement sequences:
Marking, handballing and kicking</td></tr>
<tr><td>Body and movement concept 1:
Quality of movement</td><td>Criteria:
▶ speed (e.g. fast, slow)
▶ timing (e.g. in time, out of time)
▶ accuracy (e.g. on target, off target)
▶ effort (e.g. level of motivation)
▶ force (e.g. strong, light)
▶ fluency and flow (e.g. free, bound)</td><td>My personal rating:
☑ Accomplished and proficient
☐ Effective
☐ Competent
☐ Variable or inaccurate
Evident criteria:
Accuracy, effort, fluency and flow, timing and speed
Supporting visual evidence:
Footage to show how I break through the defence by leading into space with an outcome that is beneficial to the team (e.g. knocking a lost ball off the ground to a teammate, breaking away from defence to receive a handball or mark; moving into free space to kick a ball to a teammate)</td><td>My personal rating:
☐ Accomplished and proficient
☑ Effective
☐ Competent
☐ Variable or inaccurate
Evident criteria:
Accuracy, force, development, continuity and outcome of movement, efficiency
Supporting visual evidence:
Footage to show that I have a high percentage of marks in front of the uprights and a high degree of goal accuracy (e.g. kicking effectively to a teammate for them to take a mark in reach of the uprights; optimising horizontal and vertical space and using force development by jumping to catch a mark in the scoring zone; fluently handballing on to a teammate, who is free to kick for goal)</td></tr>
<tr><td>Body and movement concept 2:
Relationships</td><td>Criteria:
▶ people (e.g. alone, with partner, with group)
▶ equipment (e.g. bats, balls and other pieces of equipment; uniforms and supplies)</td><td>My personal rating:
☐ Accomplished and proficient
☑ Effective
☐ Competent
☐ Variable or inaccurate
Evident criteria:
People (i.e. interaction with teammates and opponents)
Supporting visual evidence:
Footage to show how I read the opponent's movement to perceive and act on affordances (e.g. choosing to kick the ball to an open teammate further up the field rather than handballing to a closer one who would be easily challenged; winning a physical contest [i.e. out-manoeuvre opponent] to take a mark)</td><td>My personal rating:
☐ Accomplished and proficient
☑ Effective
☐ Competent
☐ Variable or inaccurate
Evident criteria:
People (i.e. interaction with teammates and opponents), equipment
Supporting visual evidence:
Footage to show that I use the opponent and the movement of the ball up the field to position myself effectively, creating affordances for my teammates so that I can mark their kick (e.g. moving to the left of the uprights and making myself seen when the ball is travelling up the left-hand side; successfully reading the irregular bounce of the ball to take possession.)</td></tr>
</table>

SOURCE 6 To meet the task requirements, your performance evaluation must use two body and movement concepts and pertain to two principles of play, as shown in this Australian footballer's multimodal planning.

SOURCE 7 Visual evidence will assist in the evaluation and justification of your visual performance.

Section 2 – Supporting evidence

Section 2 of this task requires you to provide 2 to 3 minutes of supporting evidence (i.e. video footage) demonstrating and applying your physical performance in an authentic environment. The visual evidence you supply to should demonstrate:

- specialised movement sequences for two different movement strategies from two principles of play
- your application of quality of movement and one other body and movement concept to reflect on your typical performance of specialised movement sequences for two movement strategies from two different principles of play.

If you completed the Evaluating and justifying your personal performance part of the assessment, you can use Source 6 to identify the two different movement strategies from two different principles of play you wish to use. For example:

Principle of play 1: Setting up attack	**Principle of play 2:** Attacking opposition goal and scoring
Movement strategy 1: Break through the defence by knocking the ball forward, handballing, kicking and running to space	**Movement strategy 2:** Move the football into opponent's defensive area to score

To demonstrate accomplished (highly skilled) and proficient (well advanced or expert) specialised movement sequences, you will need to have sufficient, sustained visual proof that shows relevant specialised movement sequences and variations of these skills. For example:

Specialised movement sequences: • Leading (e.g. moving into space) • Marking (e.g. from handballs and kicks) • Handballing (e.g. various distances, bounce pass, using left- and right-hand passes) • Kicking (e.g. drop punts of different heights and distance, torpedo, grubber)	**Specialised movement sequences:** • Marking (e.g. from handballs and kicks) • Handballing (e.g. various distances, bounce pass, using left- and right-hand passes) • Kicking for goal (e.g. snap shot, banana kick, set shot)

As your supporting evidence can only be 2 to 3 minutes long, you will need to choose the footage you include carefully. If applicable, you are permitted to use some of the footage you included in the folio; however, it is recommended to only do this if it reflects your typical, sustained performance.

If you need more visual evidence to meet the time requirements of your supporting evidence, select clips that show variations of specialised movement sequences with successful outcomes.

PERFORMANCE

SKILL DRILL **2.6**

Evaluate the effectiveness of a personal tactical strategy

>> Turn to pages 332–333 to complete this integrated physical performance activity.

2.6 Check your learning

Engage and understand

1 **Access** an up-to-date version of the instrument-specific marking guide (ISMG) for Summative internal assessment 1: Project – folio. A copy is available on your obook assess. Read the assessment objectives and marks allocated for each. **Identify** the areas of the task you think will be most challenging. **Identify** some techniques that you can use to help you perform well in these areas.

2 **Identify** and **explain** three possible recommendations you will be asked to justify in the evaluation of your personal tactical strategy.

Analyse and apply

3 **Differentiate** between the terms 'outcomes', 'limitations' and 'implications' when used to evaluate your personal tactical strategy.

Evaluate and justify

4 **Design** a GPAI that you could use to gather data about your performance of at least two specialised movement sequences for one movement strategy.

5 Mack is one week into studying tactical awareness. The chosen physical activity is basketball, a sport that he is already quite proficient in. The primary data below is an excerpt from his personal reflection journal:

Journal entry: Week 1 Lesson 1 Unit 3: Tactical awareness

'I know the sport of basketball well and I know how to optimise my performance. I don't need to participate in any constraints-led activities: I can write down a personal tactical strategy right now as I already have several set plays that I have been working on with my coach for the Friday night basketball comp. My tactical strategy (to perform the set plays) can be a dynamic solution because I will be able to make small changes every time I perform, depending on the opposition. I am ready to put my Project – folio together.'

Reflect on the way that Mack has devised his tactical strategy and assess the degree to which it honours the intent of the dynamic systems approach for developing tactical awareness.

Check your obook assess for the following additional resources and more:

- » Student book questions
  2.6 Check your learning
- » Video
  Assessment support for Summative internal assessment 1: Project – folio
- » Sample GPAI
  A performance analysis GPAI template (designed to analyse changes in your specialised movement sequence)
- » Weblink
  A link to the ISMG for Summative internal assessment 1: Project – folio (© QCAA)

CHAPTER 2 REVIEW

Sum it up!

2.1 **Tactical awareness** is the ability to identify what is happening in a game situation and use this information to select and implement the correct physical responses in order to increase the chances of a successful outcome.

2.2 The **cognitive systems approach** is a broad theoretical framework used to help explain the processes involved in motor learning. It suggests that learning is hierarchical (i.e. top down) and linear (i.e. one command after the other).

The **dynamic systems approach** is a broad theoretical framework used to help explain the processes involved in motor learning. It suggests that our movements are coordinated and controlled through complex, non-linear interactions between all parts of the body, and that no single body system or part is more important than the other in the learning process.

2.3 **Dynamic models of learning** are theories (ways of thinking) that support the dynamic systems approach to motor learning. Dynamic systems theory and the ecological model are two dynamic models of learning.

Dynamic systems theory views the learner as a complex movement system that self-organises (finds movement solutions without instruction or cognitive thought) in response to constraints placed upon it. **Constraints** are variables present at any given time that impact implementation of movement strategies and specialised movements sequences. Constraints can pertain to the learner, the task or the environment.

The **ecological model** attempts to explain how the learner's **motor control system** interacts with the environment to simultaneously 'perceive and act' and 'act and perceive' **(perception–action coupling)** in order to identify opportunities (**affordances**) and produce movements that will maximise the chances of success. The ability to successfully identify affordances is called **attunement**.

2.4 The **constraints-led approach** is a contemporary coaching method based on the principles of the dynamic systems approach to motor learning. A constraints-led approach advocates 'authentic' and 'learner-centred' opportunities to teaching and learning in sports and physical activities. By manipulating constraints, learning opportunities are presented to the learner and the learner is then challenged to find their own movement solutions to the problems faced or the goals to be achieved.

The approach to learning has an impact on the role that the coach plays. Under a cognitive approach, the coach favours the use of technical drills in isolation, outside authentic game situations. Under a constraints-led approach, the coach favours the use of activities that closely represent authentic game play, purposefully manipulating constraints to amplify movement solutions for a problem area.

When using the constraints-led approach to support the emergence of a personal tactical strategy, the coach should identify the specific area of the learner's game a manipulation of constraints needs to address: which **specialised movement sequences**, for which **movement strategy**, within which **principle of play** the performance relates to.

2.5 Considerable planning needs to go into the implementation of a constraints-led approach. A performance appraisal using **body and movement concepts** and the **principles of decision-making** as a guide can help to identify problem areas on which to base constraint manipulation.

There are four steps to designing and implementing effective constraints-led activities: select the technical and/or tactical problem to address; design the constraints-led activity; implement the constraints-led activity; and review and revise the activity.

2.6 The assessment for the tactical awareness topic is a **Project – folio**, which is made up of two components. The first component is comprised of a multimodal presentation on devising, evaluating and justifying a personal tactical strategy and evaluating and justifying personal performance. The second component is a video of the highlights of your physical performance. No voice-over or accompanying text is required for this component – it is only footage.

Dig deeper!

Exam-style revision questions and tasks

SECTION 1

→ Ten multiple-choice questions

QUESTION 1

Tactical awareness is developed in all of the following examples, except

(A) when using perception–action coupling to attune to affordances.

(B) during constraints-led activities where tactical strategies can emerge spontaneously.

(C) when solely using the dynamic systems approach.

(D) when principles of decision-making are applied through authentic game play.

QUESTION 2

The cognitive approach is a traditional approach that uses

(A) the ecological model.

(B) the information processing model.

(C) the application of task, learner and environmental constraints.

(D) the non-linear pedagogy model.

QUESTION 3

Which of the following types of practice reflects 'repetition without repetition'?

(A) Massed practice in closed environments

(B) Distributed practice in closed environments

(C) Blocked practice

(D) Variability practice

QUESTION 4

A coach who uses principles from the dynamic system approach would agree with which statement?

(A) Control the uncontrollable using predetermined set plays.

(B) Any constraint modification will allow movement solutions to emerge.

(C) Exaggerate affordances through tasks constraints.

(D) Reinforce one perception–action coupling response through massed practice.

QUESTION 5

An individual's ability to use their vision to detect bowling affordances in cricket is a

(A) learner constraint.

(B) task constraint.

(C) environmental constraint.

(D) physiological constraint.

QUESTION 6

Which of the following is an example of interacting with environmental constraints?

(A) Playing on changing surfaces

(B) Allowing one bounce in volleyball

(C) Playing water polo in a swimming pool

(D) Playing using a lighter ball (e.g. using a volleyball in netball)

QUESTION 7

Participating in an activity that represents an authentic game environment but manipulates one or more task constraints is referred to as

(A) the ecological system.

(B) the constraints-led approach.

(C) the cognitive approach.

(D) the 3 A Model: Affordance–Attunement Approach.

QUESTION 8

The four principles of decision-making in correct order are

(A) read, recognise and respond, react, recover.

(B) read, react, recognise and respond, recover.

(C) read, recover, react, recognise and respond.

(D) read, respond, recognise, recover.

QUESTION 9

Gibson (1979) said: ‘We must perceive in order to move, but we must also move in order to perceive.’ Which dynamic systems concept was he referring to?

(A) Bernstein’s degrees of freedom problem
(B) Perception–action coupling
(C) Constraints-led approach
(D) Information processing stage

QUESTION 10

Refer to Source 1. What is the coach doing?

SOURCE 1

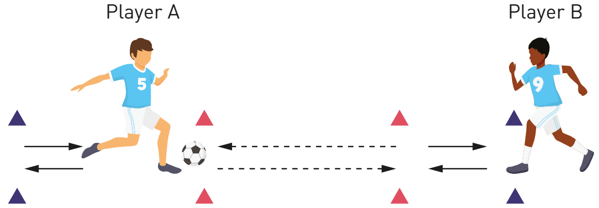
(A) Manipulating ecological constraints
(B) Manipulating the learner constraints
(C) Interacting with environmental constraints
(D) Manipulating task constraints

SECTION 2

→ Three short-response questions

STIMULUS 1

During a soccer coaching session, players complete the following drill. Both players move from the blue markers to the red markers. One player (e.g. Player A) passes the ball to their opponent (e.g. Player B). Both players then return to the blue markers. Players repeat this drill, taking turns passing and receiving.



QUESTION 11 (150 words)

Examine Stimulus 1 and **identify** the approach to motor learning this drill is based on (i.e. cognitive systems approach or dynamic systems approach). Provide evidence to support your response.

QUESTION 12 (150 words)

Examine Stimulus 1 and **propose** two modifications that could make this activity more representative of an authentic game environment. **Discuss** whether you think these modifications would result in optimised performance..

QUESTION 13 (150 words)

Examine Stimulus 1 and **design** an alternative activity to develop these skills that is informed by a constraints-led approach to teaching and learning. **Justify** the design and structure of your activity (making references to the dynamic models of learning).

SECTION 3

→ One extended response question

QUESTION 14 (400 words)

Analyse the data provided in Stimulus 2 to **evaluate** the effectiveness of each specialised movement option. **Design** a constraint-led activity designed to achieve ONE of the following goals:

1 Support the learner to further adapt and develop in an area of strength

OR

2 Highlight a performance problem and support the learner to adapt and develop in an area of weakness.

Justify the design of your activity by making reference to relevant aspects of motor learning theory.

STIMULUS 2

A volleyball player has collected the following data during a period of game play.

Specialised movement options	Accurate execution	Inaccurate execution	Effective option (defence could not maintain possession)	Ineffective option (defence could maintain possession)
Cross-court hit	卌 ||	|	|	卌 ||
Line hit	||		||	
Tip		|		
Deep roll	|			|

Practice assessment task

This practice assessment task was prepared according to the specifications in the *Physical Education 2019 v1.1 General Senior Syllabus*. It has not been endorsed by the QCAA.

Subject	Physical Education	**Instrument number**	IA1 (i.e. Summative internal assessment 1)
Technique	Project – folio		
Unit	3 Tactical awareness, ethics and integrity and physical activity		
Topic	1 Tactical awareness integrated with one selected 'Invasion' or 'Net and court' physical activity		

Conditions			
Duration	5 hours		
Mode	Multimodal (visual and written or spoken)	**Length**	Section 1 – Folio: 9–11 minutes Section 2 – Supporting evidence: 2–3 minutes
Individual / group	Individual	**Other**	Examples of multimodal presentations include: → a pre-recorded presentation submitted digitally → a presentation conducted in front of an audience → a digital portfolio of video, images and diagrams → a multimedia movie or slideshow. Schools implement authentication strategies that reflect QCAA guidelines for ensuring student authorship.
Resources available	Refer to 'Section 6 – Physical activities' of the *Physical Education 2019 v1.1 General Senior Syllabus*.		

Context

Throughout this unit, you have been engaged in a range of constraints-led activities for the selected physical activity, allowing you to find movement solutions and make decisions in the presence of a range of task, learner and environmental constraints. You have also participated in authentic game play and used the body and movement concepts to critique your personal performance of the specialised movement sequences for various movement strategies.

Task

Devise a personal tactical strategy for specialised movement sequence/s to optimise your performance of one movement strategy in the selected physical activity. **Evaluate** and **justify** the effectiveness of your personal tactical strategy. **Evaluate** and **justify** your personal performance of specialised movement sequences and two movement strategies from two different principles of play by applying two body and movement concepts (i.e. quality of movement and one other).

Supply visual evidence of specialised movement sequences and two movement strategies from two different principles of play in an authentic environment.

Detailed instructions for this task (including a copy of the ISMG) is available on your obook assess.

Check your obook assess for these additional resources and more:

» **assess quiz**
Test your skills with this auto-correcting multiple-choice quiz for Chapter 2

» **Revision notes**
Make your own revision notes with this handy template designed to help you prepare for assessment tasks

» **Data analysis worksheet**
This worksheet helps you to practise analysing secondary data and writing extended responses

» **Practice assessment task**
A printable and editable version of the practice assessment task in for Chapter 2 (including ISMG)

‘Winning isn’t everything; it’s the only thing.’

Vince Lombardi (1913–1970)

American football player, coach and executive in the National Football League (NFL)

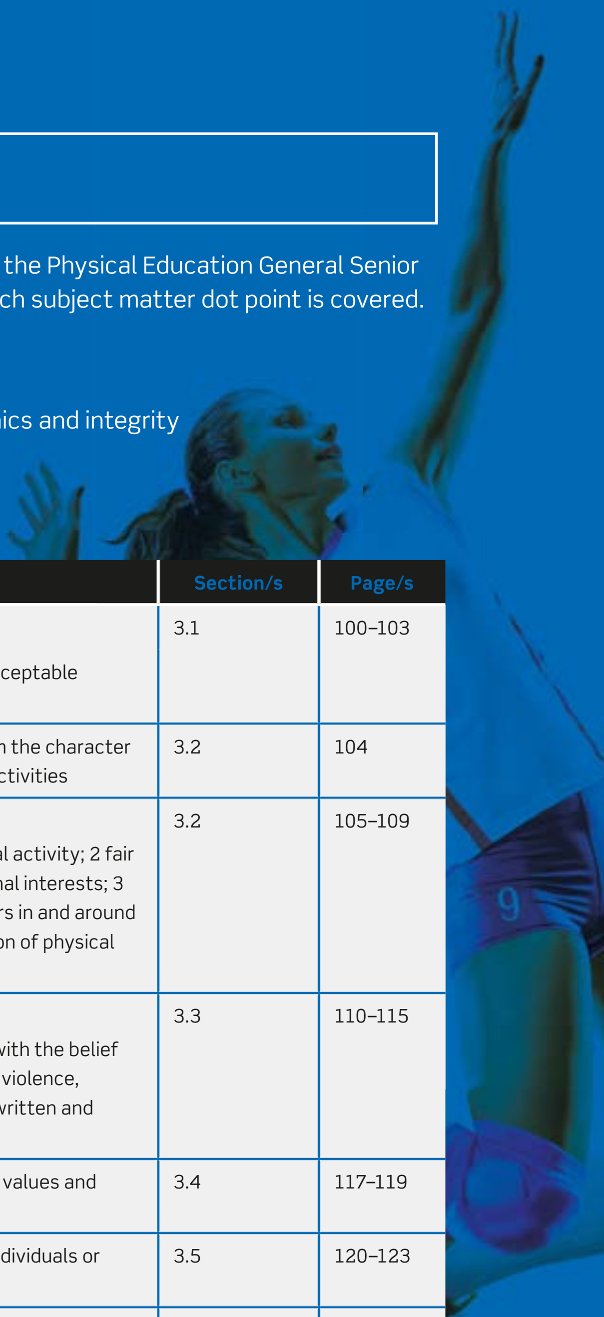
CHAPTER 3

ETHICS AND INTEGRITY

KEY TERMS

By the end of this chapter, you should understand the meanings of the following key terms. They are defined throughout the chapter, as well as in the glossary. Use this handy checklist to test your understanding.

- ☐ ability
- ☐ agents of socialisation
- ☐ bias
- ☐ code of behaviour
- ☐ code of conduct
- ☐ commercialisation
- ☐ commodification
- ☐ corruption
- ☐ doping
- ☐ enabler
- ☐ equality
- ☐ ethical decision-making framework
- ☐ ethical dilemmas
- ☐ ethical values
- ☐ ethics
- ☐ ethics strategies
- ☐ exploitation
- ☐ fair competition
- ☐ fair play
- ☐ gender exclusion
- ☐ gender inclusion
- ☐ globalisation
- ☐ gross domestic product (GDP)
- ☐ integrity
- ☐ mass media
- ☐ match fixing
- ☐ morals
- ☐ multinational
- ☐ norms
- ☐ para-sport
- ☐ personal values
- ☐ Play by the Rules
- ☐ positive engagement
- ☐ respect
- ☐ risk management
- ☐ sledging
- ☐ slippery slope trap
- ☐ Sport Australia
- ☐ stakeholder
- ☐ sweatshop
- ☐ team spirit
- ☐ unwritten rules
- ☐ written rules



SUBJECT MATTER OUTCOMES COVERED IN CHAPTER 3

All of the subject matter dot points you are required to cover in **Unit 3 – Topic 2** of the Physical Education General Senior Syllabus are included in this chapter. The tables below show you exactly where each subject matter dot point is covered.

Unit 3 – Topic 2: Ethics and integrity

In Unit 3 – Topic 2, students engage in learning that involves the integration of ethics and integrity subject matter and a range of physical activities.

Stage 1: Engage and understand

Subject matter	Section/s	Page/s
In this area of study, students will: → recognise and explain that ethics is the set of norms and ways of life through which we realise acceptable behaviour and values of right and wrong	3.1	100–103
→ recognise and explain that ethics in physical activity is developed as a system of values that form the character or integrity of each player and translate, through action, into a player's engagement in physical activities	3.2	104
→ comprehend and explain the concept of integrity in physical activity, which includes – 1 the demonstration of the ethics and values that promote community confidence in physical activity; 2 fair and honest performances and outcomes, unaffected by illegitimate enhancements or external interests; 3 positive engagement by athletes, administrators, officials, supporters and other stakeholders in and around physical activities, which enhances the reputation and standing of the contest and perception of physical activity	3.2	105–109
→ understand and describe the concept of fair play, which includes – 1 observing rules; 2 demonstrating attitudes and behaviours in physical activity consistent with the belief that it is an ethical pursuit; 3 eliminating forms of exploitation in an effort to win, e.g. acts of violence, cheating, drug abuse; 4 fair competition and equality; 5 respect; 6 team spirit; 7 respect for written and unwritten rules such as integrity, solidarity, tolerance, care, excellence and joy	3.3	110–115
→ identify the role of peers, family, coaches, school and community in the development of personal values and ethical behaviours in physical activity	3.4	117–119
→ explain how a system of ethical values and ethics strategies influence fair play and integrity of individuals or teams in physical activity	3.5	120–123
→ comprehend and describe how ethics strategies can positively or negatively influence integrity	3.5	120–123
→ access codes of behaviour and conduct, and rules and policies (including risk assessment) in class, school and community contexts to identify how they support ethical behaviour and fair play in physical activity	3.5	120–123
→ identify and explain how globalisation and media coverage have influenced ethical values and behaviours	3.6	124–131
→ identify ethical dilemmas (gender inclusion or exclusion, ability, enhancements in technology and equipment, corruption) through involvement in a physical activity context	3.7	132–141
→ recognise and explain the ethical decision-making framework for exploring ethical dilemmas – 1 identify the ethical dilemma, i.e. the problem or situation, and the tension that exists between the organisation's or player's values; 2 find information about the relevant facts of the problem or situation, individuals and groups who have an important stake in the outcome, strategies that have been used in response to similar problems or situations; 3 evaluate alternatives by determining which strategies will produce the most good and do the least harm, best respect the rights of all who have a stake, treat people equally or proportionately, best serve the community as a whole, lead players to act with integrity; 4 devise strategies that provide a course of action to improve the integrity of the player or organisation; 5 reflect on the outcome by determining the effectiveness of the ethics strategy on all stakeholders	3.8	142–147

Subject matter	Section/s	Page/s
→ gather primary data about the relationship between ethical dilemmas, the influence of concepts and principles about ethics and integrity, and engagement in physical activity	Skill drill 3.4 Skill drill 3.7 Skill drill 3.8	334–335 336–337 338–339
→ use secondary data to analyse how the development of ethics strategies can influence engagement in physical activity.	Chapter 3	96–157

Stage 2: Analyse and apply

Subject matter	Section/s	Page/s
In this area of study, students will: → apply the ethical decision-making framework to investigate the factors that influence integrity in class, school and community physical activity contexts	Skill drill 3.4 Skill drill 3.7 Skill drill 3.8	334–335 336–337 338–339
→ analyse and synthesise primary data and secondary data about ethical dilemmas in class, school and community contexts to identify individuals and groups who have an important stake in the outcome and strategies that have been used in response to similar problems or situations		
→ devise ethics strategies that provide a course of action in response to the ethical dilemmas that identify the audience, context and outcome to be achieved		
→ propose or implement the ethics strategies to gather primary data about the potential outcome, implications and limitations about decisions		
→ analyse primary data and secondary data to ascertain relationships between the ethical dilemma, ethics strategy, concepts and principles and engagement in the class, school and community physical activity contexts.		

Stage 3: Evaluate and justify

Subject matter	Section/s	Page/s
In this area of study, students will: → reflect on primary data and secondary data to evaluate the effectiveness of the ethics strategies to enhance integrity and optimise engagement for all stakeholders in the class, school and community physical activity contexts	Skill drill 3.4 Skill drill 3.7 Skill drill 3.8 Chapter 3 review – Practice assessment task	334–335 336–337 338–339 157
→ make decisions to maintain or modify the ethics strategies to optimise integrity and engagement in the class, school and community physical activity contexts		
→ justify the development of the ethics strategies using evidence from primary data and secondary data → justify maintenance or modification of the ethics strategies using evidence from primary data and secondary data → make decisions about and use language, conventions and mode-appropriate features to convey meaning for particular purposes and contexts.		

Source: *Physical Education 2019 v1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

Check your obook assess for the following additional resources and more:

» **Chapter glossary**
A printable and editable list of key terms to learn in Chapter 3

» **Flashcard glossary**
A digital interactive to help you test your knowledge of key terms in Chapter 3

» **Weblink**
A link to the QCAA Physical Education General Senior Syllabus

3.1 Introduction to ethics and integrity

That's a goal!

By the end of Section 3.1, you should be able to:

→ **define** the terms 'ethics' and 'integrity'
→ **identify** how both concepts relate to sport and physical activity
→ **identify** your own experiences with ethics and integrity in physical activity.

Defining ethics and integrity

Making decisions is an essential part of everyday life; in fact, you may have already made hundreds (if not thousands) of decisions today alone. These decisions – both big and small – affect all aspects of your life. They influence everything from the clothes you wear and the foods you eat, to the things you do and the people you are friends with. Ultimately, all of the decisions combine to influence the type of person you are.

Even though you may not consciously realise it, almost all of the decisions you make every day can be connected to the concepts of **ethics** and **integrity**.

ethics
a system of principles and values (i.e. standards of behaviour) that develop within a social group and by which actions are judged to be 'good' or 'bad'; 'right' or 'wrong'

integrity
the quality of having strong morals and personal values (e.g. honesty, loyalty, respect for others, trustworthiness, fairness)

What is ethics?

In simple terms, ethics is a set of principles and values that help us to judge what is morally 'good' or 'bad'; 'right' or 'wrong'. A system of ethics usually develops between members of particular social groups (e.g. friends, families, social or sporting clubs, communities, societies and nations) over a period of time until they become a set of accepted **norms** (i.e. normal, typical, expected or accepted behaviours).

norms
a standard or pattern of behaviour that is acceptable or expected within a particular social group (e.g. family, club, society)

SOURCE 1 Norms are standards or patterns of behaviour that are accepted and expected within a particular group – like encouraging and supporting members of your team before a game.

Examples of some ethical behaviours that are common to a range of social groups are provided in Source 2.

Family	Sporting club	Society
→ Cleaning up after yourself → Knocking on closed doors before entering a room → Being polite and respectful towards your parents and other family members	→ Following the rules and code of conduct → Wearing the correct uniform and attending practice (as required) → Being respectful towards your coach, members of your team and opponents	→ Not littering → Wearing your seatbelt when travelling in a car → Offering a seat to an elderly person on public transport → Not deliberately causing damage to other people's property

SOURCE 2 Some examples of common ethical behaviours in different social groups

What is integrity?

In simple terms, integrity is the quality of having strong **morals** and **personal values**. These morals and personal values are the principles and ideals that each person believes are central to the way they live their life. These may include honesty, strength, loyalty, respect, trust and fairness.

In many ways, integrity is a measure of how thoroughly and consistently a person chooses to apply and follow a system of ethics. One of the defining characteristics of a person with integrity is that they will choose to do what is 'right' or 'good' even when no one is watching.

morals
ideals or standards of behaviour that a person may try to follow or live up to in order to be considered 'good' and 'right' by other members of a society (e.g. being honest, showing respect for others, being faithful, showing kindness)

personal values
the principles or standards of behaviour that guide how an individual lives their life; a person's judgment on what is important in life (e.g. honesty, fairness, trustworthiness)

Understanding the difference between ethics and integrity

Ethics and integrity are both challenging and complex concepts to define – mainly because they are both influenced by an individual's personal, social, cultural, religious, political and environmental beliefs. They can also be challenging to define because they share many common characteristics and are often used interchangeably in everyday conversation. Although they do share some common characteristics, there are also some key differences between ethics and integrity. Although it is a simplistic approach, it may help you to think about both concepts in these terms:

- Ethics is about knowing and following a system of rules or principles.
- Integrity is about doing the 'right thing' (in terms of your moral and personal values), regardless of what the system of rules or principles says.

SOURCE 3 In simple terms, ethics is a set of principles that help us to judge what is morally 'right' or 'wrong', while integrity is a measure of how thoroughly we follow a system of ethics.

PAGE 101

Theory in action | Vince Lombardi – A win at all costs?

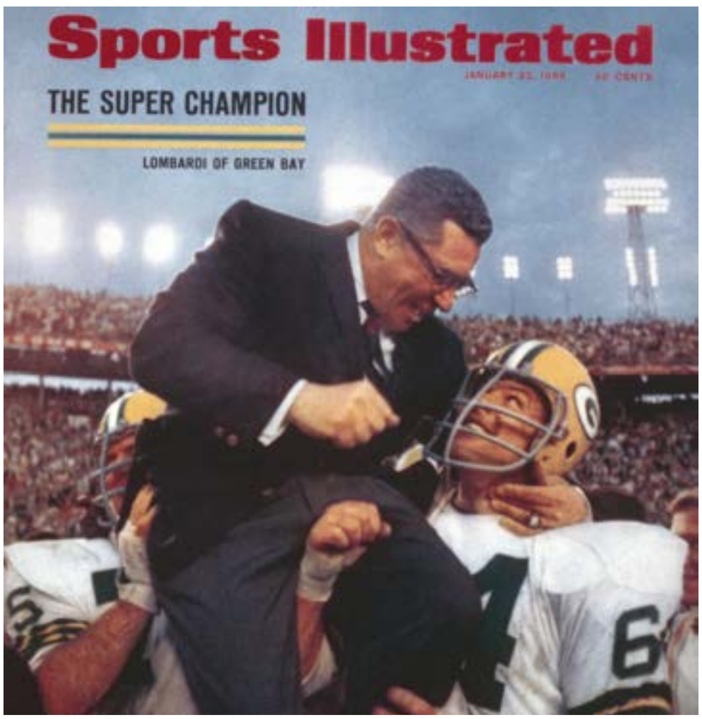
Vince Lombardi (1913–1970) is widely regarded as one of the America's greatest coaches, due to his legacy of leadership and success in the National Football League (NFL) as head coach of the Green Bay Packers during the 1960s. In fact, the NFL Super Bowl trophy is named after him.

Lombardi used a range of tactics to coach, teach, inspire and motivate his players and staff – and many of his speeches and quotes have become famous around the world today. Lombardi was once quoted as saying, 'Winning isn't everything; it's the only thing'.

Over time, this quote captured the public's attention and took on a life of its own. It became well-known and often quoted across a variety of sports; however, when asked about it later, Lombardi claims he didn't mean for people to interpret it the way they did (i.e. to do whatever it takes to win at all costs).

Instead, he later stated, 'I wish I'd never said the thing. I meant the effort. I meant having a goal. I sure didn't mean for people to crush human values and morality. Winning is wonderful, but sportsmanship is the lesson to retain for life.'

Lombardi further reiterated his views around integrity and success in sport by reminding his players, staff and fans that 'The objective is to win: fairly, squarely, decently, win by the rules, but still win.'



SOURCE 4 Coach of the Green Bay Packers, Vince Lombardi, shown on the cover of *Sports Illustrated* magazine celebrating his team's victory in Super Bowl II on 14 January 1968

Why study ethics and integrity?

The study of ethics and integrity is central to almost all aspects of life in a society, including sport and physical activity. Remember, almost all decisions you make are linked to the concepts of ethics and integrity. By studying ethics, you will develop an appreciation of the many ways in which even the smallest decisions – such as the clothes you buy or the foods you eat – can impact other people and the planet.

For example:

- Is the brand of jeans you wear manufactured in Australia or overseas? Is the manufacturer a fair and reasonable employer that pays their workers fairly and provides safe working conditions? If not, will these factors influence the brand of jeans you choose to buy in the future?
- Are the foods you eat grown locally or imported from overseas? Are they sourced responsibly? Do they contain any animal products? If so, were those animals killed and processed humanely? Is the packaging recyclable? If not, will these factors affect what you choose to eat in the future?

As you can see, issues relating to ethics and integrity can be connected to even the simplest everyday decisions. This is also the case when we look at ethics and integrity issues in the context of sport and physical activity.

In this chapter, you will learn about the important role that ethics and integrity play in all forms of sport and physical activity. You will also develop a range of skills required to identify challenging ethical problems (known as **ethical dilemmas**) and respond appropriately to them. Finally, you will learn how integrity and ethical behaviour can be developed in order to promote sport and physical activity in the community and build trust and confidence in sporting codes and clubs.

ethical dilemmas
situations in which a difficult choice must be made between two options, when neither option will result in an outcome that is ethically or morally acceptable; in physical education, ethical dilemmas are determined by the interactions between your values and principles, and your purpose for engaging in physical activity

3.1 Check your learning

Engage and understand

1 In your own words, **define** the terms 'ethics' and 'integrity'.

2 **Explain** the difference between ethics and integrity.

3 **Identify** three examples of:

 a ethical behaviour that you have observed or read about in the news (or on social media) over the past week

 b unethical behaviour that you have observed or read about in the news (or on social media) over the past week.

Analyse and apply

4 **Identify** three or four personal decisions you have made over the last week.

 a **Classify** each decision based on whether it relates to daily life (e.g. food, clothing, shopping, entertainment, hobbies), family and friends, school, work, sport or other.

 b **Analyse** each decision to **determine** whether you believe you acted:
  - ethically and with integrity
  - unethically and without integrity.

 Provide reasons to support your answers.

 c In each case, **determine** the reasons/factors that motivated you to act the way you did. Did you consciously consider the consequences of each decision at the time you made it? **Reflect on** the reasons why/why not

Evaluate and justify

5 **Read** the Theory in action 'Vince Lombardi – A win at all costs?' and complete the following tasks:

 a **Compare** the following quotes by Lombardi below and **explain** which resonates most with you using examples from your own sporting experiences:
  - 'Winning isn't everything; it's the only thing.'
  - 'The objective is to win: fairly, squarely, decently, win by the rules, but still win.'

 b **Justify** the need to reframe Lombardi's 'winning is the only thing' quote for a modern audience.

Check your obook assess for the following additional resources and more:

» **Student book questions**
3.1 Check your learning

» **Weblink**
A guide to the importance of ethics and integrity in sport

» **Weblink**
Vince Lombardi and the meaning of his famous quote

3.2 Ethics and integrity in sport and physical activity

That's a goal!

By the end of Section 3.2, you should be able to:

→ **explain** the role that ethics and integrity play in sport and physical activity

→ **explain** how ethics and integrity can help to:

- promote positive engagement in sport and physical activity
- ensure physical performances are fair and honest
- enhance the reputation and perception of physical activity.

The importance of ethics and integrity in sport and physical activity

written rules
the formally documented regulations governing a sport

unwritten rules
a set of expectations, qualities or values that are known and understood by a group but have not been formally documented

stakeholder
a person (or group of people) who has an interest, connection, concern or investment in something (e.g. stakeholders in a sporting team may include the players, coaching staff, administrative staff, members, spectators, sponsors and investors)

enabler
a factor that encourages a person to participate in a sport or physical activity

The concepts of ethics and integrity are an important part of almost all sports and physical activities. In fact, it is difficult to attend a sporting event, watch a sports broadcast, read a commentary or have a conversation about sport without some reference being made to:

- competing fairly or unfairly (i.e. following the **written rules** of the sport)
- competing in the 'spirit' of the game (i.e. following the **unwritten rules** of the sport)
- setting a good or bad example (i.e. behaving with honour, loyalty or respect).

Sport and physical activity play an important role in the lives of most people, not only in Australia, but around the world. While not all Australians participate actively in sport, many spend significant amounts of time watching and talking about sport, helping out at local sporting clubs and organisations, or supporting family and friends who play sport. In many ways, sport and physical activity is like a mirror; it reflects what is going on in society. It can show us:

- the best and most positive qualities of ourselves, our community and our society (e.g. team spirit, optimism, respect, honesty, inclusiveness, cooperation, trust, determination)
- the worst and most negative qualities of ourselves, our community and our society (e.g. jealously, racism, cheating and dishonesty, corruption, bullying, exclusion, discrimination).

However, unlike a mirror, sport is active, meaning that the things that take place in the sporting world influence broader society just as much as broader society influences them. In short, sport is a product of society as much as society is a product of sport.

For this reason, it is important that sporting clubs, associations and codes at all levels take steps to set clear expectations of the types of ethical behaviours they want to promote and ensure that all **stakeholders** act in accordance with these expectations. If a particular player, sporting club or governing body acts ethically and with integrity, it can be a significant **enabler** to engagement and participation in that sport. A number of other positive benefits can also result. In particular, ethics and integrity can help:

- promote positive engagement in sport and physical activity
- ensure physical performances are fair and honest
- improve community confidence and enhance the reputation of sport and physical activity.

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

How ethics and integrity can help to promote positive engagement in sport and physical activity

One of the main ways that ethics and integrity can help promote positive engagement and participation in sport and physical activity is by setting a good example, both for those who play and watch the sport, and for the wider community.

Sporting clubs and associations at all levels (i.e. from small local clubs, to large national or international governing bodies) that set clear ethical guidelines around how athletes, administrators, officials, supporters and other stakeholders conduct themselves gain a reputation for fairness, honesty and integrity on and off the field.

Individual athletes and sporting clubs that model appropriate ethical values and behaviours often become ambassadors for their sport. This helps to promote their sport and attract a range of different people in the community to get involved – from young, aspiring athletes and fans and spectators, through to corporate sponsors. This is referred to as **positive engagement**.

There are a number of ways in which sporting clubs and codes set expectations around ethical behaviours and provide ongoing training and support to stakeholders. Many clubs and teams use one or more of the following tools to support and encourage ethical behaviour:

- a **code of conduct** – a document that formally outlines the principles, standards and rules of a particular group, team or organisation (and describes the possible penalties and sanctions for breaches)
- a **code of behaviour** – a document that formally sets out the expected standards of behaviour for members of a particular group, team or organisation (and describes the possible penalties and sanctions for breaches). It generally focuses on the expected behaviours for members who publicly represent the team during training, competitions or club-sanctioned activities (e.g. players, coaches, administrative staff), as shown in Source 1
- **contracts –** agreements between employees or business partners of a particular group, team or organisation that outline employment conditions (e.g. wages, working conditions) and roles, responsibilities and expectations of the club
- **membership agreements –** agreements entered into by people who wish to become official members of a particular group, team or organisation. They often include rules and expectations for members who are participating in club activities (e.g. showing respect to players and umpires, dressing appropriately, consuming alcohol responsibly)
- **training, development and community partnership programs –** many clubs and organisations conduct regular training sessions to educate players on a range of ethical issues (e.g. respecting the rules of the game; embracing diversity – including respecting people of all ages, races, religions, genders, sexual orientations, physical and mental abilities, and socioeconomic backgrounds; the dangers of performance-enhancing drugs; avoiding cheating and **match fixing**; avoiding bribery and corruption).

All players participating in the professional tennis events are covered by the TACP. It is your responsibility to be aware of and comply with the rules.

If you break the rules you could face a maximum fine of $250 000 and a lifetime ban from participating in, or attending tennis events.

SOURCE 1 Tennis Australia has a number of codes of behaviour for players, clubs and spectators, such as this one from the Tennis Anti-Corruption Program (TACP). The codes contain the rules and responsibilities for all stakeholders and outline the penalties for breaches.

positive engagement
participation in sport and physical activity that sets a good example, both for those who play and watch the sport, and for the wider community

code of conduct
a document that outlines the principles, standards and rules of a particular group, team or organisation

code of behaviour
a document that sets out the expected standards of behaviour for members of a particular group, team or organisation (with a focus on stakeholders who publicly represent the team during training, competitions or club-sanctioned activities)

match fixing
the action or practice of dishonestly determining the outcome of a match before it is played (usually for financial or personal gain)

SOURCE 2 In March 2015, former Wallabies captain David Pocock (second from left) slammed the use of homophobic slurs by a member of the NSW Waratahs. After the game, Pocock said, 'There's no room for homophobic language in our sport. We want to make it inclusive.' He was supported by both Rugby Australia and the Wallabies' major sponsor, Qantas.

SOURCE 3 Dylan Alcott is an Australian Paralympic athlete who was named Paralympian of the Year at the 2016 Australian Paralympic Awards. Alcott promotes and supports diversity and inclusivity in sport. He is also a radio host and motivational speaker, and he has even started his own inclusive music festival, Ability Fest.

The In the news below further explores the ramifications of unethical behaviour in sport.

In the news

Ben Barba sacked from Cowboys after 'domestic violence incident' at Townsville casino

NEWS.COM.AU, 2 FEBRUARY 2019

Ben Barba's planned comeback to Australian rugby league is in tatters.

The controversial playmaker, sacked by North Queensland hours after he was touted for an NRL redemption, has become yet another ugly blotch on the NRL's ongoing battle with off-season misbehaviour.

Barba had his Cowboys contract torn up on Friday night in relation to an incident at a Townsville casino, the same day the 29-year-old was officially unveiled as fullback for the indigenous All Stars.

The Courier Mail later reported Barba allegedly 'attacked his partner and mother of their four daughters, Ainslie Currie'.

It is unclear whether police charges have been laid, however Townsville police are reportedly investigating. Channel 9's Danny Weidler reported CCTV cameras had recorded the incident.

The club informed the NRL integrity unit of the matter on Friday before moving quickly to sack Barba later in the day.

'When a player joins the North Queensland Cowboys he agrees to abide by the terms of the contract,' Cowboys chairman Laurence Lancini said on Friday. 'After an internal investigation, it has been determined that this player has acted in contradiction to both the terms and the spirit of that agreement.' [...]

The development comes six years after Currie was forced to deny being assaulted by Barba when photos of facial injuries, believed to be hers, were published in a newspaper. [...]

FOR THE RECORD!

In October 2018, professional Ukrainian tennis players and twin brothers Gleb and Vadim Alekseenko were found guilty of match-fixing offences by the Tennis Integrity Unit (the international anti-corruption body covering professional tennis). They were fined US$250 000 and banned from competing for life after being caught betting on their own matches at a number of European tennis tournaments.

Many clubs also form partnerships with schools, community groups and charities in order to promote positive engagement and build trust with members of the community. An example of this is provided in the Theory in action below.

Theory in action How community partnerships promote positive engagement

An excellent example of a community partnership that promotes positive engagement in sport, while helping members of the community, is a program known as the Taipans Indigenous Program (TIP).

The program – established by NBL team the Cairns Taipans and sponsored by local shipping company Sea Swift – aims to spread healthy living messages to Indigenous children and increase participation levels in basketball (and other physical activities) throughout the Cairns and Cape York region.

TIP is led by former and current Taipans players, including Kerry Williams and Nate Jawai. Jawai spent time playing in the NBA and EuroLeague before returning home to North Queensland to join the Taipans.

SOURCE 4 Cairns Taipans player Nate Jawai is the lead ambassador for the Indigenous Health and Wellbeing Program (part of the Taipans Indigenous Program). Community programs like this can help to promote positive engagement in sport and strengthen the reputation of sporting clubs.

How ethics and integrity can help to ensure physical performances are fair and honest

There are many serious issues that threaten ethical conduct and integrity in sport and physical activity. Some of the most serious threats to fair and honest performances include:

- **the use of illegal and/or unauthorised performance-enhancing substances**, including substances taken by unethical athletes with the intention of enhancing or improving their physical performance (e.g. anabolic steroids, peptides, hormones)
- **the use of unauthorised technological enhancements or equipment**, including sporting equipment that has been enhanced in order to illegally or unfairly improve the performance of an athlete (e.g. the use of full-body swimsuits, self-correcting golf balls, concealed motors inside road bikes)
- **dishonest conduct and external influence**, including any fraudulent or deceitful conduct by athletes, coaches and officials that gives a player an unfair advantage or affects the outcome of a competition (e.g. bribery, corruption, cheating, match fixing).

If sporting clubs and organisations fail to take these issues seriously, they run the risk of damaging the reputation and credibility of their organisation and sport. Failing to demonstrate integrity within sport and physical activity can have serious negative consequences and lead to the ethics and values of a sporting organisation being called into question by the players, members, fans and wider community. For this reason, these types of ethical issues (and many more) are clearly prohibited or outlawed in sporting codes of conduct, codes of behaviour and contracts. Many sporting associations have dedicated departments, tribunals or teams of people within their organisations to investigate and penalise individuals who are caught in breach of the rules, such as the World Anti-Doping Agency (WADA), the International Partnership Against Corruption in Sport (IPACS) and the International Cricket Council's Anti-Corruption Unit (ACU).

A recent example of how an ethical issue related to dishonest conduct can result in serious negative consequences at a local, national and international level is the 2018 ball-tampering scandal that involved members of the Australian cricket team (see Source 5). In this case, Cameron Bancroft was caught by television cameras trying to rough up one side of the ball with sandpaper to make it swing in flight. As details emerged, captain Steve Smith and vice-captain David Warner were found to be involved and all three players received unprecedented sanctions from Cricket Australia.

How ethics and integrity can build community confidence and enhance the reputation of sport and physical activity

If the 2018 ball tampering scandal is evidence of one thing, it's that the unethical actions of a few can have far-reaching effects on the reputation of a sport – locally, nationally and internationally.

The event was described by countless media outlets as a 'national disgrace' and a 'day of shame for Australian sport', and it went on to seriously damage community confidence in the sport of cricket. Major sponsors cancelled lucrative deals with Cricket Australia to distance themselves from the fallout of negative publicity. Steve Smith was also dropped as a brand ambassador for Sanitarium Weet-Bix.

All of this was the result of ethical standards not being met and players not acting with integrity. In order to restore community confidence in the sport, Cricket Australia handed down some of the most severe penalties in its history. It also commissioned an investigation into how they could improve the culture of the organisation and work to prevent unethical behaviour at all levels of cricket.

The International Cricket Council (ICC) also raised its penalty for ball tampering and announced new offences in its Code of Conduct. Along with harsher penalties and new offences, the ICC will investigate how Member Boards, such as Cricket Australia and the Board of Control for Cricket in India, can be held liable for the behaviour of their players.

All of these moves are designed to rebuild community confidence in the sport and repair damage to its reputation around the world. We will examine this scandal in more detail in Section 3.8.

In much the same way that examples of unethical behaviour can undermine community confidence in a sport and damage its reputation, examples of ethical behaviour can serve to increase community confidence and enhance the reputation of a sport or physical activity, regardless of the type of sport or its relative popularity.

Despite the occasional failure of some athletes, clubs and sporting organisations to comply with ethical policies (and live up to community expectations), on the whole, Australians have a proud history of acting ethically and with integrity in sport.

One of the most famous displays of good sportsmanship (i.e. ethical behaviour) in Australian history took place at the 1956 Australian National Championships (in the lead up to the 1965 Melbourne Olympic Games). During the final of the one mile race, John Landy stopped to help fellow Australian Ron Clarke, who had fallen. Amazingly, in the final two laps, Landy came from behind to win the race.

SOURCE 5 In 2018, at a press conference immediately after the ball tampering plot was revealed, Captain Steve Smith (shown here with teammate Cameron Bancroft) admitted, 'My integrity, the team's integrity, the leadership group's integrity has come into question and rightly so.'

This single event continues to be a source of pride for many Australians and is one the best examples of how the ethical behaviour and integrity of a single athlete more than 60 years ago continues to build community confidence and promote sport and physical activity.

SOURCE 6 This statue near Olympic Park in Melbourne (left) immortalises one of Australia's most famous acts of good sportsmanship – when John Landy stopped to help fellow runner Ron Clarke at the 1956 Australian National Championships (right).

3.2 Check your learning

Engage and understand

1 **Explain** why it is important for sporting clubs and governing bodies to have clear expectations around the behaviour of their stakeholders.

2 **Identify** five tools that sporting clubs and governing bodies use to help ensure players, coaches and other stakeholders behave ethically and in accordance with the rules.

Analyse and apply

3 Visit the website of your favourite professional sporting team or association and access any available ethical policies, codes of conduct and codes of behaviour.

  a **Reflect on** whether you think the information provided is clear, appropriate and accessible, both as a supporter and as a potential player. (e.g. Are the rules and expectations of players expressed clearly and simply? Are the rules reasonable?)

  b **Consider** whether any improvements could be made to these policies. (e.g. Is anything important missing? Are there clearer/better policies on other teams' websites? If so, how are they better?)

4 Write a paragraph to **compare** the events of the 2018 ball tampering scandal (Source 5) with those of John Landy's 1956 performance (Source 6). In your response, **analyse** the reaction to each event, making reference to the role of ethics and integrity.

Evaluate and justify

5 Read the Theory in action 'How community partnerships promote positive engagement'.

  a **Create** five endings for this sentence that relate to the concept of ethics and integrity: 'Members of sporting clubs should spend time within their local community because …'

  b **Justify** how the community partnership program established by the Cairns Taipans promotes community confidence in physical activity.

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Check your obook assess for the following additional resources and more:

- » **Student book questions**
  3.2 Check your learning
- » **Video**
  Ethics, integrity and engagement in physical activity
- » **Student worksheet**
  Ethics and integrity in sport and physical activity
- » **Weblink**
  Famous displays of good sportsmanship

3.3 Fair play

That's a goal!

By the end of Section 3.3, you should be able to:

→ **define** the concept of fair play and **explain** its importance
→ **identify** and **describe** the seven main elements of fair play
→ **explain** how athletes can demonstrate integrity through fair play on and off the sporting field.

Defining fair play

fair play
following the written and unwritten rules of competition and showing respect, fairness, friendship and tolerance to others (both on and off the field)

Fair play is central to ethics and integrity in sport. In simple terms, fair play can be defined as following the rules of competition and showing respect, fairness, friendship and tolerance to others (both on and off the field).

Fair play is such an important part of ethics and integrity in sport that many of the world's largest and most influential sporting organisations work hard to help their members develop an understanding of the concept and apply it in all aspects of their lives.

An international organisation dedicated to promoting fair play is the International Committee for Fair Play (CIFP). Established in 1963, this organisation works with the IOC, UNESCO and other national and international governing bodies of sport.

Play by the Rules
a national organisation that provides support and resources to help all Australians embrace the concept of fair play

In Australia, a collaboration between a number of state and territory government organisations (including Sport Australia and the Australian Human Rights Commission) has resulted in the creation of a national organisation known as **Play by the Rules**. It provides support and resources to help athletes, family members, coaches, administrators, officials and spectators embrace the concept of fair play (including assisting them to prevent and deal with discrimination and harassment, protect child safety and promote inclusion and integrity in sport).

SOURCE 1 Play by the Rules is an Australian organisation that provides information, resources, tools and free online training to increase the ability of administrators, coaches, officials, players, parents and spectators to promote fair play.

The elements of fair play

There are seven main elements of fair play. These include:

- observing rules
- demonstrating appropriate attitudes and behaviours
- eliminating forms of exploitation (e.g. acts of violence, cheating, drug abuse, **sledging**)
- fair competition and equality
- respect
- team spirit
- respect for written and unwritten rules (e.g. integrity, solidarity, tolerance, care, excellence, joy).

We will now examine each of these characteristics in more detail.

sledging
the practice of making taunting or teasing remarks to an opposing player, especially a batsman, in order to disturb their concentration

Observing rules

Observing the established rules of any sport or physical activity is one of the most important elements of fair play. If all athletes, family members, coaches, administrators, officials and spectators play by the same rules, everyone involved in sport and physical activity can participate with confidence and a clear understanding of the types of actions and behaviours that are acceptable and those that are not.

Choosing to play outside the established rules of a game changes the nature of that game and usually gives certain individuals an unfair advantage over others. In many sports – such as Australian football, soccer and water polo – rules exist to protect the safety of the players. Imagine, for example, if the rule preventing players from pushing or holding an opponent under water in water polo was not observed and enforced. Not only would the nature of the game change completely, it would likely result in cases of serious injury or even death.

When rules are observed and respected, other components of fair play can also applied.

Demonstrating appropriate attitudes and behaviours

Demonstrating appropriate and consistent attitudes and behaviours in sport and physical activity is another key element of fair play.

Modelling the appropriate attitudes and behaviours can have a positive impact on the levels of enjoyment of players and ultimately improve the reputation and success of a sport or physical activity. In contrast, modelling inappropriate attitudes and behaviours can have a negative impact on the levels of enjoyment of players and ultimately damage the reputation and success of a sport or physical activity. A range of appropriate and inappropriate attitudes and behaviours are provided in Source 2.

FOR THE RECORD!

In the sport of Ultimate – a non-contact sport played with a flying disc (or Frisbee) – observing the rules is the responsibility of all players because there are no referees! Ultimate players make their own calls when violations occur, so each player has a role in upholding the ideals of fair play. If there is disagreement regarding an incident, the disc returns to the player who made the last pass and the game resumes.

Appropriate attitudes and behaviours

- Following the rules (written and unwritten)
- Showing discipline and commitment
- Behaving honestly
- Promoting team spirit
- Valuing friendship
- Striving for excellence
- Respecting yourself and others
- Accepting and promoting diversity
- Taking safety seriously

Inappropriate attitudes and behaviours

- Breaking the rules (written and unwritten)
- Behaving dishonestly (e.g. cheating, match fixing)
- Abusing opponents or acting violently
- Bullying
- Sledging or taunting opponents
- Harassing others
- Doping or using banned substances
- Winning at any cost
- Ignoring safety issues

SOURCE 2 Examples of appropriate and inappropriate attitudes and behaviours that can be displayed in the context of sport and physical activity

Theory in action | Neymar goes viral

At the 2018 FIFA World Cup in Russia, the behaviour of Brazilian player Neymar caused some controversy, which resulted in widespread criticism in the mainstream media (and went viral on social media).

Despite being legitimately fouled by other players, Neymar was repeatedly caught engaging in exaggerated theatrics on the pitch, which included dives, rolls and play-acting injuries, as well as frequently arguing with referees during games. In fact, an analysis conducted by a Swiss TV station revealed that Neymar spent a total of 14 minutes lying on the ground during the World Cup.

Although it provided for some light-hearted entertainment on social media, Neymar's attempts to use this behaviour to draw fouls, run down the clock or draw yellow or red cards for opponents is dishonest and not in the spirit of fair play.

SOURCE 3 Brazilian soccer player Neymar is shown diving and play-acting an injury during the 2018 FIFA World Cup in Russia.

Eliminating forms of exploitation

exploitation
the act of treating someone or something unfairly in order to gain an advantage or benefit

In simple terms, **exploitation** is the act of treating someone or something unfairly in order to gain an advantage or benefit. There are many forms of exploitation that have the potential to undermine ethics and integrity in sport and restrict fair play. Some of the most serious threats to achieving fair play in sport include:

- **acts of violence**, including verbal abuse (i.e. using aggressive language to intentionally cause harm or insult) and physical violence (i.e. intentionally inflicting a physical injury on another person)
- **cheating**, including dishonest or unfair actions that breach written or unwritten rules or codes of conduct (e.g. accepting bribes, match fixing, breaking the rules of the game,

acting dishonestly, taking banned substances, using banned equipment to gain an unfair advantage)
- **the use of performance-enhancing drugs**, including the use of any illegal or prohibited substance designed to give an athlete an unfair mental or physical advantage. Performance-enhancing drugs (e.g. peptides, anabolic steroids, growth hormones, diuretics) are expressly prohibited in the rules or codes of conduct of all major sports and physical activities.

In order to uphold the ideals of fair play and protect their ethical reputations, athletes, sporting clubs and governing bodies must work hard to identify instances of these threats and work towards eliminating them.

SOURCE 4 Using performance-enhancing drugs to gain an unfair advantage is an example of exploitation within sport.

Fair competition and equality

Fair competition and **equality** are core elements of fair play.

- **Fair competition** relies on all athletes and coaches observing the written and unwritten rules of their sport and complying with codes of conduct and behaviour. If there are disagreements or disputes on the field or breaches of the rules, referees and officials must also apply the rules consistently and without **bias**.
- **Equality** relies on all athletes being treated fairly (regardless of their personal differences). No athlete should be discriminated against or excluded from any involvement in a physical activity or sport because of their age, race, gender, religion, ability level or sexual orientation.

Overall, competing on equal terms is essential, otherwise performance cannot be measured properly or fairly. Any unfair competition violates the integrity of sport.

Respect

Respect is another key element of fair play. In simple terms, respect is a feeling of admiration towards a person or thing based on their abilities, qualities or achievements. In a sporting context, showing respect for yourself and others involves:

- following the rules
- accepting and valuing the decisions of others (e.g. coaches or referees) even if you do not agree with them
- valuing the efforts and contributions of all participants.

Another important part of showing respect relates to the actions and behaviour of spectators and supporters. Unfortunately, some spectators verbally abuse and insult players or umpires during performances (as shown in Source 5). This lack of respect for the athletes is in complete opposition to the goals of fair play.

fair competition
observing the rules of a sport and complying with codes of conduct and behaviour; it relies on referees and officials acting fairly and without bias

equality
a concept that relates to being equal in terms of status, rights or opportunities; it means striving for fairness and justice by treating people the same (regardless of their personal differences)

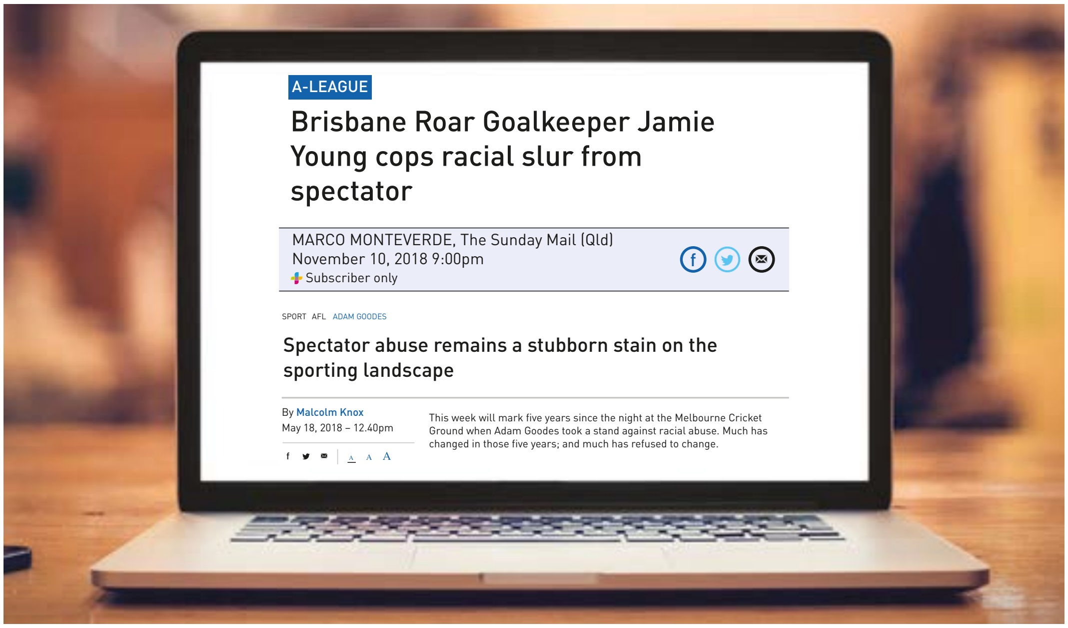
bias
prejudice for or against a particular person or group (especially in a way that could be considered unfair)

respect
a feeling of admiration towards a person (or thing) based on their abilities, qualities or achievements

STUDY TIP

You may have noticed some clear connections between the concepts in Unit 3 – Topic 2: Ethics and integrity and Unit 2 – Topic 2: Equity – barriers and enablers.

To improve your understanding, revisit and revise Chapter 5 (pages 252–321) in *Physical Education for Queensland Units 1 & 2.*



SOURCE 5 Spectators who abuse players or officials are not showing respect or upholding the concept of fair play.

Team spirit

team spirit
a term used to describe feelings of pride, loyalty and solidarity shared among the members of a group, enabling them to cooperate and work together as a single unit

The development of **team spirit** contributes to fair play when teammates encourage each other to demonstrate respect, push each other to be better and appreciate the joy of sporting contests.

Team spirit can be developed by:

- setting personal and team goals
- discussing and agreeing on shared team values
- setting clear expectations and keeping lines of communication open (including players knowing and accepting their roles)
- participating in team-building activities.

The development of team spirit helps players to understand that, although individuals can be strong on their own, a team is more than the sum of its parts. In addition, sharing a moment of victory with your team is the ultimate pleasure. A team that celebrates the success of younger players, shows support for those who are injured and celebrates individual members for the different roles they play, can develop a strong culture that leads to success on and off the field.

Respect for written and unwritten rules

In this section, we have discussed the importance of observing the written rules (i.e. the formally documented regulations governing a sport) in some depth. However, if the goals of fair play are to be fully realised, athletes, coaches and officials also need to be mindful of a number of unwritten rules (e.g. a set of expectations, qualities or values that are known and understood by a group but have not been formally documented).

Some of the most common unwritten rules in sport and physical activity include:

- **Act with integrity** – As we have already learnt, integrity is the quality of being honest and having strong moral principles. Although no rule book will include this as a requirement, it is essential to fair play. Participation in sport within a sound ethical framework is key if you strive to be a true champion.

- **Show solidarity –** Solidarity is a sense of unity and understanding between people with a shared goal. It includes a willingness to support others to reach a common objective. Solidarity means that healthy rivalry between opponents during competition need not exclude friendship and respect.
- **Practise tolerance –** Tolerance is a willingness to accept behaviour, decisions, people or things that you may not agree with. Practising tolerance can be challenging, especially during competition as decisions you may not agree with (e.g. referee calls) can be the deciding factor when it comes to winning or losing.
- **Show care –** Care involves showing consideration for doing something correctly to avoid damage and risk. It can also mean showing mutual respect for all players as this can bring mutual success on and off the field. True champions care about each other because they know that healthy competition breeds success and drives each competitor to be their best.
- **Strive for excellence –** The quest for excellence is one of the things that drives every sporting champion. When the motivation and desire to be an outstanding athlete comes from a range of sources (i.e. intrinsic and extrinsic), athletes often embody the spirit of excellence.
- **Experience joy –** Experiencing the joy and fun that sport and physical activity can bring requires athletes to tap into the feelings of happiness that made them want to play the sport in the first place, even during the toughest training session or fiercest competition.

In many cases, displays of 'true sportsmanship' are the result of athletes and teams embodying these unwritten rules (i.e. displaying these characteristics, values and qualities) even when they are not officially required to. An example of this is discussed in the Theory in action on the next page.

3.3 Check your learning

Engage and understand

1 **Identify** the seven elements of fair play.

2 In your own words, **explain** the difference between fair play and fair competition.

Analyse and apply

3 **Create** an ending to complete this sentence: 'A fair and honest performance is ...'

4 Read the Theory in action 'Neymar goes viral'. In a written response of 150 words, **apply** the elements of fair play to **determine** whether you think the media and members of the public (on social media) were justified in condemning Neymar's actions.

Evaluate and justify

5 **Discuss** the following statements with a partner and **decide** if you agree or disagree with each one. Provide reasons to **justify** your position in each case.

a It's only cheating if you get caught.

b It's the referee's job to catch wrongdoing. The athletes and coaches have no responsibility to follow rules.

c If an umpire makes an incorrect decision, athletes should correct them to ensure the contest is fair and honest.

Check your obook assess for the following additional resources and more:

» **Student book questions**
3.3 Check your learning

» **Weblink**
Official website of 'Play by the Rules'

» **Weblink**
Understanding fair play in sport

3.4 Developing personal values and ethical behaviours

That's a goal!

By the end of Section 3.4, you should be able to:

→ **define** the term 'personal values' and **identify** your own personal values
→ **describe** the roles that family, peers, coaches, school and the community play in the development of personal values
→ **describe** some core values of sport and physical activity in Australia.

SOURCE 1 A selection of personal values

Defining personal values

Personal values are the principles, standards of behaviour and qualities that every person relies on to help them guide how they live their life. Every decision you make – in your personal life, at school or during sport – is influenced by your personal values to some extent. In short, personal values reflect the things we care about most in life.

Some of your personal values may change over the course of your life – as you get older or as your personal situation changes – while others will remain constant.

It is important that you are aware of your own personal values, as they will provide you with primary data for this unit. Source 1 lists around 50 personal values. Look carefully at these values and try to identify those you feel best describe you personally, or that you aspire to. This should help you to determine and articulate your personal values.

'Somewhere behind the athlete you've become – and the hours of practice and the coaches who have pushed you – is a little girl who fell in love with the game and never looked back ... play for her.'

Mia Hamm

SOURCE 2 American soccer legend Mia Hamm made her debut for the USA national team when she was 15 and quickly became the face of women's soccer. In 2012, ESPN named Hamm the best female athlete of the last 40 years. Despite all this, Mia never lost sight of her personal values and reasons for playing the game.

Factors influencing the development of personal values

When it comes to sport and physical activity, a number of different factors can influence the development of someone's personal values. The most common factors are:

- **family –** members of your immediate and extended family (e.g. parents or guardians, siblings, aunties and uncles, cousins, grandparents)
- **peers –** friends and others of a similar age
- **coaches –** instructors, mentors and training staff at your sporting club
- **school and community –** teachers, administrators, sponsors and community groups.

As a whole, these groups of people are referred to as **agents of socialisation**. They are the people in our lives who teach us how to act and behave in society. Along the way, these people also play a significant role in the development of our personal values.

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

agents of socialisation
the people in our lives from whom we learn the types of behaviours and values that are expected of us in society (e.g. parents and guardians, siblings, friends, teachers and coaches)

Family

Family has a significant impact on the development of personal values relating to sport and physical activity. Parents can pass on attitudes and values relating to sport and physical activity in general, or to particular sports and physical activities. Either way, these influences can have a lifelong impact on the development of a child's personal attitudes and values regarding sport.

In many cases, the personal values of a parent will have a direct influence on the development of the personal values of their children – this is also true for siblings and members of the extended family. This influence affects not only the types of sports and physical activities that children are interested in watching and participating in, but also the way in which they behave while they are participating (e.g. how they act during training and competition).

Different families will place different emphases on what they see as the most important personal values of sport and physical activity. For example, one family may value winning competitions as the most important aspect of sport and physical activity, while another may value the social aspect of sport (e.g. teamwork, friendship, fun) and yet another may value the hard work and dedication of training as the most important aspect. As a result, children growing up in each of these three families will likely develop very different personal values relating to sport.

SOURCE 3 Family members (such as parents, guardians and siblings) have the most significant impact on the development of personal values relating to sport and physical activity. The values of fun, togetherness, respect and responsibility can all develop as a result of participating in physical activities with family.

Peers

After family, a person's peers (i.e. friends and people their own age) are generally the most influential when it comes to the development of personal values in sport. In fact, research shows that as children get older, the influence of family members decreases and the influence of close friends becomes more important.

When we interact with our peers, we learn explicitly and implicitly about values and behaviours that are seen as acceptable or unacceptable. Many children and adolescents are also influenced by the desire to 'fit in' and 'belong' to a peer group. As a result,

Sport Australia
a federal government agency in Australia responsible for providing strategic leadership and allocating funding for sporting activities at a national level (formerly known as the Australian Sports Commission)

peers can not only influence the way a person behaves during sport but also their personal values around sport. For example, if members of a person's friendship or peer group display negative values and behaviours (e.g. bullying or teasing), this may cause them to tolerate or even take part in similar behaviour. On the other hand, peers who demonstrate strong leadership qualities and ethics can have a positive influence on teammates' behaviours and values on and off the field.

Coaches

Coaches can play a significant role in the development of a person's personal values around sport and physical activity. Coaches can model positive or negative values and behaviours. For example, you may have been exposed to a junior coach who valued winning over having fun, which might have influenced your thinking and personal values about the goal of sport and encouraged you to think about your values more deeply. Coaches who model positive values such as respect – for players, opponents, spectators and officials – or who value and reward effort over results can create an environment where players develop positive personal values.

SOURCE 4 Coaches can model positive or negative values and behaviours.

SOURCE 5 Sport Australia believes that all Australians should embrace the principles and values included in the Essence of Australian Sport.

School

For many young people, school provides their first or only exposure to recreational or competitive physical activity. While a school's curriculum plays a role in shaping attitudes to physical activity, it is teachers who will ultimately influence the personal values that students develop. 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.

In the same way that families influence personal values and attitudes to sport, so too do different teachers. Some may value winning and talent over anything else, while others may value the lifelong health benefits that sport can bring. Either way, when teachers have a passion for sport, they use their expertise, enthusiasm and commitment to give students positive experiences and support them to develop positive values.

Community

A person's personal values are also influenced by the community in which they live. Generally speaking, a community includes the people that live in your local area. It may include family friends, local business owners, members of different sporting teams and clubs, and so on. Although you may not realise it directly, the values of all of these people have an influence on the development of your personal values about sport and physical activity. For example, your sporting club may be sponsored by one or more local businesses. Over time, it's likely that the values of the people who own and operate these businesses will have some influence on the values of your club and therefore your personal values too.

In addition to the people in your local area, the term 'community' can also be used to refer to people who live in your region, state or country. For example, at a national level, organisations such as **Sport Australia** provide guidance and training for athletes and coaches that is designed to encourage the development of core values (e.g. fairness, respect, responsibility, safety) for anyone involved in sport. As shown in Source 5, Sport Australia suggests that these values be demonstrated by everyone involved in Australian sport, from grassroots through to elite/professional level.

Finally, as a result of **globalisation**, it's arguable that we're all members of a global community. This means that, on some level, our personal values are shaped and influenced by people, events and media external to Australia.

globalisation
a term used to describe the increasing interconnection and interdependence of countries around the world (on a range of economic, cultural, political and environmental issues)

PERFORMANCE SKILL DRILL 3.4

Determine your personal values and ethical behaviours in physical activities

>> Turn to pages 334–335 to complete this integrated physical performance activity.

3.4 Check your learning

Engage and understand

1 In your own words, **define** the term 'personal values'.

2 Look carefully at Source 1 and use the table below to complete the following tasks listed.

a In column A, **select** and record five personal values that you feel best describe you (or are most important to you) in relation to sport and physical activity.

b In column B, **explain** your reasons for selecting each one.

c In column C, **identify** the factor (i.e. family, peers, coaches, school or community) that has had the biggest influence on the development of this personal value.

A Personal value	B Reason	C Factor

Analyse and apply

3 Look carefully at Source 5. In a written response of 150 words, **consider** whether the members of your PE class and/or your teacher demonstrate the four core values identified by Sport Australia in the 'Essence of Australian Sport' poster.

Evaluate and justify

4 'Sponsorship of sport and physical activity by companies whose products cause harm to individuals and society is unethical.' Conduct some additional research online to find examples of sponsorship deals that may fall into this category. **Discuss** this statement with your classmates and prepare a short written summary that **synthesises** the key points.

5 Look at Mia Hamm's statement in Source 2.

a **Discuss** Hamm's statement in relation to her personal values and **justify** whether you believe this view is relevant for all elite sportspeople.

b **Devise** a strategy that could be used with your own sporting club or team to help players remember the joy of their first games.

Check your obook assess for the following additional resources and more:

» **Student book questions**
3.4 Check your learning

» **Weblink**
Official website of 'Sport Australia'

» **Weblink**
Link to 'The essence of Australian sport' developed by Sport Australia

3.5 The influence of ethical values and ethics strategies on fair play and integrity

That's a goal!

By the end of Section 3.5, you should be able to:

→ **explain** how ethical values and ethics strategies can influence fair play and integrity in sport and physical activity

→ **identify** a range of ethics strategies (e.g. codes of behaviour, codes of conduct, rules and policies) that are being used in a range of settings (i.e. classroom, school and community) and **explain** how they support ethical behaviour and fair play in these settings.

Defining ethical values

ethical values a term used to describe a specific group of principles, characteristics or standards of behaviours that most people in a community or society would associate with ethical behaviour

Ethical values is a term used to describe a specific group of principles, characteristics or standards of behaviours that most people in a community or society would associate with ethical behaviour.

Unlike personal values, which can differ based on what different people consider to be important to them, ethical values are a more clearly-identified group of values that are prized (i.e. highly regarded and valued) by the members of a society. Although they are not always written down, and can change over time, the ethical values of a society are generally communicated and agreed on by its members through:

- its laws
- political and public debates
- the policies and actions of public institutions (e.g. schools, police)
- official reports and campaigns produced by government agencies
- information presented in the media.

In Australian society, some examples of ethical values include:

- equality of opportunity for individuals (i.e. regardless of their age, sex, race, religion, ethnic background or sexual orientation)
- respect for the freedom and dignity of the individual and a 'fair go' for all
- respect for the rule of law
- tolerance, fair play and compassion for those in need.

SOURCE 1 Ethical values are essential for influencing fair play and integrity in team sport.

Defining ethics strategies

By comparison, **ethics strategies** are any plans of action created with the goal of promoting ethical values, ethical behaviours and fair play. More often than not, ethics strategies include a number of tools designed to help the strategy succeed. These tools include things such as:

- codes of behaviour and codes of conduct
- rules and policies (including **risk management**).

We will now examine each of these tools in more detail.

ethics strategies
any plans of action created with the goal of promoting ethical values, ethical behaviours and fair play

risk management
the identification, assessment and implementation of control measures designed to reduce or remove potential safety and wellbeing hazards

Codes of conduct and codes of behaviour

Codes of conduct and codes of behaviour are two of the most common and reliable ways in which sporting clubs and organisations implement ethics strategies.

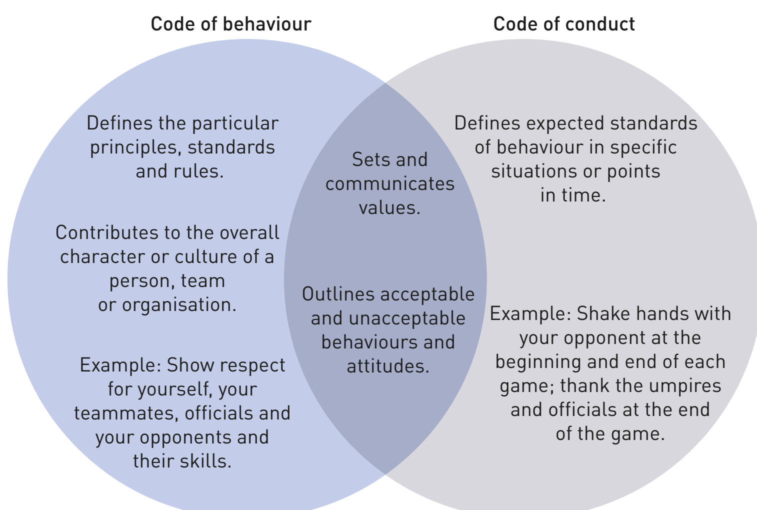
You have probably heard both terms used interchangeably in general conversation and, although they are very similar, there are a few technical differences between them. As discussed earlier in this chapter:

- **codes of conduct** are formal documents that outline the principles, standards and rules of a particular sport, team or organisation (and describe the possible penalties and sanctions for breaches of these rules)
- **codes of behaviour** are documents that set out the expected standards of behaviour for members of a particular group, team or organisation (and describe the possible penalties and sanctions for breaches). They generally have a focus on the expected behaviours for members who publicly represent the team during training, competitions or club-sanctioned activities (e.g. players, coaches, administrative staff).

Source 2 examines some key differences between the two codes and provides examples to illustrate these.

Codes of conduct and codes of behaviour can both support and encourage people involved in a range of different sports and physical activities to:

- understand the official rules and become familiar with the penalties or sanctions for breaches of these rules
- understand the minimum standards of conduct and behaviours expected of them
- recognise and promote ethical behaviour
- resolve conflicts with transparency and fairness (i.e. through application of the codes)
- communicate and promote the ethical values of the sport to all stakeholders (i.e. participants, coaches, officials, members and the wider community).



SOURCE 2 Despite their differences, codes of conduct and codes of behaviour are both tools designed to achieve ethics strategies.

Rules and policies (including risk management)

FOR THE RECORD!

In March 2018, the Tongan Minister of Education, Penisimani Fifita, issued a ban against girls playing rugby in state-funded schools. Mr Fifita asserted that 'it's against Tongan traditions and culture for girls to play rugby'. This led to a public outcry in Tonga and around the world. The Tongan Prime Minister subsequently reversed the decision.

Another tool that sporting clubs, facilities and other organisations use to help them successfully implement ethics strategies and encourage fair play is a clearly structured set of rules and policies. These rules and policies are generally agreed upon by the officials and administrators of a club in consultation with its members, sponsors and investors. Rules and policies can govern a whole range of different matters, both general and specific, including:

- membership conditions, registration requirements, fees and payments
- the expected behaviour of members and guests (e.g. sideline behaviour, on and off field)
- technical aspects of the game
- the safe use of equipment and facilities
- safety and security issues relating to club facilities (e.g. emergency evacuation procedures, incident and first aid management)
- team selection guidelines
- uniform policies
- inclusion
- governance and management
- doping
- corruption
- child protection
- social media
- data protection and privacy.

SOURCE 3 Nick Kyrgios receiving medical attention during a Davis Cup match. The International Tennis Federation (the organisation that manages the Davis Cup tournament) has a number of rules and policies that relate to the provision of first aid to players during tournaments.

Each of these policies can be used to help clubs implement ethics strategies to support fair play and integrity. Many of the rules and policies that are common across clubs are a requirement of state or federal law, or are a requirement that clubs need to enforce in order to receive government funding through Sport Australia. Consistent and ethical governance of resources, facilities and sport infrastructure is important as it can support equal opportunities for all Australians to engage in physical activity and sport.

SOURCE 4 Many sporting clubs have a policy that requires potential new members to register their interest via an application form. Only once they have read and agreed to the rules and policies of the club will they be accepted.

Risk management

Risk management is an important sub-section of many sporting clubs' rules and policies. It involves the identification, assessment and implementation of control measures designed to reduce or remove potential safety and wellbeing hazards. Risk assessments are important as they enable potential hazards to be identified so that control measures and safety requirements can be implemented.

For example, state and federal laws require sport and physical activity providers to promote and protect the safety and wellbeing of children and young people. Risk management strategies related to child protection in schools and clubs includes developing codes of conduct for teachers, coaches and volunteers, and ensuring that all employees are properly qualified for their roles and hold relevant Working with Children Checks.

3.5 Check your learning

Engage and understand

1 In your own words, **define** what is meant by the term 'ethics strategy'.

2 **Explain** the difference between a code of conduct and a code of behaviour.

Analyse and apply

3 **Explain** why risk management is important for sport and physical activity providers.

4 The Queensland Department of Education and Training is responsible for producing the Queensland School Sport Code of Conduct. A link to the code is provided on your obook assess. Read the code online and complete the following tasks.

a **Categorise** each of the requirements of the code based on whether they relate to:

Rules of the game	Individual and/or team behaviour	Other (e.g. safety)

b **Identify** the elements of the code that are directly linked to the concepts of fair play and integrity. Provide reasons to support your decisions.

Evaluate and justify

5 Go online to view the Play by the Rules 'Spectator Behaviour Policy' template. **Modify** the template so it's applicable to spectators at your school's sporting events.

Check your obook assess for the following additional resources and more:

» **Student book questions**
3.5 Check your learning

» **Weblink**
A link to the Queensland School Sport Code of Conduct

» **Weblink**
Tongan Prime Minister overrides 'girls' rugby ban

3.6 The influence of globalisation and mass media coverage on ethical values and behaviours

That's a goal!

By the end of Section 3.6, you should be able to:

→ **define** the terms 'globalisation' and 'mass media' and describe how both have influenced ethical values and behaviours

→ **explain** the ways in which media coverage and globalisation can influence ethical values and behaviours.

Defining globalisation

In simple terms, globalisation is a process that results in the economies, societies and cultures of different regions and nations becoming more integrated and interconnected (i.e. connected and reliant on each other). Although different countries traded with each other and people travelled between these countries in the past, the world's economies, societies and cultures mostly remained separate and independent. However, we are increasingly part of a global economy and the different aspects and traditions of the world's societies and cultures are blending and integrating to create a global society.

Globalisation is largely the result of a number of important factors. These include:

- **improvements in transportation –** people and goods can now move around the world more quickly and in larger numbers than ever before
- **advances in technology –** the internet and mobile technology have allowed greater communication between people in different countries, bringing them closer together
- **reductions in trade regulations and tariffs –** agreements between a large number of nations and global organisations (e.g. the World Trade Organization) have resulted in free trade agreements that remove taxes and create a global marketplace
- **increased access to labour and skills –** agreements between nations have resulted in huge numbers of people moving around the world for work. Organisations can also now access labour more cheaply and competitively from a range of countries.

SOURCE 1 Sport connects and unites people all over the world.

Globalisation in sport

When it comes to sport and physical activity, globalisation can be defined as the process by which sporting organisations (e.g. clubs, teams, codes) begin to operate on an international scale and/or develop international influence (i.e. financial, social, cultural). We will now explore some of the ways in which the globalisation of sport and physical activity has influenced ethical values and behaviours.

The influence of globalisation on ethical values and behaviours

Sport has a unique ability to unite people all over the world. In this way, it is a kind of universal language that connects people. As more and more sporting events begin to take place on a global scale – in a similar way to the Olympic Games and FIFA World Cup – sport becomes a global commodity that is traded on financial markets. This can have a number of influences on the ethical values and behaviours of particular sports.

The financial issues resulting from globalisation of sport

One of the most observable results of the globalisation of sport is the increased financial value of many sporting clubs and codes. For example, in 2018, *Forbes Magazine* judged American NFL team the Dallas Cowboys (see Source 2) to be the most valuable sporting organisation in the world for the third year running. Valued at US$4.8 billion (A$6.8 billion), the Cowboys have the highest annual revenue (US$840 million) and earnings (US$350 million) of any sporting organisation on the planet. To put this in context, the total value of the Dallas Cowboys is roughly equal to the **gross domestic product (GDP)** of the nation of Fiji in 2018. Although this is astounding, there are many similar examples of professional players and clubs competing in sports such as soccer, tennis, Formula One, golf and cricket at an international level. These earnings can come from a variety of sources:

- gate receipts (i.e. ticket sales and attendance at games)
- sponsorship (i.e. deals with businesses who provide financial support in return for opportunities to promote their brands or products)
- media rights (i.e. deals with various media companies to broadcast games)
- merchandising (i.e. the sale of official club products and services such as branded items of clothing, bags and memorabilia).

gross domestic product (GDP)
a measure of the market value of all the goods and services produced in a period of time

SOURCE 2 AT&T Stadium is the home of American NFL team the Dallas Cowboys. It cost US$1.2 billion to build, which gives an indication of the significant infrastructure generated by a global sport like American football.

SOURCE 3 In 2015, leaked documents linked FIFA (the world governing body for soccer) to acts of bribery, money laundering and corruption. It resulted in arrests and fines, the loss of major sponsors and the resignation of disgraced president Sepp Blatter. After legal costs, FIFA posted a net loss of US$369 million in that year.

Although these financial benefits can be seen as a positive effect of globalisation, they also have the potential for many negative effects. When the potential financial benefits for players, clubs and governing bodies are so high, the motivation to ignore ethical values and behave in unethical ways increases dramatically. Some examples of this include:

- individual athletes acting unethically or breaching codes of conduct in order to gain unfair advantage
- sporting clubs or organisations compromising their ethical values to comply with the wishes or demands of major sponsors, or accepting sponsors that do not align with their values (e.g. sponsorship deals with alcohol and tobacco companies)
- officials breaching codes of conduct or engaging in corrupt practices in return for personal financial gain (e.g. money laundering, accepting bribes from government officials or organised crime in return for lucrative club contracts). An example of this is shown in Source 3.

Other key issues resulting from the globalisation of sport

In addition to the financial effects of globalisation on sport, there are other broad themes to consider. Each of these presents a number of benefits and threats to ethical values and behaviours in sport. Some of these include:

- **the increased involvement of global media companies in sport** – international media corporations (e.g. ESPN, Sky TV, Fox Sports, Eurosport) have an increasing stake in sport and a vested interest in the decisions made by sporting clubs and organisations. Increased media coverage helps teams to promote their sport and creates revenue, which can be used to increase participation, promote ethical values and engage in partnerships with community groups and charities. However, in return for broadcast rights, media companies make demands on officials to change certain aspects of their sport for the benefit of their advertisers and shareholders, such as dictating season dates and playing times
- **the free movement of people and labour** – globalisation has enabled talented athletes from all over the world to travel and access better coaching and training facilities, equipment and support services in their chosen sport. Athletes from some of the world's poorest countries have been given the opportunity to play with some of the world's best clubs or compete for their nation in the Olympic Games. This movement has clear benefits, but also presents many ethical challenges. For example, when developing countries such as Kenya invest heavily in programs and infrastructure to train local athletes and promote the sport of athletics, and then those athletes leave to take positions in teams overseas, the local economy and reputation of the sport in Kenya is negatively affected
- **the production and manufacture of sporting equipment, apparel and accessories** – **multinational** sporting companies (e.g. Nike, Adidas, Under Armour) now have greater access to skilled workers in different countries and can move their production and manufacturing to new locations in order to minimise cost and maximise profits. While this presents huge opportunities for these companies – and for employment in these countries – it does create incentives for people to act in unethical ways. One of the most famous examples of this is discussed in the following In the news article.

multinational
a term used to describe clubs, companies or organisations that operate in many different countries

In the news

How Nike shed its sweatshop image to dominate the shoe industry

ASHLEY LUTZ, BUSINESS INSIDER AUSTRALIA, 6 JUNE 2015

Nike is the undisputed leader of athletic brands. Between its Nike and Jordan lines, the company controls a shocking 62% of athletic footwear brand share in the US, more than four times the combined value of competitors Adidas, Skechers, and Asics.

While many companies strive to focus on a specific demographic, Nike, which has annual sales of $US28 billion, appeals to every generation.

In a recent survey, Nike was named the favourite brand among millennials, beating out names like Apple, Coca-Cola, and Nintendo.

Two decades ago, the company was under major fire for abusive labour practices after outsourcing labour overseas because it was cheaper.

The public was shocked by reports of Indonesian Nike workers earning as little as 14 cents an hour. Disturbing allegations of abuse included stories that a Vietnamese sub-contractor ran women outside until they collapsed for failing to wear regulation shoes.

Customers staged embarrassing public protests at the Olympics and at Nike stores. People began boycotting the brand in droves.

The perception that Nike abused its workers lasted for more than seven years.

SOURCE 4 Protesters alleged that Nike didn't pay workers enough. This led to protests and boycotts of Nike products.

SOURCE 5 Workers pack shoes at a Nike factory in Tangerang in Indonesia.

'The **sweatshop** perception was one of the biggest challenges Nike has faced,' branding expert and University of Southern California professor Jeetendr Sehdev told Business Insider. 'It seemed impossible they could ever shake the perception.'

LAYOFFS AND A TURNING POINT

By 1998, Nike had to lay off staff amid declining sales. That's when then-CEO Phil Knight started to aggressively and publicly make changes within the company. The key to Nike's turnaround was being honest and transparent about the labour issues it faced.

'The Nike product has become synonymous with slave wages, forced overtime, and arbitrary abuse,' Knight said in a public address at the time. 'I truly believe the American consumer doesn't want to buy products made under abusive conditions.'

Nike also raised the minimum wage it paid workers, improved oversight of labour practices, and made sure factories had clean air.

In many ways, Nike has become even more transparent than its competitors about its labour practices, publishing a 108-page report revealing conditions and pay in its factories and acknowledging widespread issues, as well as a complete list of factories it contracted with.

To this day, Nike continues to publish public reports of conditions in its factories.

sweatshop
a factory or workshop (especially in the clothing industry) where manual workers are employed at very low wages for long hours and under poor conditions

The environmental effects of global sport

One final issue that must be considered in relation to the globalisation of sport is the lasting impact it can have on the natural environment. Some of the environmental issues to consider as a result of globalisation include:

- the impact that the construction of large sporting facilities has on the natural environment and ecology (i.e. native flora and fauna) of regions and countries around the world (e.g. the number of new venues constructed for global events such as the Olympic Games can have serious environmental effects)
- the environmental damage inflicted upon the natural environment as a result of increasing numbers of spectators, including the energy they use, the food and resources they consume, and the waste they generate (e.g. around 1.2 million visitors attended the 2016 Rio Olympic Games over 14 days)
- the ecological footprint that athletes, support staff, organisers and spectators generate by travelling large distances to attend sporting events.

Numerous studies have shown that while international sporting events – such as the Summer and Winter Olympic Games, the FIFA World Cup and the PGA tour – generate economic benefits for host cities and nations, they also pay a significant environmental price. The pressure from organisers for host nations to build new facilities and venues can be immense, and lead to unethical behaviours. For example, in preparation for the 1998 Nagano Winter Olympic Games, Fédération Internationale de Ski (FIS) requested the length of the men's downhill course to be increased by 120 metres. Nagano officials originally refused to extend the course because it would damage an ecologically sensitive area of the mountain (and harm a number of native species). After an extended battle, the Japanese organising committee agreed to extend the start line by approximately 85 metres – ignoring concerns for vegetation and wildlife – in order to ensure a longer downhill ski course for athletes.

There are many similar examples where sporting venues are constructed for international events or tournaments that last just a few weeks and after which the venues are abandoned and fall into disrepair (as shown in Source 6).

Golf courses are another example of sporting facilities that can have a negative impact on the environment. The development and ongoing maintenance of golf courses can have negative effects on native wildlife and vegetation. Also, in countries like Australia, the water resources required for their upkeep can be unsustainable.

SOURCE 6 The buildings and sporting facilities constructed to host the 2004 Athens Olympic Games came at a huge financial cost (around A$13 million) and significant environmental impact. Today, nearly all of the facilities – such as this beach volleyball venue in Neo Faliro – lie empty, unused and decaying.

Defining mass media

Mass media is a term used to describe a collection of technologies that are used to communicate messages to very large numbers of people. Today, mass media is made up of:

- **broadcast media** (e.g. TV, film, radio)
- **print media** (e.g. newspapers, magazines, billboards, brochures, pamphlets)
- **digital media** (the internet, social media apps).

mass media
a collection of technologies (i.e. print, broadcast, digital) that are used to communicate messages to very large numbers of people

Information and messages that are communicated via mass media, including advertisements and marketing materials, have enormous potential to influence the attitudes, opinions, values, thoughts and beliefs of the people who are exposed to them. For this reason, mass media is one of the most significant factors influencing ethical values and behaviours in sport and physical activity.

The media has immense power to promote particular sports, reinforce certain attitudes to physical activity and influence ethical values and behaviours in sport. In addition, mass media can influence our engagement with sport and physical activity by constructing stereotypes about gender, ethnicity, religion and social class, and reinforcing perceptions around issues relating to health and wellbeing (e.g. ideal body types).

SOURCE 7 Media has a vital role in bringing live sport to the masses.

The influence of media coverage on ethical values and behaviours

A number of studies have shown that on any given day the average person will spend more time engaging with mass media than they will engaging with members of their own family. For this reason, mass media can be considered an agent of socialisation, meaning that it has significant influence on the ethical values and behaviours of people in society – both positive and negative. It not only reflects the values of society, but it also helps to actively shape them. Source 8 lists a few of the ways in which the media can have a positive and negative influence on ethical values and behaviours in sport.

Positive influences of mass media on ethical values and behaviours	Negative influences of mass media on ethical values and behaviours
→ Promoting the positive values and behaviours of athletes and clubs → Raising awareness and reputation of a variety of sports and activities → Promoting healthy and active lifestyles → Presenting positive and inspiring role models → Promoting fairness, respect and honesty in sport → Exposing all forms of cheating and corruption → Promoting equality by addressing gender imbalances in sport and promoting equal participation rates for males and females → Challenging accepted stereotypes → Celebrating examples of good sportsmanship	→ Promoting the negative values and behaviours of athletes and clubs → Undermining athletes' confidence and careers → Reinforcing inequalities and imbalances by restricting coverage to traditional and/or male-dominated sports → Under-representing people from a diverse range of backgrounds (e.g. different ethnic groups, sexual orientations, levels of physical and mental ability) → Undermining the decisions of referees and officials → Providing coverage that is biased, inaccurate or incomplete → Restricting coverage of live events to pay TV or subscription channels

SOURCE 8 Positive and negative influences the mass media can have on ethical values and behaviours in sport and physical activity

The commercialisation of sport

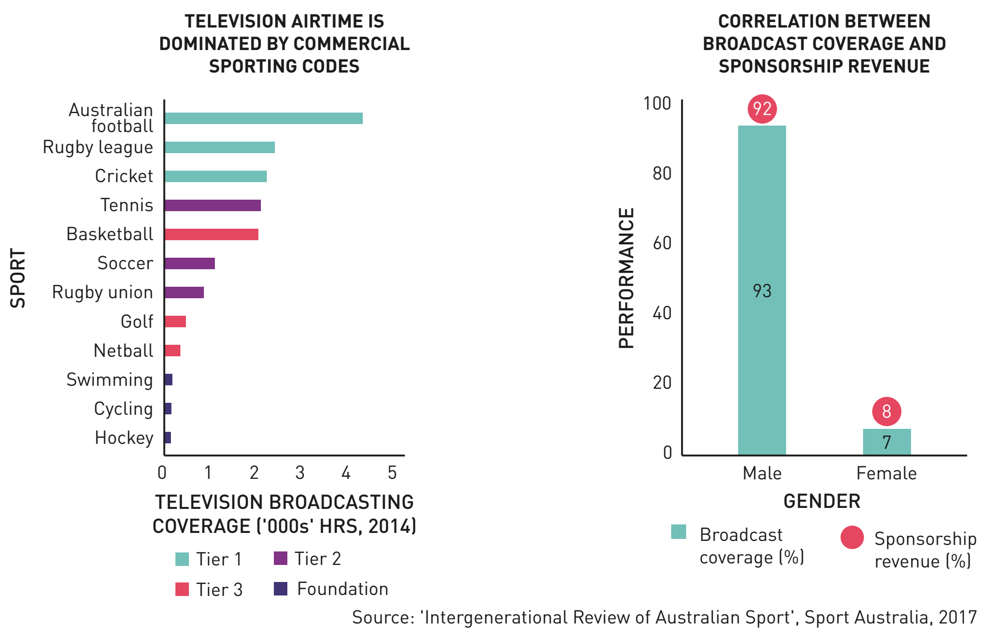
commercialisation the process of managing or running something (e.g. a sporting club or sporting code) primarily for financial gain

commodification the process of turning something with social, cultural or artistic (i.e. non-monetary) value into a commodity (i.e. a product that can be bought and sold)

In 2017, Sport Australia released a report titled 'Intergenerational Review of Australian Sport'. The report analysed a range of different trends relating to participation rates and investment levels in Australian sport over the previous 10 years, including the move towards the **commercialisation** and **commodification** of sport.

On the whole, the report showed that although sport in Australia is becoming increasingly professional and commercial in nature, the benefits of this trend are not being shared evenly across all sports. In many cases, the media is the biggest single contributing factor. As shown in Source 9, television airtime is dominated by just five commercial sporting codes – namely, Australian football (AFL), rugby league (NRL), cricket, tennis and basketball. The report states that, 'the recent round of rights negotiations have resulted in the big commercial sports receiving more than $4 billion for multiyear TV-rights deals – a 60% to 150% increase since the last round of rights negotiations. The success of the big commercial sports significantly increases their financial strength, given the extra flow-on benefits on sponsorship and exposure to future fans and participants.' By contrast, most other sports are experiencing flat or declining television exposure and rights deals. Australian sports like swimming, athletics and cycling receive very limited television exposure outside the Olympic Games and their respective major international championships.

Although there are obvious benefits of media coverage for commercial sports, these can come at a price. As media organisations increase their investment in sporting clubs and codes, their influence over those sports grows. In many cases, these deals mean that media organisations can exert significant pressure on clubs and sporting codes to comply with their wishes and/or modify elements of the game (e.g. shorten/lengthen playing times, adjust rules or change competition schedules, dates and venues) to accommodate peak television viewing periods (see Source 9), television ratings periods, commercial breaks and the demands of advertisers.



SOURCE 9 The Intergenerational Review of Australian Sport revealed ethical concerns related to media coverage of male and female sport.

Another serious ethical concern relates to the representation of female sports on television. According to a study published by Sport Australia in 2014 titled 'Towards a Level Playing Field: Sport and Gender in Australian Media Coverage', 'coverage of women in sport made up 9% of all sports coverage in Australian television news media, while 7% of non-news programming content on television was devoted to female sport. Male sport, on the other hand, occupied 81% of television news reporting, and 86% of non-news programming on television.'

These findings are also supported by a report released by the CSIRO in 2013 titled 'The Future of Australian Sport', which revealed that Australian football, NRL and cricket – all male-dominated sports – account for more than half of all televised sport (see Source 9).

Clearly, this situation raises some ethical concerns that need to be addressed in sport and in the wider community.

FOR THE RECORD!

Supported by Tourism and Events Queensland, the Gold Coast Marathon is a partner event with the Kobe Marathon in Japan and offers special race day packages for Japanese tour groups. Each year, start times for participants in the Gold Coast Marathon are scheduled to coincide with preferred TV viewing times in a range of target markets across Asia and the United States.

3.6 Check your learning

Engage and understand

1 **Define** the term 'globalisation' and briefly **describe** three ways in which it affects ethical values and behaviours in sport.

2 **Define** the term 'mass media' and **describe** its three components.

Analyse and apply

3 Read In the news 'How Nike shed its sweatshop image to dominate the shoe industry' and complete the following tasks.

a **Consider** the ethical values and behaviours of Nike two decades ago and **reflect on** the events that led to the boycott of Nike products.

b **Analyse** the role that globalisation played in this situation.

c **Compare** Nike's production processes today with those that were in place just prior to the boycott. **Explain** the steps taken by the company to restore public confidence.

Evaluate and justify

4 **Discuss** the role that globalisation and the media have played in the commodification and commercialisation of sport in Australia in a 150-word written response. In your response, include three examples to **justify** your position.

5 Look closely at Source 9. Conduct some additional research to **investigate** possible reasons for the stark difference in the television coverage of male and female sport (and sponsorship opportunities).

6 **Propose** three strategies to address the imbalance in the television coverage of male and female sports in Australia.

Check your obook assess for the following additional resources and more:

» **Student book questions**
3.6 Check your learning

» **Student worksheet**
The influence of globalisation and mass media on ethical values and behaviours

» **Student worksheet**
The influence of globalisation and mass media on ethical values and behaviours

» **Weblink**
How ethical is Nike today?

3.7 Ethical dilemmas

That's a goal!

By the end of Section 3.7, you should be able to:

→ **define** the term 'ethical dilemma'

→ **identify** and **analyse** ethical dilemmas in a physical activity context relating to:
- gender inclusion and exclusion
- ability
- enhancements in technology and equipment
- corruption.

Defining ethical dilemmas

An ethical dilemma is a situation in which a difficult choice must be made between two options, even though neither option will result in an outcome that is ethically or morally acceptable.

The tram problem

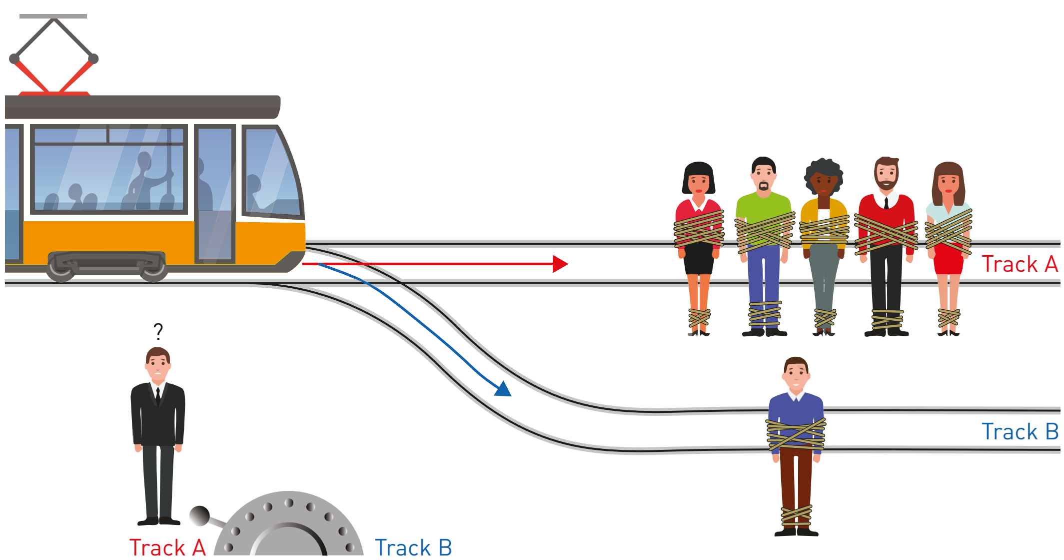
One of the most common tools used to illustrate ethical dilemmas is called the trolley (or tram) problem. It was created by a British philosopher named Philippa Foot in 1967. Consider this scenario:

A runaway tram is travelling out of control down a track (i.e. Track A). Five people are lying in its path, tied to the track. You are standing at the intersection of two different tracks and have the power to pull a lever to divert the tram onto a side track (i.e. Track B) where only one person is tied to the track. You have two options:

1 Do nothing and allow the tram to kill five people.

2 Intervene and pull the lever to divert the tram and kill one person.

Which do you think is the more ethical option?



SOURCE 1 The trolley (or tram) problem is a helpful tool for examining our personal values. It can also be applied to other scenarios we encounter in life.

Ethical dilemmas in sport and physical activity

For the remainder of this section we will investigate four areas in the context of sport and physical activity in which ethical dilemmas often arise:

- **gender inclusion** or **gender exclusion**
- **ability**
- enhancements in technology and equipment
- **corruption**.

gender inclusion
the action or state of welcoming or including people in a sporting club, association or code, regardless of their gender or sex

gender exclusion
the action or state of restricting or excluding people from a sporting club, association or code based on their gender or sex

ability
the degree to which a person possesses the means to do something (i.e. their physical or mental ability) and/or the degree of proficiency or skill a person possesses (i.e. their talent)

corruption
a term used to describe dishonest or fraudulent conduct carried out by those in power (typically for personal financial gain); in sport, it also includes any unethical or illegal activity that aims to deliberately change or alter the result of a sporting contest

Gender inclusion or exclusion

In the context of sport and physical activity, gender inclusion and gender exclusion are both terms used to describe the degree by which a person is given the opportunity to participate, based purely on their sex or gender.

Teams, clubs, competitions and sports that are gender inclusive have policies and strategies in place that:

- welcome people of all sexes and genders
- ensure that people of all sexes and genders are treated equally and equitably
- protect people of all sexes and genders from discrimination
- provide equal rewards and conditions for players, regardless of their sex or gender
- remove barriers to participation that may be the result of a person's sex or gender.

By contrast, teams, clubs and sports that are gender exclusive have policies in place that:

- actively or passively restrict people of all sexes and genders from participating or becoming members
- provide unequal rewards and conditions for players based on their sex and gender
- treat members or participants unequally and inequitably based on their sex or gender
- fail to protect people of all sexes and genders from discrimination.

Understanding the difference between sex and gender

There are three biological sexes recognised under Australian law (i.e. male [M], female [F], and indeterminate/intersex/unspecified [X]), but gender is a more complex and difficult concept to define because it is socially constructed. 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 or female. Put simply, we are born a particular sex, but we learn what it means to be a particular gender.

Examining ethical dilemmas relating to gender inclusion and exclusion

Because gender and sex are such a large part of who we are, there is a high chance of situations arising in sport and physical activity that will result in ethical dilemmas.

Consider how specific sports or physical activities are often associated with particular attitudes, behaviours and genders. For example, sports like rugby are typically associated with displays of physical strength and aggression. These traits – traditionally associated with men rather than women – often result in rugby being thought of as a 'masculine' sport. This can exclude many women from engaging with, or participating in, the sport.

STUDY TIP

Gender inclusion and exclusion is closely related to a topic you learnt about in Unit 2 – Topic 2: Equity – barriers and enablers called 'The social construction of gender'.

It may help you to revisit and revise that information as background to this topic. It is included in section 5.3B of *Physical Education for Queensland Units 1 & 2* (pages 284–286).

FOR THE RECORD!

Did you know that women hold the Guinness World Records for highest and lowest altitude games of soccer?

The records were set in 2017 and 2018, with games taking place on top of Mount Kilimanjaro in Tanzania (5714 m above sea level) and at the Dead Sea in Jordan (400 m below sea level).

The games were organised by Equal Playing Field, recognised by FIFA and featured female professional and semi-professional players from over 23 countries.

Statistics published by Sport Australia and other government departments show that participation rates in physical activity for males and females differ significantly. Although there is a range of contributing factors for this (e.g. family and cultural background, past experiences, genetic disposition, socioeconomic status, geographic location), issues surrounding gender inclusion and exclusion play a significant role.

The 'Intergenerational Review of Australian Sport' (2017) predicted that young women will face the most significant declines in physical activity rates over the next 20 years. This is due to a combination of factors such as 'a less active childhood, an absence of free time' but also 'insufficient flexible and appropriate sporting options when compared to young males'.

Despite the lack of options for women, the last 10 years have seen improvements such as the establishment of the W-League, the Women's Big Bash League, Suncorp Super Netball and the AFL Women's.

In addition to the limited options available to women, one of the biggest ethical dilemmas relating to gender inclusion in sport is the stark differences in wages and conditions for professional male and female athletes. For example:

- in the ranking of the 100 highest-paid athletes, there is just one woman – Serena Williams
- when the US women's soccer team won the 2015 World Cup, they received a US$2 million (A$2.8 million) reward, while their male counterparts were awarded US$35 million ($A48.5 million) for their win the previous year.

In 2015, a dispute over wages for Australia's national women's soccer team, the Matildas, led to strikes by players. There was also criticism surrounding the poor working conditions faced by Australian W-League players in Australia. For example, players were regularly denied minimum workplace conditions such as change rooms, safe training and playing surfaces, and basic medical care. Some players reported that they were forced to change in buses, hallways, under stands or in kitchen areas after games or training sessions because there were no facilities available to them.

Thankfully, female athletes' pay and conditions have been increasing over the past few years. A 2017 global study into prize money conducted by BBC Sport found that, of the 68 sports surveyed, 83% now awarded men and women equal prize money. This is a significant improvement compared to the 2014 study results, which revealed that only 70% of sports had closed the gender prize gap – but there is still some way to go.

A question of gender inclusion and exclusion

Source 2 includes a range of ethical dilemmas for you to consider in light of the information we have discussed so far.

- Should transgender athletes such as Hannah Mouncey be eligible to compete in women's competitions?
- Should the testosterone levels of female runners such as Caster Semenya be measured, and should their participation be restricted on that basis?
- Should the rules of all sports be consistent for men and women (e.g. tennis rules regarding the number of sets)?
- Should female athletes be paid as much as their male counterparts if game attendance is higher for male sports?
- Should the uniforms of male and female athletes in all sports be the same (e.g. consider beach volleyball)?

SOURCE 2 Examples of ethical dilemmas relating to gender inclusion and exclusion in sport and physical activity

Theory in action Equal Playing Field

Many organisations have been successful in raising the profile of gender inequity, either in their own country or around the world. One shining example is Equal Playing Field (EPF).

EPF is a grassroots, non-profit initiative that aims to challenge gender inequality in sport and promote sports development for females around the world, particularly in marginalised countries. They set themselves extraordinary challenges to play record-breaking games, which draws attention to their cause by challenging the norms and expectations around women's abilities.

EPF's volunteer players, coaches, referees and mentors focus on three key areas:

→ opportunity for girls and women to play sport (e.g. worldwide football camps to develop female teams and coaches)

→ respect for all women and girls, particularly those who play sport

→ equality of wages, with women and girls receiving a fair wage to play the sports they love.

Founder Laura Youngson says, 'I hope that in 30 years' time, it won't even be a conversation. It will simply be, you can be a girl and you can play sport and have the same respect as the guys and you can have a living wage to play the sport you want to play.'

SOURCE 3 A dispute over wages led to strikes by players of the national women's soccer team, the Matildas. Thankfully, female athletes' pay and conditions have been improving.

Ability

In the context of sport and physical activity, ability can be used to describe:

- the degree to which a person possesses the means to do something (i.e. their physical or mental ability)
- the degree of proficiency or skill a person possesses (i.e. their talent).

Examining ethical dilemmas relating to ability

Because our ability to move – and the degree of skill and proficiency we demonstrate while moving – is such a large part of who we are as human beings, there is a high chance of situations arising in sport and physical activity that will result in ethical dilemmas.

In this section, we will address two aspects of ability in sport and physical activity that can result in ethical dilemmas. These include:

- **disability** – any physical and/or mental conditions that limit a person's movements, senses or activities
- **talent identification and early specialisation** – the practice of identifying young children with sporting ability and conducting intense training in one sport while excluding other sports.

Disability

The Australian Bureau of Statistics (ABS) and Australian Human Rights Commission (AHRC) estimate that around 20% of Australians have a disability, limitation, restriction or impairment that affects their everyday activities. This is roughly equivalent to 4 million Australians. Some of these disabilities may be hereditary (i.e. passed down in the genes from parent to child), while others are due to accidents or illnesses.

According to the AHRC, 'everyone has the right to be an active member of their community and to have a say in the decisions that affect their lives'. This includes equitable access to physical activity.

para-sport
any sport played by people with a disability or impairment (including physical, vision, hearing, intellectual)

Most sporting associations and codes today have a **para-sport** equivalent. Para-sport exists so that athletes with a disability have equal opportunities to compete and be successful in sport. The term 'para-sport' is now used widely to describe events and sports for disabled athletes because they run parallel to able-bodied sports (i.e. they are similar or take place at a similar time). For example, the Summer and Winter Paralympic Games run parallel to the Olympic Games.

Para-sports operate using a classification system, which groups athletes with similar impairments into categories for competition (e.g. physical impairment, vision impairment, intellectual impairment, hearing impairment, transplant athletes). Classification systems vary across para-sports, but disability groups are separated into varying classifications to ensure fair competition.

Athletes are required to provide medical documentation that details their impairment type and level of impairment. There are specific minimum impairment criteria that athletes must meet in order to be eligible for each sport. This is determined through a classification assessment.

Examples of ethical dilemmas relating to disability

There are many types of ethical dilemmas related to disability that can arise in sport and physical activity. This can include issues such as:

- intentional misrepresentation – when athletes or coaches deliberately mislead medical experts, team officials or event organisers by misrepresenting the type or severity of a disability to gain an unfair advantage over other athletes
- policies and practices at sporting clubs or associations that intentionally or unintentionally discriminate against people with a disability – when policies or lack of facilities (or modifications) at a club limit a disabled person's access
- the types of technologies and equipment that can be used by para-athletes – the possible advantages offered by particular types of equipment (e.g. prosthetics, implants), who has access to the best technology, who can afford it, etc.
- the amount of media coverage and sponsorship that is dedicated to para-sports compared to their able-bodied equivalents – the ability for all people to access and view para-sports.

SOURCE 4 Australian para-athlete Angie Ballard competes at the 2015 International Paralympic Committee (IPC) Athletics World Championships in Doha, Qatar

Talent identification and early specialisation

In 2012, Sport Australia commissioned some research into the historical, social and cultural factors that encourage participation of young people in sport. The research, published in the 'Review of Junior Sport Framework', raised concerns over the growing emphasis on the 'performance ethic' (i.e. a focus on competitive success rather than enjoyment) in Australian sport.

This emphasis is linked to a trend in identifying ability (i.e. talent) in young children and encouraging them to specialise in one sport (to the exclusion of all others). The idea behind this is that athletes who specialise in one sport will develop better technical skills, higher levels of achievement and more competitive success.

Examples of ethical dilemmas relating to early specialisation

There are many types of ethical dilemmas related to early specialisation that can arise in sport and physical activity. They can include issues such as:

- an overemphasis on competition and winning at the expense of broader sporting experiences
- the high rates of overuse injuries and burnout
- a failure to recognise that many young athletes are interested in sport for engagement, enjoyment and health, as well as the chance to make friends
- overly long and strenuous training sessions, games and seasons that conflict with school, recreational, religious or family activities
- the high cost for families of training, coaching, equipment and travel when competing
- early starts and long travel times
- not recognising, appreciating and accommodating cultural, racial and ethnic differences
- creating environments that are not welcoming in terms of language, expectations and inclusion
- practices that make participants self-conscious or uncomfortable about their developing bodies.

In 2017, Sport New Zealand, the national body responsible for government sport and recreation, released a strategic document titled 'Balance is Better'. It outlined their approach to talent development and recommended that balance should be adopted in sport, rather than specialisation and high pressure on athletes to compete and win.

They have addressed early specialisation by encouraging young athletes to explore a range of sports so that they develop a range of skills, greater creativity and better decision-making capabilities. They have valued both time and encouragement as necessary components of an athlete's development, fully recognising the need to support their social, emotional, cognitive and spiritual needs. This holistic focus on the athlete is a refreshing approach in a competitive youth sports world that is increasingly focused on the performance ethic.

SOURCE 5 Sport NZ have implemented several policies to support a balanced and holistic approach to sport and athlete development.

A question of ability

Source 6 includes a range of ethical dilemmas for you to consider in light of the information we have discussed so far.

- Should para-sport athletes be able to compete against able-bodied athletes?
- To be eligible for selection in the interschool competition, should you have to play a club season for your school's team?
- To avoid the complicated athlete classification system, should para-athletes be able to enter events based on the recommendation of their local doctor?
- The NRL prohibits agents signing players before the age of 15, but should it be lowered to 13 (if talent is identifiable from this age)?
- Do you agree with the Australian Rugby League Commission's decision to remove grand finals from Junior Rugby League up until the age of 13?

SOURCE 6 Examples of ethical dilemmas relating to ability in sport and physical activity

Enhancements in technology and equipment

When it comes to sport and physical activity, enhancements in technology and equipment have the ability to shape almost every aspect of the way we participate in, engage with and consume sport. These enhancements can influence everything from simple improvements to the design or function of sporting equipment (e.g. the use of new materials that are lighter or faster), right through to the introduction of new types of scientific or medical techniques (e.g. that improve recovery times for athletes).

Examples of ethical dilemmas relating to enhancements in technology and equipment

There are many types of ethical dilemmas related to enhancements in technology and equipment that can arise in sport and physical activity. They can include issues such as:

- coaching and competition analysis (e.g. on-field cameras and tracking devices embedded into players shoes, helmets and other gear)
- clothing, equipment and wearables (e.g. wearable tech providing athletes with more data about their bodies and performances than ever before)
- science and human performance (e.g. movement analysis and muscle activity technologies such as electromyography revolutionising performance)
- media broadcasting (e.g. digital media and social media making it easier than ever before for fans to contact and interact with their favourite players)
- entertainment (e.g. virtual reality technologies with the potential to revolutionise watching sport, making it possible for spectators to be on the 'virtual field' during play)
- esports (i.e. multiplayer video game competitions), which have increased in popularity and now compete with traditional sports (with predicted 250 million viewers annually by 2020)
- the planning, construction and use of sporting facilities (e.g. new design software and building materials enabling the construction of larger and more advanced sporting stadiums and training facilities).

Some sports have a high dependence on equipment and access to these resources can present ethical dilemmas for organisers and sports administrators. In a school context, access to equipment and technology can be barriers or enablers to participation and development.

Theory in action | Technology and fair competition in triathlon

Triathlon is one example of a sport in which athletes rely heavily on high-quality, technologically advanced equipment to remain competitive.

Colin Leeson, editor of *Age Group Triathlete Magazine*, points out that 'the equipment required to complete the cycling leg can be the difference between finishing on the podium or not'.

As shown in Source 7, many of the items required for the bike leg that offer the potential to improve speed and reduce time (e.g. carbon wheels) can be very expensive. This means that wealthy athletes (or those who have sponsors) can improve their results through the use of such equipment, while others may not be so lucky.

SOURCE 7 Triathletes that do not have the funds or sponsors to purchase expensive equipment may be at a disadvantage during competition.

A question of technology and equipment

Source 8 includes a range of ethical dilemmas for you to consider in light of the information we have discussed so far.

- Should school/junior sporting fixtures be videoed in order to analyse opposing teams?
- Is it the school's/club's responsibility to give teams the best chance of winning by investing in technology and enhancements?
- Should schools/clubs have a policy about the data you can capture on wearable devices?
- Is it the competition organiser's responsibility to ensure a level playing field in terms of technology and enhancements?
- Should enhancements (e.g. hypoxic chambers) be encouraged at all schools because they produce better athletes?

SOURCE 8 Examples of ethical dilemmas relating to enhancements in technology and equipment in sport and physical activity

Corruption

Corruption is a term used to describe dishonest or fraudulent conduct carried out by those in power (typically for personal financial gain). In the context of sport and physical activity, corruption includes any unethical or illegal activity that aims to deliberately change or alter the result of a sporting contest. Corruption in sport also includes the use of performance-enhancing drugs – a practice commonly known as **doping**.

doping
the use of banned performance-enhancing drugs by athletes and competitors during training or competition

FOR THE RECORD!

In 2016, Femke Van den Driessche became the first person to be charged with 'technical fraud' (also known as 'mechanical doping') while competing at the 2016 UCI Cyclo-cross World Championships. Van den Driessche was found with a concealed motor in her bike. She was subsequently banned from the sport for 6 years.

Examples of ethical dilemmas relating to corruption

Corruption can involve a wide range of offenders – from individuals who operate in isolation (e.g. players, coaches, referees, judges), through to large, well-organised groups who work in collaboration with one another (e.g. club and federation officials, crime gangs, criminal syndicates).

Corruption can affect every aspect of how sport is played, managed and promoted, including:

- how matches or races are contested (e.g. match fixing)
- the measures taken to enhance individual or team performance (e.g. the use of performance-enhancing drugs or banned substances)
- the selection and transfer of athletes
- the management of clubs and sporting federations
- the election of officials to governing bodies
- the acquisition of sponsorship, media and marketing rights
- bids to host large sporting events.

In the news

Australia's $46 million 2022 World Cup bid 'never had a chance', says former FIFA boss Sepp Blatter

STEVE CANNANE, ABC, 25 JANUARY 2010

These words were uttered by disgraced former FIFA president Sepp Blatter late last year as he had lunch with former Football Federation Australia (FFA) executive Bonita Mersiades in Zurich.

He was talking, of course, about Australia's bid for the 2022 Football World Cup. The revelations are contained in Ms Mersiades' new book, *Whatever It Takes: The Inside Story of the FIFA Way*, which was launched to a packed room opposite the Houses of Parliament in London overnight.

It would have been nice if the Australian Government had known Blatter's true thoughts in 2008 before it committed $46 million of taxpayers' money to the bid.

At least some of that money is alleged to have been used to help buy votes during a corrupt bid process. FIFA investigator Michael Garcia found there was 'significant evidence' that Australia tried to influence voting through improper payments.

The reason Australia was never going to win?

'You never had a chance because you were never going to be competitive for the broadcasters,' according to Mr Blatter, as quoted in *Whatever It Takes*.

'Not the time zone, not the money. It is obvious. We have to make enough money at the World Cup for the next four years and Australia wouldn't be able to do it.'

Qatar, the eventual winner of the 2022 bid had a similar problem, but according to revelations in Ms Mersiades' book, it found a way around it.

She says Al Jazeera offered FIFA a payment of US$100 million if Qatar won the right to host the World Cup.

SOURCE 9 FIFA president Sepp Blatter announces Qatar as host nation for the 2022 World Cup

One of the best-known examples of widespread, systemic corruption in sport was exposed in 2015 when the world governing body for soccer, FIFA, was engulfed by accusations of bribery, money laundering and corruption. The very public scandal sent shockwaves through the organisation and around the world. It ultimately resulted in arrests and fines for a number of officials, the loss of major sponsors and the resignation of disgraced president Sepp Blatter. One aspect of the case involved Australia's bid to host the 2022 World Cup.

A question of corruption

Source 10 includes a range of ethical dilemmas for you to consider in light of the information we have discussed so far.

- Should performance-enhancing drugs be permissible, given it is so difficult to police?
- Should athletes be drug tested all year round, or just before competitions?
- Should sporting clubs be free to sign on with any sponsorship partner?
- Does the current system for bidding to host football world cups and the Olympics encourage corruption?
- Have sports-betting agencies had a negative or positive effect on the development of the various codes they are involved with?

SOURCE 10 Examples of ethical dilemmas relating to corruption in sport and physical activity

PERFORMANCE | SKILL DRILL **3.7**

Investigate personal responses to an ethical dilemma

>> Turn to pages 336–337 to complete this integrated physical performance activity.

3.7 Check your learning

Engage and understand

1 **Define** the term 'ethical dilemma' in your own words.

2 **Identify** some of the ways in which sporting clubs, teams and organisations can be more gender inclusive.

Analyse and apply

3 **Compare** the issues and factors that affect men and women around the world seeking to become professional athletes. **Create** a Venn diagram to help you structure and present your thoughts.

4 **Consider** the examples of ethical dilemmas related to talent identification and early specialisation. **Reflect on** your personal experiences in sport as a young child and **determine** whether they influenced your sporting participation, enjoyment and/or success.

5 Read the Theory in action 'Technology and fair competition in triathlon' and **consider** how the cost of equipment may present an ethical dilemma for athletes and event organisers in the sport of triathlon.

Evaluate and justify

6 **Create** your own scenario to illustrate the key features of an ethical dilemma. Share your scenario with a partner (or other members of your class) and **discuss** how you would act in response.

7 Read In the news 'Australia's $46 million 2022 World Cup bid "never had a chance", says former FIFA boss Sepp Blatter'. Conduct some online research to **investigate** whether the Australian bid team acted ethically during the selection process for the 2022 FIFA World Cup. **Justify** your position in a 400-word written response.

Check your obook assess for the following additional resources and more:

» **Student book questions**
3.7 Check your learning

» **Student worksheet**
Ethical dilemmas

» **Weblink**
Official website of 'Equal playing field'

» **Weblink**
Femke Van den Driessche becomes the first person to be charged with 'technical fraud'

3.8 The ethical decision-making framework

STUDY TIP

A more detailed version of the ethical decision-making framework (Source 2) is available on your obook assess.

That's a goal!

By the end of Section 3.8, you should be able to:

→ **identify** and **explain** the ethical decision-making framework for exploring ethical dilemmas

→ **apply** the ethical decision-making framework to an ethical dilemma in sport and physical education.

Now that you have completed Section 3.7, you should be familiar with the concept of ethical dilemmas in sport and physical education. You should also have a good understanding of the four aspects of sport in which ethical dilemmas can arise. However, would you feel comfortable dealing with an ethical dilemma in your own life?

In this section, you will be given some practical tools and strategies to help you carefully consider the issues involved in ethical dilemmas and respond to them appropriately, so you can be confident that you are acting ethically and with integrity.

ethical decision-making framework
a five-stage tool that provides a set of simple, practical tips and recommendations that can be used as a guide when responding to any ethical dilemma

Introducing the ethical decision-making framework

Thinking about your values, morals, principles and beliefs – and deciding exactly how you will act in ethical dilemmas – is a complex and difficult task, which can take years to become skilled at. One of the most useful tools to help you analyse and respond to any ethical dilemma is known as the **ethical decision-making framework**.

SOURCE 1 The ethical decision-making framework is designed to assist you to make good ethical decisions in sport and physical activity.

As shown in Source 2, the ethical decision-making framework has five stages. Each stage provides a set of simple, practical tips and recommendations that you can use as a guide when responding to any ethical dilemma. This framework was originally developed by Dr Paul Oliver, Sports Project Advisor with the Australian Human Rights Commission (AHRC). Since its creation, the framework has been used and adapted by a number of sporting agencies, including Sport Australia's National Integrity of Sport Unit and Play by the Rules' Safeguarding the Integrity of Sport forums. *This framework has been adapted for use by the QCAA Physical Education General Senior Syllabus.*

The ethical decision-making framework

Stage 1 – Identify the ethical dilemma Ask yourself:	**Clearly identify an ethical dilemma from class, school or community physical activity contexts** → Does an ethical dilemma exist? What is the ethical dilemma? For example, would you feel comfortable if everybody found out about this (or if it was published in the media)? If not, there is likely to be an ethical dilemma. → Does any tension exist between the values of the player/s and the organisation/s or other stakeholders?
Stage 2 – Find information Ask yourself:	**Investigate the ethical dilemma by determining the facts** → What are the facts of the situation (and what facts are not known)? → Who are the stakeholders involved in this ethical dilemma (i.e. individuals, groups, club officials)? → Are there any rules, policies, codes or laws that apply to the ethical dilemma? → What are the consequences (or potential consequences) of the choices of the people involved? → Have any similar situations or ethical dilemmas arisen in the past? If so, what strategies were used to improve integrity?
Stage 3 – Evaluate alternatives Ask yourself:	**Consider different courses of action and brainstorm possible ethics strategies that will promote integrity and positive engagement and/or solve the ethical dilemma. Assess each of these options.** → How will this strategy produce more good than harm? (i.e. How will you know? Do you need to collect primary data?) → How will this strategy best serve the community as a whole? → How will this strategy comply with existing rules, codes and laws? → How will this strategy encourage stakeholders to act with integrity in future? (i.e. How will you know? Do you need to collect primary data?) Note: If you have chosen a practical ethical dilemma that has arisen within a class, school or community setting, Stage 3 provides you with an opportunity to gather primary data by evaluating alternatives through modification of games. Modifications should aim to improve integrity and positive engagement.
Stage 4 – Devise strategies and implement a course of action Ask yourself:	**Decide on the most appropriate ethics strategy and implement it** → What would be an ideal or acceptable outcome from implementation of this ethics strategy? → What is the best course of action when implementing this ethics strategy? → How does this decision and ethics strategy measure up with your values, sense or purpose and belief about physical activity and sport? → Are you prepared to stand by this decision and ethics strategy if it is opposed by others? (Do you have research that supports your ethics strategy?) → Do you need to use a sounding board or trusted ally (e.g. friend, family member or mentor) to test your decision? → When will you implement your ethics strategy?
Stage 5 – Reflect on the outcome Ask yourself:	**Evaluate the effectiveness of the ethics strategy** → What were the (actual or potential) outcomes of the ethics strategy? → Has the ethical dilemma been resolved (or will it arise again in the future)? → Did the ethics strategy lead to enhanced integrity and positive engagement? → What were the (actual or potential) implications of the ethics strategy? → Were there any unintended effects for any stakeholders? → Where there are knock on effects due to outcomes of the ethics strategy? → Were all stakeholders affected in the way you had intended? If not, why not? → What were the (actual or potential) limitations of the ethics strategy? → Were there any negative size effects? → Would you devise and implement the same ethics strategy again? If not, what would you do differently?

SOURCE 2 The ethical decision-making framework. A more detailed version is available on your obook assess.

The ethical decision-making framework in context

Now that you have been introduced to the ethical decision-making framework and have an idea of the types of questions and actions you need to take at each of the five stages, we will now explore the framework in greater detail and model how it can be applied to a real-life ethical dilemma – Steve Smith and the ball tampering scandal that affected the Australian cricket team in 2018.

As you will see, ethical dilemmas sometimes present themselves quickly and people have very little time to consider their options and make ethical decisions. Other times, events unfold more slowly, allowing people plenty of time to weigh the options. Either way, it's important that you are familiar with the framework so that you can apply it appropriately in a range of situations and the time you have available.

Applying the decision-making framework to the 2018 Australian ball tampering scandal

SOURCE 3 Steve Smith and Cameron Bancroft confess their wrongdoing at a press conference on day three of the third Test between South Africa and Australia.

On 24 March 2018, the Australian men's cricket team was involved in a ball tampering scandal as a result of the actions of some players during the third Test match against South Africa in Cape Town. During the game, Cameron Bancroft was caught by television cameras tampering with the ball (i.e. using sandpaper to make it swing in flight).

After the game, Captain Steve Smith and Vice-captain David Warner were both found to be aware of and/or involved in the incident. All three players received a variety of penalties and sanctions from Cricket Australia and the International Cricket Council (ICC). Although Australia's coach, Darren Lehmann, was not found to have been directly involved, he announced he would step down from his role as a result of the scandal.

Stage 1 – Identify the ethical dilemma

Stage 1 of the ethical decision-making framework requires you to identify the nature of the ethical dilemma by asking yourself a number of questions (see Source 2).

In the Australian ball tampering scandal, Steve Smith chose not to act when he became aware of David Warner and Cameron Bancroft's plan to tamper with the ball in order to give Australia an advantage over South Africa.

This situation highlights the speed at which ethical dilemmas can take place and the complex issues that are involved. Steve Smith had only a matter of seconds to act when he observed David Warner and Cameron Bancroft in the dressing room hatching a plan to apply sandpaper to the ball. When he heard their discussion, Smith reportedly said: 'I don't want to know anything about it.'

If Smith had asked himself any of the questions in Stage 1 of the framework – especially: 'Would you feel comfortable if everybody found out how you acted in this situation (or if it was published in the media)?' – he may have acted differently. In fact, after the event, Smith was quoted as saying: 'If things go pear-shaped, what's it going to look like? If things go well, how does that look? Now it's about learning and almost slowing your thinking down and ensuring that you make the right decisions more often than not.'

Stage 2 – Find information

Stage 2 of the ethical decision-making framework requires you to obtain as much information about the ethical dilemma as you can in the time you have. It supports you in this by providing another set of question for you to consider (see Source 2).

Working through these questions will help you to obtain the facts, identify who is involved and how they are connected, consider if there are any rules, policies, codes or laws that apply to the situation, and encourage you to think about the consequences of your choices.

Ensuring that you are fully aware of the rules, policies, codes or laws that apply to the situation – and complying with them – is probably the best and simplest way to make a good ethical decision. If anything goes wrong, rules and codes of conduct are the first thing investigators fall back on to establish wrongdoing.

In reality, however, certain aspects of the rules, policies or goals of a club or sport may compete with, or contradict, each other making what should be a simple decision much harder. In the case of the Australian ball tampering scandal, Steve Smith faced an ethical dilemma because of the immense pressure on him to deliver a win for Australia. While Cricket Australia has strict rules and policies in place regarding cheating, they also widely promote the goal: 'Elite players and teams – No. 1 in all formats'. As a result, Smith was under intense pressure, both on and off the field, to win the match in South Africa. When Smith chose to ignore the actions of Warner and Bancroft, he prioritised winning the match over following the rules.

SOURCE 4 Part of Cricket Australia's 2017–2022 strategy is to be No. 1 in all formats of the game. Goals like this are often in conflict with other rules and policies, which can create ethical dilemmas for athletes.

Stage 3 – Evaluate alternatives

Stage 3 of the ethical decision-making framework requires you to consider and evaluate a range of strategies or courses of action. Source 2 provides you with a range of questions to develop and refine potential ethics strategies. Within this stage you should reflect on your values, principles and morals to ensure that the options you consider are ethical. You will also need to consider if any of your values are in conflict with one another (e.g. your loyalty to a teammate who may be planning to do something unethical and your honesty to report that behaviour).

When evaluating all potential ethics strategies, you are aiming to identify strategies that produce more good outcomes than bad (i.e. strategies that serve the community as a whole, treat people fairly and equitably, encourage other players to act with integrity, and promote positive engagement). It is also important to ensure that the rights of all stakeholders are recognised so that you don't accidentally discriminate against a group.

Breaking the rules 'just once' or 'bending the rules a little' are examples of behaviours that can lead to what is known as a **slippery slope trap**.

slippery slope trap
a series of small unethical actions (e.g. 'bending the rules') that can develop into more serious unethical behaviour over time

In the case of the Australian ball tampering scandal, Steve Smith failed to uphold his personal values of honesty, fair play and respect for his opponents. Instead, he chose to show loyalty to his teammates and not report their actions. Had Smith applied the framework and considered the issues it highlights, it's likely he would have considered a number of different strategies that were more ethical.

Stage 4 – Devise strategies

STUDY TIP

Remember that using the ethical decision-making is a skill that can be learnt, practised and refined. Applying the decision-making framework might seem challenging at first, but with practice you'll be able to move through this framework confidently. It will help you answer the key question: What is ethical in this situation and what should I do?

Stage 4 of the ethical decision-making framework requires you to decide on the most suitable and appropriate course of action and implement it. It supports you by providing a number of questions (see Source 2).

Your feelings and beliefs about what sport should be (i.e. the purpose of physical activity and sport) are key when committing to one of the strategies you have evaluated in Stage 3. In other words, you need to pick the ethics strategy and course of action you think will best represent your sport, physical activity, and context. Consider the effect that your ethics strategy or action would have on the reputation of your sport, physical activity, and context if your actions became public knowledge.

In the case of the Australian ball tampering scandal, if Steve Smith had chosen to commit to a strategy that aligned with his sense of purpose and belief about what cricket should be (i.e. if he had weighed up whether cricket was more about winning at all costs or more about the honour of competition and the spirit of fair play), it's likely that he would have chosen a different path. Furthermore, if he had thought about whether he would be prepared to stand by his decision (even if it was not popular), the correct course of action is clear.

If the situation had been different, Smith may have had time to consult with a trusted ally or 'sounding board' to test his decision with them.

Stage 5 – Reflect on the outcome

Stage 5 of the ethical decision-making framework requires you to reflect on your strategy and consider how effective it was. Again, the framework provides questions to support your reflection (see Source 2).

In the aftermath of the ball tampering scandal, Steve Smith, who lost his captaincy and was dealt a 12-month suspension, had several issues to reflect on, particularly regarding what he would do differently next time. What began as an incident involving a small number of players quickly developed into an international media sensation that sidelined careers, terminated sponsorship deals and damaged the reputation and integrity of the game – both in Australia and internationally. Smith, who was permitted to play Sydney Grade Cricket during his suspension, said he had struggled at times in the fallout from what happened in Cape Town.

'I've had my ups and downs. I've been really fortunate to have a close group around me that helped me get through those difficult times. There have been some dark days where I

SOURCE 5 Media attention in the wake of the ball tampering scandal was intense and included a lot of anger directed at Captain Steve Smith.

SOURCE 6 An emotional Steve Smith addressed the media in Sydney, saying: 'I take full responsibility ... There was a failure of leadership, of my leadership. I'll do everything I can to make up for my mistake and the damage it's caused.'

haven't wanted to get out of bed and things like that. I've made a mistake and it was a big mistake, and from now on I'm trying to move on from that and improve as a person.'

Overall, the Australian ball tampering scandal highlights the need for better education for all stakeholders of all sports across all levels around what constitutes ethical behaviour – and how to respond when faced with ethical dilemmas. The ethical decision-making framework presented in Source 2 provides a way forward for you when you encounter ethical dilemmas in your personal and sporting life.

PERFORMANCE

SKILL DRILL **3.8**

Use the ethical decision-making framework to devise an ethics strategy and evaluate its effectiveness

>> Turn to pages 338–339 to complete this integrated physical performance activity.

3.8 Check your learning

Engage and understand

1 In your own words, **describe** what the ethical decision-making framework is designed to do and **identify** the five stages.

2 **Explain** how the ethical decision-making framework can support athletes, coaches and other key stakeholders to make ethical decisions in sport.

Analyse and apply

3 **Reflect on** your 'sense of purpose and belief of what sport should be'. (e.g. Is winning more important than participating? Is fun and friendship more important than personal gain?) **Determine** how your personal position aligns with Stage 4 of the ethical decision-making framework and how it might influence the types of strategies you use.

4 **Analyse** a decision you have made (or an action you have taken) in sport that could be considered an example of the 'slippery slope trap'. In a 150-word written response, **reflect on** how the ethical decision-making framework could help you to avoid making a decision like this again in future.

Evaluate and justify

5 In 2018, the Board of Cricket Australia commissioned an independent, not-for profit organisation called The Ethics Centre to 'undertake a review of the organisational culture and governance frameworks that affect its operations and have a wider impact on men's cricket in Australia'. The findings of the review were published in a report called 'Australian Cricket – A matter of balance'. Locate a copy of the report online and read pages 4–12 before completing the task below.
In a 400-word written response, **discuss** the reasons that led to the unethical behaviour of players such as Cameron Bancroft, David Warner and Steve Smith. **Compare** the findings of the report against the types of values included in 'The essence of Australian Sport – What we stand for' released by Sport Australia (see Source 5 on page 118) and **justify** how this situation may have arisen.

6 **Develop** responses to the ethical dilemmas below by applying the ethical decision-making framework.
   a In mixed netball, male players are not allowed to jump while defending female shooters.
   b In volleyball, your teacher allows all the tall players to be on the same team.
   c In tennis, the winners of an in-class doubles tournament automatically receive the highest marks in the class.
   d In basketball, your senior class is timetabled to share facilities and courts with a junior class.

Check your obook assess for the following additional resources and more:

» **Student book questions**
3.8 Check your learning

» **Video**
Using the ethical decision-making framework

» **Student worksheet**
The ethical decision-making framework

» **Weblink**
Further reading on the ethical decision-making framework

3.9 Assessment support – Summative internal assessment 2: Investigation – report

That's a goal!

By the end of Section 3.9, you should be able to:

→ **analyse** and **synthesise** data to devise an ethics strategy about an ethical dilemma relevant to a class, school or community physical activity context
→ **evaluate** an ethics strategy relevant to a class, school or community physical activity context
→ **justify** an ethics strategy relevant to a class, school or community physical activity context
→ **make decisions** about and use language, conventions and mode-appropriate features to **communicate** information about a strategy to inform a technical audience.

Overview of Summative internal assessment 2: Investigation – report

As part of your assessment for Unit 3 of the QCE Physical Education syllabus, you will be required to complete an Investigation – report. The Investigation – report requires you to research an ethical dilemma by collecting, analysing and synthesising primary and secondary data.

This section of the chapter is designed to support you as you complete your own 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.

As part of your Investigation – report, you will be required to investigate an ethical dilemma and identify a class, school or community physical activity context and devise an ethics strategy. It may help you to complete the Investigation – report in two sections. We will work through these sections now in order to model one possible approach for completing the task.

Section 1 – Conduct research

Section 2 – Present your findings in report format

The Investigation – report will be assessed and marked against the assessment objectives contained in the instrument-specific marking guide (ISMG). This means that all parts of the task must be completed in order to maximise your chances of success.

SOURCE 1 This assessment task requires students to devise an ethics strategy about an ethical dilemma relevant to a class, school or community physical activity context.

Section 1 – Conduct research

Section 1 of this task requires you to complete a number of stages of research. You will need to:

- define an ethical dilemma relevant to a class, school or community physical activity context
- gather and analyse primary and secondary data relating to the ethical dilemma
- devise an ethics strategy
- evaluate the ethics strategy.

As you conduct these stages of research, you should refer to the ethical decision-making framework (Source 2 on page 143). The framework will pose a number of relevant questions and will help you ensure that you are considering the issues from all angles. Source 1 will help you align the stages of your research to the relevant stage of the ethical decision-making framework.

Stages of research		Stages of ethical decision-making framework
Define an ethical dilemma relevant to a class, school or community physical activity context	→	Stage 1 – Identify the ethical dilemma
Gather and analyse primary and secondary data relating to the ethical dilemma	→	Stage 2 – Find information Stage 3 – Evaluate alternatives
Devise an ethics strategy	→	Stage 4 – Devise strategies
Evaluate the ethics strategy	→	Stage 5 – Reflect on the outcome

Define an ethical dilemma relevant to a class, school or community physical activity context

To begin your investigation, you will need to identify and define an ethical dilemma that exists within a class, school or community physical activity context. As you have learned, an ethical dilemma is a 'situation in which a difficult choice must be made between two options, when neither option will result in an outcome that is ethically or morally acceptable'.

You may have a specific ethical dilemma in mind that you want to investigate; 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 ethical dilemma that exists within it.

At this point, you should refer to Stage 1 of the ethical decision-making framework. It contains a range of questions you should ask yourself in order to help you to define your ethical dilemma.

Once you have identified an ethical dilemma and decided on the context (i.e. class, school, or community) you will need to express it as a 'should' question.

Example

Ali is a Year 12 PE student and a talented basketball player. Over the past few years, he has been a member of his local basketball club and also competed successfully at state competitions. He has dreams of playing professionally one day and also hopes to be selected for the Australian team.

Ali thinks about an issue he is experiencing in a school context and begins his investigation by defining his ethical dilemma in this way: 'When PE teaching staff are hired to teach the subject at my school, no consideration is given to their sporting background or area of expertise. For this reason, out of a total of 4 PE teachers at my school, three of them have specialised knowledge and experience teaching and coaching touch football.

During my time at the school, I have noticed a strong touch football culture and students who are interested in touch football are receiving more specialised teaching and coaching support than other students. The recipients of major sporting awards at our school are almost always touch football players. Many of these students extend their skills by also playing for a local club that is coached by teachers from our school. This means these teachers and students work together out of school hours to train, compete, and secure sponsorship for club trips and so on. Consequently, the perception among the student body is that the good touch football players have an elevated status; they are almost more like friends with the teachers than students.

By comparison, it seems no one at the school is experienced or interested in teaching or coaching many other sports (such as basketball), even though I suspect many students would love to play something other than touch football if they were given the chance.'

Ali defines this ethical dilemma in the following way: 'Should my school introduce an employment policy that includes a requirement to hire staff with experience and specialist knowledge in a range of different sports to ensure that more students benefit from access to expert teaching and coaching in different sports (and student engagement in different sports can be encouraged)?'

Gather and analyse primary and secondary data relating to the ethical dilemma

Once you have defined your ethical 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 ethics strategy that appropriately addresses the dilemma. The data you gather and analyse should help you explore the relationships between:

- the ethical dilemma
- the influence of local and national stakeholders on the ethics and values demonstrated in the class, school and community physical activity context
- the tensions that exist in relation to integrity and fair play
- strategies that have been used in response to similar ethical dilemmas.

At this point, you should refer to Stages 2 and 3 of the ethical decision-making framework. They will help you to determine the types of questions you will need your primary and secondary data to answer.

Advice for gathering primary data

The primary data you gather will need to show that the ethical dilemma has an impact on people in the class, school or community physical activity context you have selected. It will also need to provide evidence that the feelings, values and ethics of key stakeholders are being affected and to what degree.

Example

Ali thinks about the most relevant types of primary data he could collect and refers to the ethical decision-making framework to read and think about a range of questions that will help guide his thinking.

He decides that the best way to collect primary evidence related to the ethical dilemma is to conduct two surveys:

- one that asks current PE teaching staff about their interests and experience teaching different sports
- one that asks students about their interests and experience in different sports and gets them to give their opinions about the impact that a lack of teacher leadership in particular sports is having on student engagement and enjoyment of physical activity within the school.

Ali thinks that the primary data he collects through these surveys will show if there is any misalignment between the expertise of the teaching staff and the interest of students in particular sports.

STUDY TIP

Creating a table is an easy way to compare the pros and cons of possible strategies (or courses of action) and decide on the best one. A table like this can also be included in your report as an appendix as evidence of your research.

Devise an ethics strategy

Once you have gathered and analysed the primary and secondary data which you will use in your analysis of your ethical dilemma, you will need to determine an ethics strategy which will best serve the class, school or community and their engagement in physical activity. It is useful to be able to implement a version (or aspects) of this strategy, if possible, to be able to collect more primary data which justifies the development of the strategy. If your context does not allow for the implementation, your secondary data can be utilised to analyse devised strategies and determine which strategy would provide the best course of action.

At this point, you should refer to Stage 4 of the ethical decision-making framework. It will help you develop an ethics strategy that provides an appropriate course of action in response to the ethical dilemma.

Example

After analysing and synthesising a range of primary and secondary data, Ali devises an ethics strategy.

The ethics strategy involves making an amendment to the school's employment policy (and adding some specific requirements to the job description of PE teachers and training staff at the school). The amendment makes it a requirement for the school to:

- take the sport-specific teaching and coaching experience of all potential PE teachers into account during the hiring process
- advocate for a range of different sports and broaden the sporting expertise of teachers at the school so that specialised tuition for a range of physical activities can be provided
- provide opportunities for all students to find enjoyment and engagement through a wide range of sports and physical activities.

Ali justifies his ethics strategy by using the data he has gathered.

Evaluate the ethics strategy

In order to evaluate the effectiveness of the ethics strategy you have developed, you will need to consider:

- the potential outcomes of the strategy – i.e. you will need to use the data to predict whether the ethics strategy you have devised will be effective within your context
- the potential implications of the strategy – i.e. you will need to predict whether there may be some unintended (i.e. knock-on) effects of the implementation of your ethics strategy
- the potential limitations of the strategy – i.e. you will need to predict whether the ethics strategy may have any issues (i.e. problems).

At this point, you should refer to Stage 5 of the ethical decision-making framework. It will help guide you through your reflection.

STUDY TIP

If you are able to implement an ethics strategy, ensure that you gather primary data to justify your evaluation.

Example

If Ali's school were to implement this ethics strategy, he believes it has the potential to:

- increase the number of sports with specialised teaching support at the school over time; increase student engagement and participation rates in a range of sports other than touch football (i.e. outcome)
- may result in a decline in the prominence/popularity of touch football at the school over the longer term (i.e. implication)
- may result in teachers with a background/specialization in touch football feeling undervalued at the school or being attracted to teaching positions at other schools that favour touch football over other sports (i.e. problem).

Ali uses the primary data he collected in her surveys to support these predictions.

He will also need to use this data to predict the implications and limitations of the strategy.

Section 2 – Present your findings in report format

Unlike the Project – folio, your Investigation – report needs to follow a specific format. Section 1.2B on pages 16–19 of the Physical Education toolkit 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 will also provide a number of tips and suggestions for referencing and crediting sources in your report.

3.9 Check your learning

Engage and understand

1. **Access** an up-to-date version of the Physical Education syllabus and locate the instrument-specific marking guide (ISMG) for summative internal assessment 2: Investigation – report. A link to the syllabus is available on your obook assess. Read the assessment objectives and marks allocated for each one.
   a. **Identify** the areas of the task you think will be most challenging.
   b. **Identify** some techniques that you can use to help you perform well in these areas.
2. **Identify** ethical issues you have encountered within class, school or community physical activity settings.
   a. **Select** one of the ethical issues you have identified.
   b. **Explain** how you would gather primary or secondary data on this issue.

Analyse and apply

3. Consider the sample coach codes of conduct available on Play by the Rules website. **Design** a GPAI that would assist a coach to collect data on their coaching behaviours.

Check your obook assess for the following additional resources and more:

» Student book questions
3.9 Check your learning

» Video
Assessment support for Summative internal assessment 2: Investigation – report

» Weblink
A link to the ISMG for Summative internal assessment 2: Investigation – report (© QCAA)

CHAPTER 3 REVIEW

Sum it up!

3.1 **Ethics** is a set of principles and values that help us to judge what is morally 'good' or 'bad'; 'right' or 'wrong'. A system of ethics usually develops between members of particular social groups (e.g. friends, families, social or sporting clubs, communities, societies and nations) over a period of time until they become a set of accepted **norms** (i.e. normal, typical, expected or accepted behaviours).

Integrity is the quality of having strong **morals** and **personal values**.

3.2 Ethics and integrity help to promote **positive engagement** in sport and physical education (i.e. participation that sets a good example, both for those who play and watch the sport, and for the wider community)

Sporting clubs and codes set expectations around ethical behaviours and provide ongoing training and support to stakeholders. Many clubs and teams use the following tools to support and encourage ethical behaviour:

- **a code of conduct**
- **a code of behaviour.**

3.3 **Fair play** means following the rules of competition and showing respect, fairness, friendship and tolerance to others (both on and off the field).

The elements of fair play include: observing rules; demonstrating appropriate attitudes and behaviours; eliminating forms of exploitation; fair competition and equality; respect; team spirit; respect for written and unwritten rules.

3.4 **Personal values** are the principles, standards of behaviour and qualities that every person relies on to help them guide how they live their life. When it comes to sport and physical activity, a number of different factors can influence the development of someone's personal values.

3.5 **Ethical values** is a term used to describe a specific group of principles, characteristics or standards of behaviours that most people in a community or society would associate with ethical behaviour.

Ethical strategies are any plans of action created with the goal of promoting ethical values, ethical behaviours and fair play. More often than not, ethical strategies include a number of tools designed to help the strategy succeed. These tools include things such as:

- **codes of behaviour** and **codes of conduct**
- **rules** and **policies** (including risk management).

3.6 **Globalisation in sport** is the process by which sporting organisations (e.g. clubs, teams, sporting codes) begin to operate on an international scale and/or develop international influence (i.e. financial, social, cultural).

Mass media is a term used to describe a collection of technologies that are used to communicate messages to very large numbers of people.

3.7 An **ethical dilemma** is a situation in which a difficult choice must be made between two options, even though neither option will result in an outcome that is ethically or morally acceptable.

In sport, most ethical dilemmas relate to one of the following areas: **gender inclusion or exclusion; ability; enhancements in technology and equipment; corruption**.

3.8 The **ethical decision-making framework** is a tool used to help people analyse and respond to ethical dilemmas.

3.9 The assessment for Unit 3 – Topic 1 is an **Investigation – report**. You will be required to investigate one ethical dilemma in a class, school or community physical activity context and devise an ethics strategy.

Dig deeper!

Exam-style revision questions and tasks

Section 1

→ Ten multiple-choice questions

QUESTION 1

Ethics is

(A) a decision-making framework.
(B) a set rules for living life.
(C) a set of principles and values that help us to judge what is morally 'good' or 'bad'; 'right' or 'wrong'.
(D) a code of conduct.

QUESTION 2

An ethical dilemma is any situation in which

(A) a person must make a difficult decision.
(B) a difficult choice must be made, when no available option will result in an outcome that is acceptable.
(C) a difficult choice must be made that breaks any written or unwritten rule.
(D) a person must make a decision somebody else does not agree with.

QUESTION 3

Which of the following groups has the most significant impact on the development of personal values by children and young people?

(A) Family
(B) Peers
(C) Coaches
(D) School and community

QUESTION 4

In simple terms, globalisation

(A) generally has a negative effect on ethics.
(B) results in the increased involvement of global media companies in sport.
(C) is a process that results in the economies, societies and cultures of different regions becoming more interconnected.
(D) is responsible for the increased financial value.

QUESTION 5

In a sporting context, codes of conduct and codes of behaviour both

(A) recognise ethical behaviour.
(B) restrict player involvement.
(C) contain values that stakeholders are expected to conform to over time.
(D) set and communicate values and outline acceptable and unacceptable behaviours and attitudes.

QUESTION 6

Stage 1 of the ethical decision-making framework is:

(A) Evaluate alternatives
(B) Find information
(C) Identify the ethical dilemma
(D) Devise strategies

QUESTION 7

The globalisation of sport is

(A) the increased ability of sporting organisations to generate revenue by selling television rights.
(B) the expansion of regional sports tournaments and competitions to new geographic areas.
(C) the process by which sporting organisations begin to operate on an international scale.
(D) the expansion of regional sports tournaments and competitions to new geographic areas.

QUESTION 8

In sport, the four of the most common areas in which ethical dilemmas arise are

(A) gender, mass media, enhancements in technology and equipment, and corruption.
(B) gender, ability, enhancements in technology and equipment, and corruption.
(C) gender, ability, enhancements in technology and equipment, and globalisation.
(D) gender, ability, mass media, competitive coaching and corruption.

QUESTION 9

Mass media can be considered an agent of socialisation. This means it

(A) has significant influence on the ethical values.
(B) has significant effects on the popularity of various sporting codes.
(C) can challenge existing stereotypes and promote examples of good sportsmanship.
(D) can reinforcing inequalities by restricting coverage.

QUESTION 10

Fair play means

(A) winning at all costs.
(B) observing rules.
(C) showing respect and tolerance on and off the field.
(D) respecting your opponents.

Section 2

→ Three short-response questions

STIMULUS 1

A memo sent to all coaches at Gumnut State High School from the head coach.

To: All coaches
From: Rob Citizen – Head coach
This season, it is imperative that we see an improvement in our school's sporting results. Please ensure that you take necessary measures throughout the season to guarantee an improvement in our results across all sports. These measures may include (but are not limited to): • Increasing training times • Playing strongest players whenever possible • Targeting strong opposition players. Cheers, Rob

QUESTION 11 (150 words)

Examine Stimulus 1 and **assess** whether the strategy outlined by the head coach at this school adheres to the elements of 'fair play'. Provide examples to **justify** your response.

STIMULUS 2

During a game of Under-12 soccer, a parent verbally abuses an umpire because he disagrees with a ruling.

QUESTION 12 (150 words)

Reflect on Stimulus 2 and **assess** the potential impact of this parent's behaviour on the child's integrity and engagement in physical activity now and in the future. In your assessment, consider the role of agents of socialisation on the development of personal values.

STIMULUS 3

An extract from a newspaper article.

Giro d'Italia: Richie Porte docked two minutes
BARRY RYAN, CYCLING NEWS, 19 MAY 2015

Australian loses time after taking help from Orica-GreenEdge

Richie Porte (Sky) has been docked two minutes by the race jury after he received an illegal wheel change from Orica-GreenEdge's Simon Clarke following his puncture in the closing kilometres of stage 10 of the Giro d'Italia from Civitanova Marche to Forlì.

UCI rule 12.1.040 prohibits 'non-regulation assistance to a rider from another team' with a two-minute penalty and a fine of 200 Swiss Francs for a first offence ...

'If that's not Aussie mate ship then what is? Punctured and Clarkey gave me his front wheel ...' Porte wrote.

QUESTION 13 (150 words)

Examine the data provided in Stimulus 3. Although Australian cyclists, Simon Clarke and Richie Porte did not respect the written rules of their sport, **discuss** whether their actions still support other elements of fair play.

SECTION 3

→ One extended response question

STIMULUS 4

A Year 12 Physical Education class at a coeducational school plays a mixed game of touch football. The following data on ball possession was collected during the game.'

Boy with possession	Girl with possession
𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 II	𝍸 II

QUESTION 14 (400 words)

Analyse the data from Stimulus 4 to **identify** an ethical dilemma faced by the class. **Apply** the ethical decision-making framework to **devise** an ethics strategy to help optimise integrity and engagement for all.

Practice assessment task

This practice assessment task was prepared according to the specifications in the *Physical Education 2019 v1.1 General Senior Syllabus*. It has not been endorsed by the QCAA.

Subject	Physical Education	**Instrument number**	IA2 (i.e. Summative internal assessment 2)
Technique	Investigation – report		
Unit	3 Tactical awareness, ethics and integrity and physical activity		
Topic	2 Ethics and integrity		

Conditions			
Duration	5 hours of class time		
Mode	Written	**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.
Resources available	Refer to Section 4.5 – Assessment of the *Physical Education 2019 v1.1 General Senior Syllabus*		

Context

Throughout this unit, you have engaged in integrated learning experiences to explore ethics and integrity concepts in a class physical activity context. To enhance positive engagement in physical activity, you have explored how ethical values influence fair play and integrity, and how ethics strategies can be used in response to ethical dilemmas.

Task

Investigate one ethical dilemma in a class, school or community physical activity context.

Devise one ethics strategy to provide a course of action in response to the following ethical dilemma in the school senior Physical Education context:

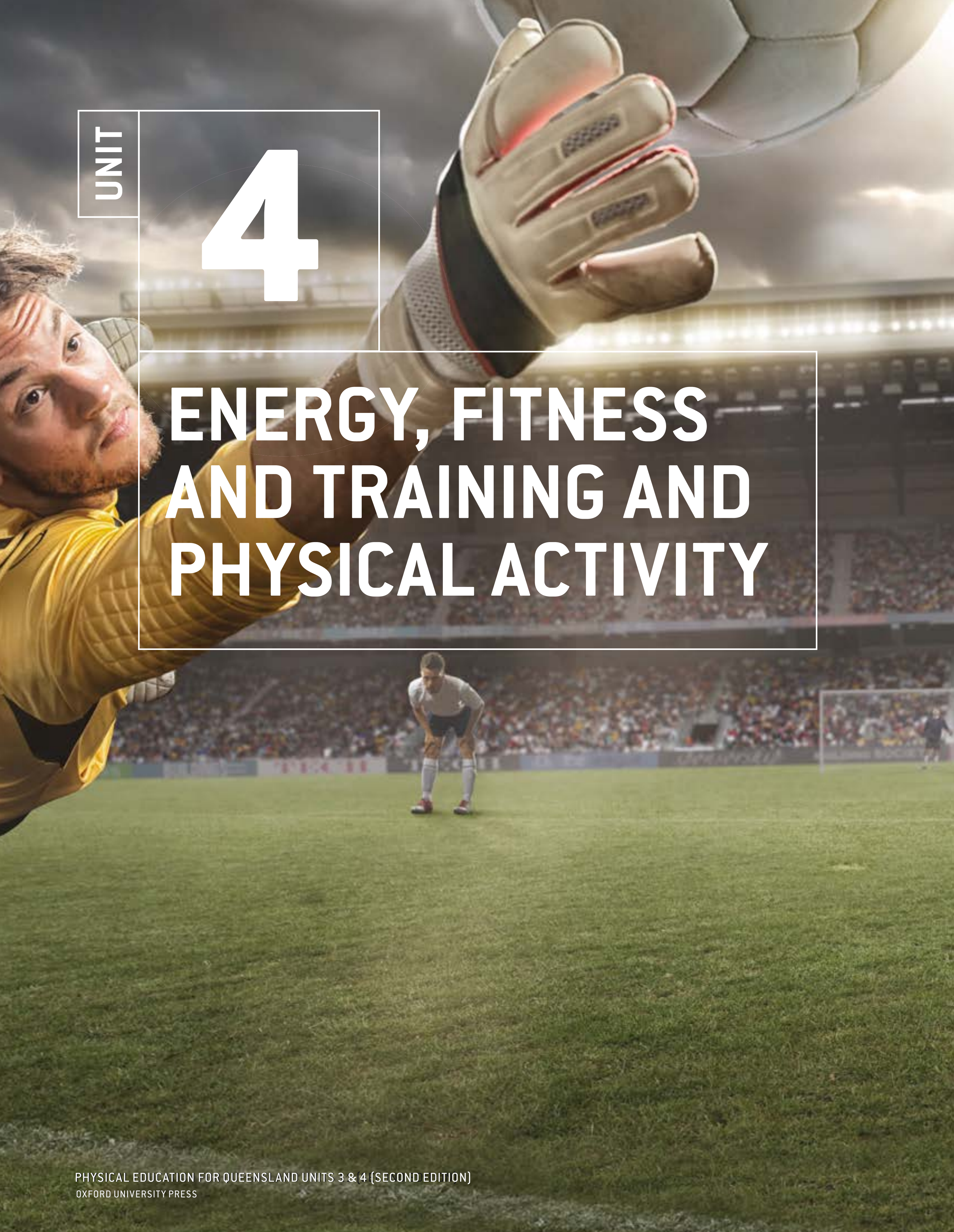
Students who fail to bring the full school PE uniform will be excluded from participating in the physical performance activity.

Evaluate the effectiveness of the devised ethics strategy to optimise integrity and positive engagement for students in senior Physical Education.

Detailed instructions for this task (including a copy of the ISMG) are available on your obook assess.

Check your obook assess for the following additional resources and more:

- **assess quiz**
  Test your skills with this auto-correcting multiple choice quiz for Chapter 3
- **Revision notes**
  Make your own revision notes with this handy template designed to help you prepare for assessment tasks
- **Data analysis worksheet**
  This worksheet helps you to practise analysing secondary data and writing extended responses
- **Practice assessment task**
  A printable and editable version of the practice assessment task in for Chapter 3 (including ISMG)



UNIT

4

ENERGY, FITNESS AND TRAINING AND PHYSICAL ACTIVITY

UNIT 4 OBJECTIVES

In this unit you will:

- → recognise and explain energy, fitness and training concepts and principles about the selected physical activity
- → demonstrate specialised movement sequences and movement strategies in the selected physical activity
- → apply concepts to specialised movement sequences and movement strategies in the selected physical activity
- → analyse and synthesise data to devise a training strategy
- → evaluate training and movement strategies
- → justify training and movement strategies
- → make decisions about and use language, conventions and mode-appropriate features for particular purposes and contexts

UNIT 4 TOPICS

The learning for this unit is covered in one topic. The table below shows how this topic aligns with the chapters in this book and lists the notional hours of teaching time.

Topic	Chapter	Notional hours
Topic 1 Energy, fitness and training integrated with one selected 'Invasion', 'Net and court' or 'Performance' physical activity	Chapter 4 Energy, fitness and training	55

Note to teachers and students:

To enable the integration of the subject matter of Topic 1 – Energy, fitness and training, the selected physical activity must come from one of the 'Invasion', 'Net and court' or 'Performance' categories. Schools must select a physical activity from a different category to Unit 3.

'It's not the will to win that matters – everyone has that. It's the will to prepare to win that matters.'

Paul 'Bear' Bryant (1913–1983)

American college football player and coach best known as the head coach of the University of Alabama football team. During his 25 years as head coach, Bryant celebrated six national championships.

CHAPTER

4 ENERGY, FITNESS AND TRAINING

KEY TERMS

By the end of this chapter, you should understand the meanings of the following key terms. They are defined throughout the chapter, as well as in the glossary. Use this handy checklist to test your understanding.

- ☐ active recovery
- ☐ acute physiological adaptation
- ☐ adenosine triphosphate (ATP)
- ☐ aerobic capacity
- ☐ aerobic glycolysis
- ☐ aerobic interval training (AIT)
- ☐ aerobic system
- ☐ aerobic training zone
- ☐ agility
- ☐ amino acids
- ☐ anaerobic glycolysis
- ☐ anaerobic training zone
- ☐ annual plans
- ☐ ATP cycle
- ☐ ATP–PC system
- ☐ carbohydrates
- ☐ chemical energy
- ☐ chronic physiological adaptation
- ☐ circuit training
- ☐ circulatory system
- ☐ competition phase
- ☐ components of fitness
- ☐ compound exercise
- ☐ conditioning phase
- ☐ continuous training
- ☐ distress
- ☐ dynamic flexibility training
- ☐ energy systems
- ☐ eustress
- ☐ exercise physiology
- ☐ fartlek training
- ☐ fats
- ☐ fatty acids
- ☐ fitness–fatigue model
- ☐ fitness profile
- ☐ flexibility training
- ☐ game analysis
- ☐ General Adaptation Syndrome (GAS)
- ☐ glucose
- ☐ haemoglobin
- ☐ heart rate recovery
- ☐ high-intensity interval training (HIIT)
- ☐ individuality
- ☐ initial training values
- ☐ inter-session recovery
- ☐ interval training
- ☐ intra-session recovery
- ☐ isokinetic resistance training
- ☐ isolated exercise
- ☐ isometric (static) resistance training
- ☐ isotonic (dynamic) resistance training
- ☐ kilojoules (kJ)
- ☐ lactate threshold training zone
- ☐ lactate turn point (LTP)
- ☐ lactic acid system
- ☐ loading-recovery pattern
- ☐ long slow distance (LSD) training
- ☐ macrocycles
- ☐ maximum heart rate (MHR)
- ☐ mechanical energy
- ☐ mesocycles
- ☐ microcycles
- ☐ muscular endurance
- ☐ muscular system
- ☐ overtraining
- ☐ passive flexibility training
- ☐ passive recovery
- ☐ peak
- ☐ periodisation
- ☐ phosphocreatine (PC)
- ☐ physiological adaptation
- ☐ physiology
- ☐ plyometric training
- ☐ point of failure
- ☐ pre-competition phase
- ☐ preparatory phase
- ☐ principles of training
- ☐ progressive overload
- ☐ proprioceptive neuromuscular facilitation (PNF) training
- ☐ protein
- ☐ recovery training zone
- ☐ repetition duration
- ☐ repetition maximum (RM)
- ☐ resistance training
- ☐ respiratory system
- ☐ resynthesise
- ☐ specialising
- ☐ specificity
- ☐ sprint interval training (SIT)
- ☐ static flexibility training
- ☐ tapering
- ☐ target heart rate (THR)
- ☐ tempo training
- ☐ training load
- ☐ training methods
- ☐ training objectives
- ☐ training phases
- ☐ training programs
- ☐ training session
- ☐ training strategies
- ☐ training zones
- ☐ transition phase
- ☐ triglycerides
- ☐ VO_2 max

SUBJECT MATTER OUTCOMES COVERED IN CHAPTER 4

All of the subject matter dot points you are required to cover in **Unit 4 – Topic 1** of the Physical Education General Senior Syllabus are included in this chapter. The tables below show you exactly where each subject matter dot point is covered.

Unit 4 – Topic 1: Energy, fitness and training integrated with one selected 'Invasion', 'Net and court' or 'Performance' physical activity

In Unit 4 – Topic 1, students engage in learning that involves the integration of Energy, fitness and training subject matter and the subject matter for a selected 'Invasion', 'Net and court' or 'Performance' physical activity.

Stage 1: Engage and understand

Subject matter	Section/s	Page/s
In this area of study, students will:		
→ recognise and explain that energy for physical activity is provided by adenosine triphosphate (ATP)	4.2	173–175
→ recognise and explain that energy requirements for physical activity – involve an on-going process of ATP resynthesis using various fuel sources	4.2	173–175
– are provided by the interplay of three different pathways, known as energy systems	4.3	176–181
– are dependent on the intensity and duration of exercise	4.3	182–184
→ recognise and explain which energy systems are used in physical activity. Energy systems include – ATP–PC – provides energy anaerobically, without oxygen, for high intensity, short duration exercise – lactic acid – provides energy anaerobically, without oxygen, for high intensity, moderate duration exercise, where ATP is resynthesised using muscle glycogen as the fuel, with resulting lactate formation – aerobic – provides energy aerobically, with oxygen, for sub-maximal intensity, longer duration exercise	4.3	176–185
→ recognise and explain how fitness requirements for physical activity are classified as components of fitness and include aerobic capacity, muscular endurance, speed, strength, power, flexibility and agility	4.4	186–195
→ recognise and explain the concepts of VO_2 max and lactate threshold, including onset of blood lactate	4.5	196–203
→ identify and explore the energy requirements for specialised movement sequences of the selected physical activity by considering – how ATP is resynthesised and transferred during performance	4.3	177–178
– the contribution ratios and interplay of the different energy systems during performance	4.3	181–184
→ identify and explore the fitness requirements for the selected physical activity by considering the components of fitness necessary for the specialised movement sequences	4.4	186–195
→ recognise and explain that principles of training for physical activity include – progressive overload – the planned, gradual increase in training load to ensure that fitness continues to be optimised – frequency – the number of times training occurs in a given period – intensity – the magnitude of exertion required – duration – the length of training time – specificity – relevant to the energy system, position-specific movements and fitness requirements of an activity – individuality – considerate of personal needs, goals, fitness levels, motivation and skills – variety – the inclusion of a range of movement options, activities and contexts in training	4.8	212–217

Subject matter	Section/s	Page/s
→ identify and explore training methods for physical activity, which include – flexibility training – to enhance the motion of the body's joints – resistance training – to enhance muscular strength, power and muscular endurance – variations of interval training – manipulation of work periods and rest periods to enhance specific components of fitness and enhance the aerobic, lactic acid and ATP–PC energy systems, e.g. high-intensity interval training (HIIT), sprint interval training (SIT), aerobic interval training – circuit training – to enhance specific components of fitness – continuous training – to enhance aerobic capacity – fartlek training – to enhance aerobic capacity	4.9	218–341
→ recognise and explain how different training phases can be sequenced to form an annual plan, known as periodisation, that includes the preparatory phase, pre-competition phase, competition phase and transition phase	4.11	253–257
→ recognise and explain how the different parts of an annual plan can target a specific or series of energy and/or fitness requirements within a designated period of time; the parts include – mesocycles – a training period of generally 4–6 weeks with a specific training focus – microcycles – a shorter training period, generally one week, with a more specific training focus and made up of a number of training sessions – training sessions – the organised description of activities within an identified time frame	4.11	247–257
→ recognise and explain the features of a training program, including – specific training objectives to achieve a determined outcome – game analysis – work volume, frequency, intensity and duration of exercise – tapering and recovery to achieve the determined outcome for a particular phase	4.6	204–208
→ recognise and explain the features of a training session, including – warm-up – e.g. RAMP (raise, activate, mobilise and prepare) approach designed to ■ raise body temperature, heart rate, respiration rate and joint viscosity ■ activate and mobilise key muscle groups, joints and range of motion ■ prepare for exercise by incorporating dynamic stretching – conditioning phase – specifies the relevant fitness components being developed, training methods used, intensity and volume of work, work:rest (W:R) ratios and repetitions, while following relevant training principles – cool down – gentle cardiovascular exercise and stretching designed to gradually reduce heart rate, body temperature, remove waste products and relax muscles	4.11	254–257
→ recognise and explain the importance of recovery in training, including active recovery, to allow the body to overcome the effects of fatigue and increase readiness for competition or future training	4.10	242–246
→ gather primary data about personal energy, fitness and training requirements for specialised movement sequences and movement strategies in authentic performance environments	Skill drill 4.4 Skill drill 4.5A Skill drill 4.5B Skill drill 4.5C Skill drill 4.12 Skill drill 4.13	340–341 342–343 344–345 346–347 348–351 352–355
→ use secondary data to analyse how energy, fitness and training concepts and principles can influence performance in the selected physical activity.	Chapter 4	160–293

Stage 2: Analyse and apply

Subject matter	Section/s	Page/s
In this area of study, students will: → analyse and synthesise primary data and secondary data about – position- or event-specific fitness testing of the relevant components of fitness to identify personal performance capacities – specialised movement sequences and movement strategies in authentic performance environments to identify the frequency, direction, intensity and duration of movements – work:rest (W:R) ratios – target heart rate (THR) and maximum heart rate (MHR) to identify training zones	Skill drill 4.4 Skill drill 4.5A Skill drill 4.5B Skill drill 4.5C Skill drill 4.12 Skill drill 4.13	340–341 342–343 344–345 346–347 348–351 352–355
→ optimise performance in the selected physical activity by devising one personal competition-phase training strategy for a mesocycle or microcycle that considers the – components of fitness and energy demands of the physical activity – relevant training methods, principles of training and recovery principles – personal performance of specialised movement sequences and movement strategies – training objectives to achieve a determined outcome		
→ implement sessions from the competition-phase training strategy to gather primary data about the outcomes, implications and limitations of decisions		
→ analyse primary data and secondary data to ascertain relationships between the competition-phase training strategy, energy, fitness and training concepts and principles, and personal performance of the specialised movement sequences and movement strategies.		

Stage 3: Evaluate and justify

Subject matter	Section/s	Page/s
In this area of study, students will: → reflect on primary data and secondary data to evaluate the effectiveness of the competition-phase training strategy to achieve a determined outcome including – meeting the energy and fitness requirements of the physical activity – using relevant training principles, training methods and recovery principles – optimising performance of the specialised movement sequences and movement strategies	Skill drill 4.4 Skill drill 4.5A Skill drill 4.5B Skill drill 4.5C Skill drill 4.12 Skill drill 4.13 Chapter 4 review – Practice assessment task	340–341 342–343 344–345 346–347 348–351 352–355 290–295
→ make decisions to maintain or modify the training and movement strategies using evidence from primary and secondary data		
→ justify the development of the competition-phase training strategy and movement strategies using evidence from primary data and secondary data		
→ justify maintenance or modification of the competition-phase training strategy using evidence from primary data and secondary data		
→ make decisions about and use language, conventions and mode-appropriate features to convey meaning for particular purposes and contexts.		

Source: *Physical Education 2019 v1.1 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

» **Chapter glossary**
A printable and editable list of key terms to learn in Chapter 4

» **Flashcard glossary**
A digital interactive to help you test your knowledge of key terms in Chapter 4

» **Weblink**
A link to the QCAA Physical Education General Senior Syllabus]

4.1 Introduction to energy, fitness and training

That's a goal!

By the end of Section 4.1, you should be able to:

→ **understand** and **define** the concepts of energy, fitness and training (commonly known as exercise physiology)

→ **explain** how energy, fitness and training concepts contribute to the effective conditioning of an athlete.

Defining energy, fitness and training

energy
(in the context of sport and physical activity) power derived from fuels (e.g. foods we eat) and used by the body to perform basic bodily functions and produce movement

fitness
a term used to describe the condition of being physically fit and healthy, as well as a person's ability to participate effectively in a particular sport or physical activity

training
(in the context of sport and physical activity) the specific tasks an individual completes to enhance their energy and fitness in preparation for their chosen physical activity

exercise physiology
a specialised field of physiology that studies the short- and long-term effects of exercise on the human body

Energy, **fitness** and **training** are three concepts that underpin the study of sport and physical activity. A thorough understanding of the role that each of these concepts plays in physical activity and performance – together with an appreciation of how all three concepts interrelate – is vital in order for athletes to maximise their potential and perform at their best.

It's common to hear all three terms being used in everyday conversation, but in the context of sport and physical activity, they have quite specific definitions:

- energy – a term used to describe the power derived from fuels (i.e. food) by a range of systems and chemical reactions that take place in the body in order to produce movement
- fitness – a term used to describe the body's ability to efficiently and effectively participate in physical activity
- training – a term used to describe the specific tasks and activities an athlete completes to enhance or improve their energy and fitness in their chosen physical activity.

The study of energy, fitness and training in sport is known as **exercise physiology**. Exercise physiology is a specialised branch of **physiology** that studies the body's response to all types of physical activity (including changes in metabolism and the structure and function of organs such as the heart, lungs and muscles). Exercise physiologists work with athletes to:

- develop training programs that will help them optimise their physical performance
- help them create exercise and training programs that are tailored to their chosen sport
- avoid injury during training and performance
- design recovery and rehabilitation programs in the event of injury.

To do this, they gather information about the athlete and their chosen sport in order to tailor **training strategies** to suit their individual needs and environment.

The continued demand for athletes at all levels to be better, faster and stronger means that a sound understanding of the concepts of energy, fitness and training is essential for all athletes. Not only will it help you get the most out of your training and optimise your performance in your chosen sport, it will also help you train safely and avoid injury.

SOURCE 1 The study of energy, fitness and training in the context of sport and physical activity is known as exercise physiology. It is a specialised branch of physiology that studies the body's response to all types of physical activity.

physiology
a field of science that studies the functions and mechanisms at work within living organisms (e.g. humans, animals and plants)

training strategies
plans developed to improve the performance of an athlete or to help them achieve a goal; training strategies consider the personal requirements of an athlete (e.g. their individual physical and mental characteristics), as well as the requirements of their chosen physical activity (e.g. the physical demands, skills, strategies and techniques needed)

As shown in Source 2, over the course of this chapter, you will learn in detail about each aspect of energy, fitness and training.

Exercise physiology	**Energy** Sections 4.2–4.3	Subject matter covered includes: → the role of food as a fuel source in the production of energy → the role of adenosine triphosphate (ATP) in muscular contraction → the role of energy systems in the resynthesis of ATP → the interplay of energy systems in the resynthesis of ATP.
	Fitness Sections 4.4–4.5	Subject matter covered includes: → fitness requirements for physical activity, specifically, the components of fitness → the role of oxygen, including VO_2 max, physiological adaptation and lactate threshold → conducting a game analysis to understand the energy and fitness requirements of specialised movement sequences for individual athletes and/or particular sports and physical activities.
	Training Sections 4.6–4.14	Subject matter covered includes: → principles of training for physical activity → training methods → fatigue in training → recovery in training → training phases and training cycles in the annual plan → setting training objectives.

SOURCE 2 In Unit 4 – Topic 1 of QCE Physical Education, you will learn about the aspects of energy, fitness and training listed above.

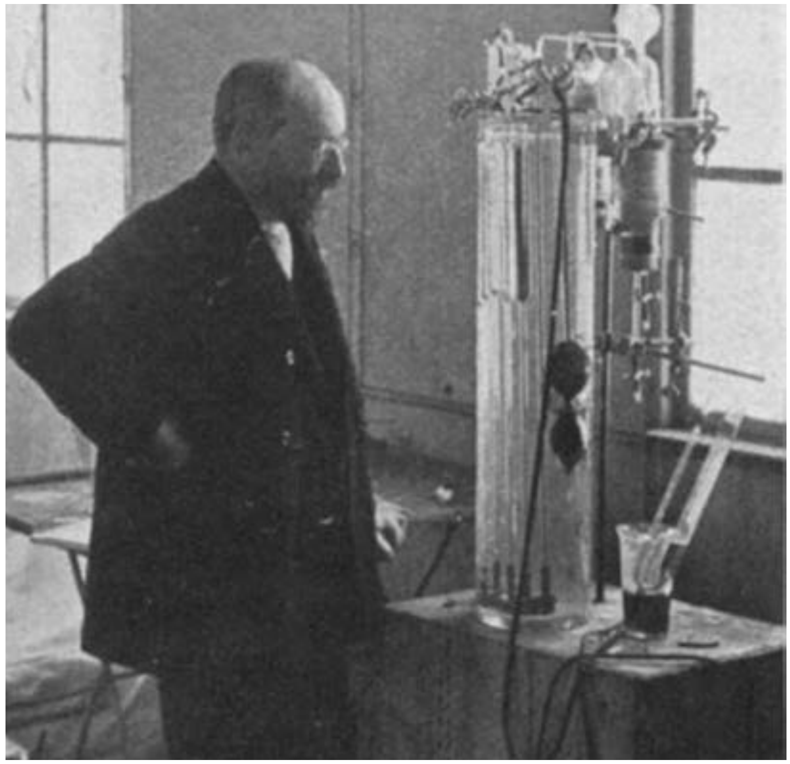
By the end of the chapter, you will be provided with assessment support designed to help you complete Summative internal assessment 3: Project – folio. This section will guide you through the process of devising and evaluating a training strategy. A training strategy is a plan devised to help an individual or team to optimise their performance.

FOR THE RECORD!

The human body has been studied for thousands of years, but the field of science known as exercise physiology is relatively new. One of the pioneers of exercise physiology was a German scientist by the name of Nathan Zuntz. In 1889, Zuntz invented a respiratory apparatus attached to one of the earliest examples of a motorised treadmill. This invention made it possible for exercise physiologists to gather information (in a controlled manner) about how the human body uses oxygen during exercise.

Zuntz later added an X-ray apparatus to his exercise machine, which enabled him to determine the changes in heart volume during exercise. He also built a climate chamber to study exercise under varying – and sometimes extreme – temperatures.

Zuntz's inventions resulted in huge advances in the study of the body's responses to exercise, including research into metabolism, nutrition, respiration, blood gases, exercise and the body's reaction to high altitudes. Many of Zuntz's studies were so pioneering that the results are still relevant today.



4.1 Check your learning

Engage and understand

1 **Define** the terms 'energy', 'fitness' and 'training' in your own words.

2 **Identify** two reasons why an understanding of exercise physiology is essential for all athletes.

3 **Describe** the types of benefits that exercise physiologists can deliver by working with athletes.

4 **Summarise** the contribution made by Nathan Zuntz to the field of exercise physiology. Why do you think he is described as a 'pioneer'?

Analyse and apply

5 Reflect on the subject matter listed in Source 2 and **categorise** the concepts into three groups:
- → 'I have never heard of this concept before'
- → 'I know a little about this concept'
- → 'I am quite familiar with this concept'.

Evaluate and justify

6 From your response to Question 5, select one of the concepts that you are 'quite familiar with' and **discuss** its importance to you with regard to your selected physical activity. You should present your response as a paragraph of approximately 150 words.

Check your obook assess for the following additional resources and more:

» **Student book questions**
4.1 Check your learning

» **Weblink**
A brief history of exercise physiology

» **Weblink**
The father of exercise physiology – Nathan Zuntz

4.2 Energy requirements for physical activity

That's a goal!

By the end of Section 4.2, you should be able to:

→ **understand** and **explain** the role of food in energy production

→ **understand** and **explain** the role of adenosine triphosphate (ATP) in energy production.

Energy requirements of the human body

nutrients
components of food that are absorbed and used by the body to provide energy for physical activity and support the growth, repair and proper functioning of cells, organs and body systems

carbohydrates
a type of nutrient found in food and used as a source of energy; foods high in carbohydrates include grains (e.g. breakfast cereals), starchy vegetables (e.g. potatoes and peas), sugars, fruits and dairy products

protein
a type of nutrient found in food and used as a source of energy; foods high in protein include meat, eggs and dairy products, as well as grains, legumes, nuts and seeds

fats
a type of nutrient found in food and used as a source of energy; foods high in fat include oils, nuts, dairy products (e.g. milk, cheese), avocados, some cuts of meat and oily fish

Whether you are asleep in bed, watching TV on the couch, walking the dog or pushing yourself to your physical limit in a particular sport or physical activity, your body is constantly at work. In order to carry out this work, your body needs a constant source of energy. This energy fuels many different body systems that:

- keep the body functioning – e.g. the circulatory system (that keeps your heart beating and blood pumping around your body), the respiratory system (that keeps you breathing and supplies oxygen to your organs) and the nervous system (that processes information and activates responses in your muscles)
- enable the body to move – e.g. the skeletal system (that gives your body its structure and provides attachment points for muscles) and the muscular system (that enables movement through the contraction of muscles that pull on the bones in the skeleton to produce movement).

The role of food in energy production

The energy needed to carry out these basic bodily functions and to perform physical activities comes from the foods we eat every day. As shown in Source 1, there are three main types of **nutrients** found in all foods. They are:

- **carbohydrates** – grains (e.g. breakfast cereals), starchy vegetables (e.g. potatoes and peas), sugars, fruits and dairy products (e.g. milk, cheese)
- **protein** – meat, eggs and dairy products, as well as grains, legumes, nuts and seeds
- **fats** – oils, nuts, dairy products, avocados, some cuts of meat and oily fish.

Carbohydrates, protein and fats are often incorrectly thought of as foods, when in fact they are components of food known as nutrients. Some foods are higher in certain types of nutrients than others. These nutrients all contain different amounts of chemical energy and are used by the body in different ways. The energy content of

SOURCE 1 The energy needed to carry out basic bodily functions and perform physical activities comes from the foods we eat every day. Nutrients found in foods, such as carbohydrates, protein and fats, contain different amounts of energy.

kilojoules (kJ)
a standard unit of measure used to describe the energy content of different types of foods

chemical energy
a type of energy stored in the bonds of chemical compounds (e.g. atoms and molecules) of certain substances, such as food. Chemical energy is released through chemical reactions and transformed into other types of energy (e.g. mechanical energy)

mechanical energy
a type of energy that an object has when it is moving

different nutrients is measured in **kilojoules (kJ)**. Kilojoules are the unit used to measure the amount of chemical energy provided by various types of foods. This **chemical energy** is converted into **mechanical energy** for movement.

We will now learn about each of these types of nutrients in more detail.

SOURCE 2 The energy we need to fuel the systems that keep our bodies functioning and moving comes from the foods we eat.

Carbohydrates as an energy source

glucose
a simple sugar that is commonly found in many carbohydrates and used as an energy source by the body

glycogen
a substance stored in body tissue that comes from carbohydrates (i.e. a stored form of glucose)

After water, carbohydrates are the most commonly consumed nutrient in the world. Carbohydrates are a great source of energy and are widely found in plant foods such as grains, fruits, vegetables and legumes (i.e. peas, beans, pulses).

Carbohydrates are made up of the elements carbon (C), hydrogen (H) and oxygen (O). This is useful to know, as the term ‘carbohydrate’ is often abbreviated to CHO. Carbohydrates can be categorised as:

- **simple carbohydrates** (e.g. sugar)
- **complex carbohydrates** (e.g. breads, grains, vegetables).

When foods containing carbohydrates are digested, a chemical reaction takes place and they are broken down into **glucose**. Glucose is a type of sugar that easily dissolves in the blood.

During physical activity, glucose can be carried through the blood to the muscles, providing the energy they need. If there is an excess supply of glucose in the body, it can be converted to **glycogen** and stored for later use (mainly in the muscles). As carbohydrates are quickly and easily broken down in the body, they are the fuel of choice in most high-intensity physical activities. The body, however, is only able to store limited quantities of glycogen (compared to energy stored from fats), so energy from carbohydrates is usually used quickly by the body. In fact, most athletes are only able to store enough glycogen for 60 minutes of continuous, vigorous exercise or 90–120 minutes of continuous moderate exercise or 90–120 minutes of continuous moderate exercise. On average, 1 gram of carbohydrate yields around 16 kilojoules of energy.

SOURCE 3 After water, carbohydrates are the most commonly consumed nutrient in the world. Carbohydrates are a great source of energy.

Nutrient type	Food source	Chemical reaction	Broken down into	Stored as	Energy yield
Carbohydrates	→ Sugars → Grains → Cereals → Bread → Vegetables → Dairy	→ Glycolysis → Glycogenolysis	Glucose	Glycogen	1 g carbohydrate = 16 kJ energy

SOURCE 4 The characteristics of carbohydrates

cells
the basic building blocks of all living things; membrane-bound units that contain the fundamental molecules of life

amino acids
the building blocks of protein in our bodies and in the food we eat; they come from the food we eat and are also produced by the body

Protein as an energy source

Protein is required by the body for the growth, maintenance and repair of **cells**. Protein is also required by the body to make enzymes, hormones, haemoglobin and antibodies to fight disease.

When foods containing protein are digested, a chemical reaction takes place and they are broken down into **amino acids**. About 20 different amino acids are found in food, but the number of combinations in which the amino acids can be arranged is unlimited.

Amino acids can be categorised as:

- **essential amino acids** (e.g. those that cannot be made by the body). There are nine essential amino acids that cannot be made by the body, so they must come from the foods we eat.
- **non-essential amino acids** (e.g. those that can be made by the body from essential amino acids).

Under normal circumstances, protein is not used as an energy source during physical activity, because converting amino acids in skeletal muscle tissue into glucose is a slow process and results in the breakdown of muscle tissue. For this reason, using protein as a source of energy during physical activity is strictly reserved for times when glycogen stores in the body have been exhausted and the body has no other option (e.g. in the final stages of extreme endurance events like a marathon). In these cases, skeletal muscle protein can supply up to 15 per cent of the body's energy needs. On average, 1 gram of protein yields around 17 kilojoules of energy.

SOURCE 5 Protein is required by the body for the growth, maintenance and repair of cells.

Nutrient type	Food source	Chemical reaction	Broken down into	Stored as	Energy yield
Protein	→ Meat → Eggs → Nuts → Pulses → Seeds → Dairy	Proteolysis	Amino acids	Amino acids	1 g protein = 17 kJ energy

SOURCE 6 The characteristics of protein

Fats as an energy source

Fats are made up of the same elements as carbohydrates – namely, carbon (C), hydrogen (H) and oxygen (O) – but in different proportions. They are found in both animal- and plant-based foods.

When foods containing fat are digested, a chemical reaction takes place and they are broken down into **fatty acids** that can enter the bloodstream and be transported around the body for use by cells. If there is an excess supply of fatty acids in the body, it can be converted to **triglycerides** and stored for later use. Triglycerides are formed from three fatty acids and one glycerol **molecule**. Fatty acids can be categorised as:

- **essential fatty acids** (e.g. those that cannot be made by the body). These must come from the foods we eat.
- **non-essential fatty acids** (e.g. those that can be made by the body).

fatty acids
the building blocks of the fat in our bodies and in the food we eat; they come from the food we eat and are also produced by the body

triglycerides
the main constituents of natural fats and oils, as well as the chemical form of fat stored by the body; they come from the food we eat and are also produced by the body

molecule
a group of two or more atoms that are bonded together

Our bodies have an almost unlimited capacity to store fat. This means that fat is the most abundant source of stored energy in the human body. On average, 1 gram of fat yields around 37 kilojoules of energy, meaning it yields more than twice as much energy per gram than carbohydrates or protein.

During physical activity, triglycerides are broken down into fatty acids and carried through the blood to the muscles, providing the energy they need. Unfortunately, the process of breaking down and transporting fats is quite time consuming. It also requires sufficient oxygen to be present for the energy from fat to be harvested. This means that fat is not able to be used as an energy source if the intensity of activity is very high (i.e. it is the fuel of choice for low- to moderate-intensity physical activities).

SOURCE 7 Fats are found in both animal- and plant-based foods.

Nutrient type	Food source	Chemical reaction	Broken down into	Stored as	Energy yield
Fats	→ Oils → Dairy products → Meat	Lipolysis	Fatty acids	Triglyceride	1 g fat = 37 kJ energy

SOURCE 8 The characteristics of fats

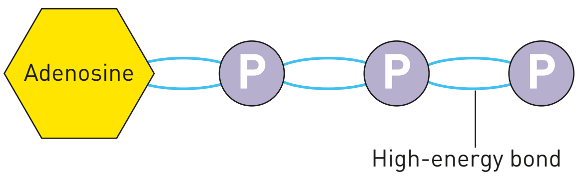
How energy is accessed by the body

As discussed, the energy we need to fuel all of these body systems comes from the foods we eat every day. However, the energy gained from carbohydrates, protein and fats cannot be used directly to carry out basic bodily functions and fuel physical activities. Instead, the chemical energy from these nutrients is processed by the body (i.e. metabolised) to produce an energy-rich molecule known as **adenosine triphosphate**, which is more commonly referred to as ATP.

adenosine triphosphate (ATP)
an energy-rich molecule found in the cells of every living organism that provides the energy required for most bodily functions (especially the muscle contractions that enable physical activity); ATP is made up of adenosine and three phosphate groups

What is adenosine triphosphate (ATP)?

Adenosine triphosphate (ATP) is a complex molecule found in the cells of every living thing, including human beings. In simple terms, ATP captures chemical energy from the breakdown of food molecules and releases it when needed in order to fuel a range of tasks, including moving the muscles.



SOURCE 9 Adenosine triphosphate (ATP) is a complex molecule found in the cells of every living thing. It is made up of adenosine and three chained phosphate groups.

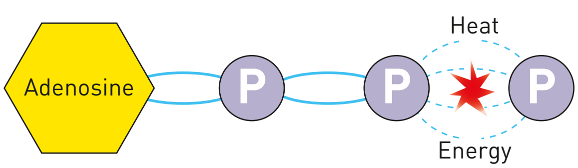
As shown in Source 9, ATP is made up of two parts:

- a compound known as adenosine
- three chained phosphate groups.

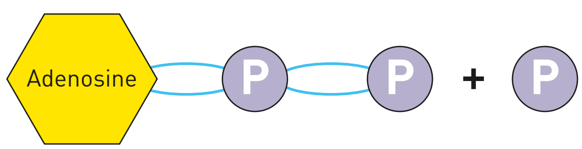
These two parts give ATP its name – adenosine triphosphate (i.e. *tri* meaning 'three').

When ATP is required to power tasks that need to be completed by cells (e.g. when a muscle cell needs to contract in order to cause movement), an instantaneous chemical reaction takes place inside the muscle cells (i.e. energy is realised in a single step).

As shown in Source 10, during an ATP reaction, the high-energy bonds joining the second and third phosphate groups are broken. This releases energy that can be used by the cell to power energy-consuming reactions (e.g. in a muscle cell, this energy powers muscle contractions that result in movement).



SOURCE 10 During an ATP reaction, the high-energy bond joining the third phosphate group is broken and energy and heat are released.



SOURCE 11 Once energy and heat are released, ATP becomes adenosine diphosphate and a separate phosphate molecule.

As well as releasing energy, ATP reactions release heat. This is why the muscles heat up during exercise. This same reaction takes place in all different types of cells within the body (e.g. blood cells, bone cells, skin cells) to produce the energy they need to perform their different functions and drive the body systems we rely on.

As shown in Source 11, the result of every ATP reaction is the creation of an adenosine diphosphate (ADP) molecule (i.e. *di* meaning 'two'), as well as a separate phosphate molecule.

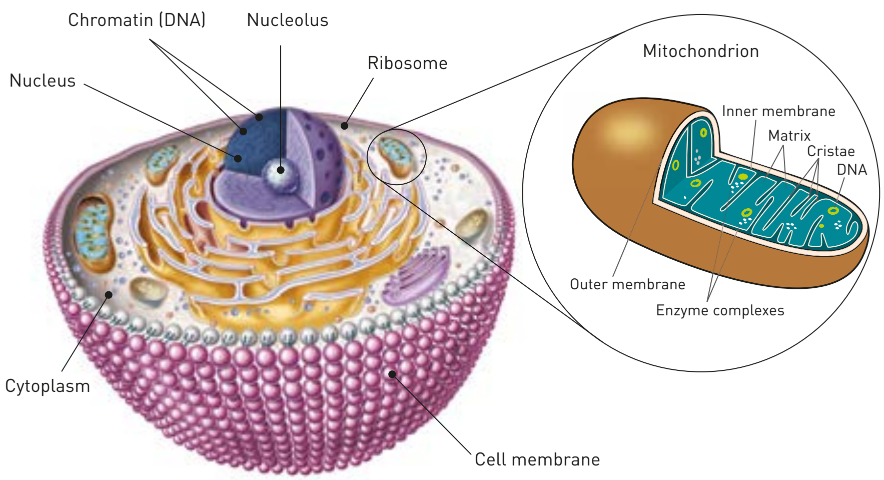
Theory in action | How cells produce ATP

A cell is the basic unit of life. It is called this because it is the smallest unit of an organism that is considered living. However, just as the basic unit of length – the metre – can be broken down into smaller parts (e.g. centimetres and millimetres), a cell is made up of smaller parts, too. Cells are made up of mini-organs known as organelles.

The different organelles in cells all have specific functions. These functions are necessary for the cell to survive. The organelle responsible for producing ATP is known as a mitochondrion (plural mitochondria). Mitochondria are the site of energy production in every cell – a bit like miniature power plants. There can be several thousand mitochondria in a cell, depending on the specific type and function of the cell. For example, skeletal muscle cells contain a lot of mitochondria to make sure we have enough energy to perform physical activity when we need to.

As shown in Source 12, mitochondria are rod-shaped organelles with an inner and an outer membrane. Inside each mitochondrion, a reaction takes place that involves the rearrangement of the atoms in glucose (i.e. from the food we eat) and oxygen to produce water, carbon dioxide and energy (in the form of ATP). This ATP is then used by our bodies to help us move and grow.

It is important to note that ATP is not a storage molecule for chemical energy (i.e. it doesn't function like a battery). That is the job of other substances in the body (such as carbohydrates and fats). Instead, when energy is needed by the cells, it is converted into ATP using energy from carbohydrates and fats. Because of the high-energy bond between the second and third phosphate molecule in ATP, when they separate, energy is released and used where it is needed in the body.



SOURCE 12 The organelle responsible for producing ATP is known as a mitochondrion (plural mitochondria). Mitochondria are the site of energy production in every cell – a bit like miniature power plants.

STUDY TIP

It is important to know and understand the subject matter relating to energy systems well because it is highly likely to be included in multiple-choice questions on the external examination.

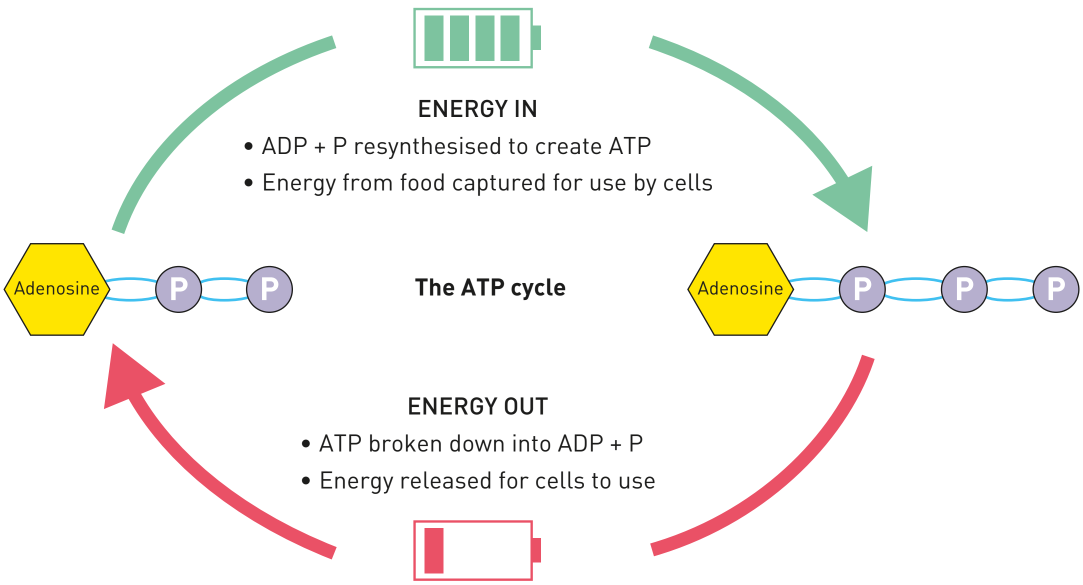
Be sure to know how we use foods as fuel for energy production and the role of energy systems in keeping our bodies moving.

The ATP cycle

Although our cells are continuously breaking down ATP to obtain energy, it is not available in endless supply. To ensure that the body gets the energy it needs at all times, every cell in the body needs to continuously:

- release energy captured in ATP by breaking it down via a chemical reaction that produces ADP and a separate phosphate
- use energy from food to **resynthesise** (i.e. remake) ADP and phosphate into ATP.

This process takes place inside the mitochondria of each cell and is known as the **ATP cycle**. As shown in Source 13, the ATP cycle is a process that simultaneously uses and releases energy. It might help you to think of the process of the ATP cycle in terms of a rechargeable battery.



SOURCE 13 The ATP cycle

resynthesise
to put different elements back together again after being broken apart

ATP cycle
a process that simultaneously releases the energy captured in ATP (i.e. by carrying out a chemical reaction that produces ADP and phosphate) and uses energy to resynthesise (i.e. remake) ATP (i.e. from ADP and phosphate)

4.2 Check your learning

Engage and understand

1 **Define** the term 'ATP' and **describe** the role it plays in supplying energy to the body. Make reference to the chemical structure of ATP in your response.

2 **Identify** the process that is taking place in Source 13. In your own words, **explain** what happens at each stage.

3 **Define** the term 'nutrients' and **identify** the three main types of nutrients found in foods.

Analyse and apply

4 **Compare** and **contrast** the characteristics of the three nutrients found in foods in regard to energy production.

Characteristic	Carbs	Protein	Fats
Commonly found in the following food sources:			
Broken down into:			
Stored as:			
Energy yield per gram:			

5 **Determine** which type of nutrient would most likely be used by the body as a source of energy in the following situations:

a a touch player sprinting away from a defensive player in a breakaway try

b a netball goalkeeper, waiting for the ball to come to his end during a training match

c a marathon runner who had 'hit the wall' in the last 2 km of her race.

Evaluate and justify

6 In a 250-word written response, **discuss** the energy requirements for your selected physical activity in Unit 4. In your response, **assess** whether your current diet is providing the types of energy necessary for you to maximise your physical performance in your selected physical activity. You may need to conduct additional research to complete your response.

Check your obook assess for the following additional resources and more:

» **Student book questions**
4.2 Check your learning

» **Student worksheet**
Energy requirements for physical activity

» **Weblink**
The role of food in energy production

» **Weblink**
How ATP resynthesis powers your body

4.3 Energy systems used in physical activity

That's a goal!

By the end of Section 4.3, you should be able to:

→ **define** the term 'energy system'
→ **recognise** and **understand** the three energy systems used in varying physical activity conditions
→ **determine** the types of training that can be used to enhance each energy system
→ **define** what is meant by the term 'interplay of energy systems'
→ **understand** how energy systems contribute in different ways throughout physical activity
→ **determine** the energy requirements of a selected physical activity.

energy systems
a system used by the body to provide the energy required to resynthesise ATP and ensure that the body has the energy it needs to take part in physical activity. There are three main energy systems used by the body – the ATC–PC system, the lactic acid system, and the aerobic system

ATP–PC system
an energy system that resynthesises ATP anaerobically for use in maximum-intensity activities lasting 0 to 15 seconds

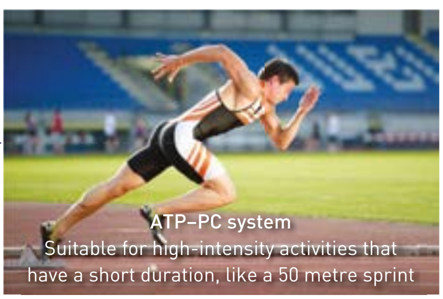
Introducing energy systems

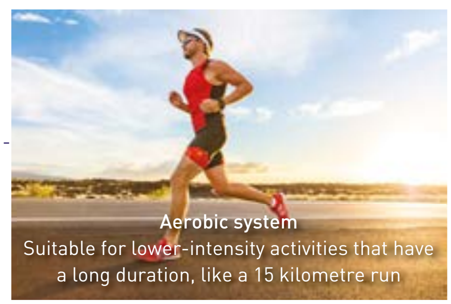
As we have learnt, energy taken from the foods we eat is used by the body to synthesise (i.e. make) and resynthesise (i.e. remake) ATP via a process known as the ATP cycle. The ATP cycle ensures that our bodies have the energy they need to maintain bodily functions and take part in physical activities.

Energy systems

Anaerobic
(i.e. not using oxygen)

Aerobic
(i.e. using oxygen)





SOURCE 1 There are three energy systems in our body that resynthesise ATP, but the way in which they do this is different. This makes them more or less useful to particular physical activities.

It's important to note, however, that the body does not have an unlimited supply of ATP on hand at any time. In fact, the small amount of ATP stored in our muscles cells would only provide enough energy for around two seconds of intense physical activity. Once this supply has been used, the ATP must be replenished through a process of resynthesis for activity to continue. There are three main **energy systems** in the body that power ATP resynthesis and ensure that our body has the energy it needs to take part in physical activity. The three energy systems include:

- the **ATP–PC system**
- the **lactic acid system**
- the **aerobic system**.

Although each of these energy systems essentially does the same thing (i.e. resynthesises ATP), the way in which they do it is different. This makes each energy system more or less suited to particular types of activities. The energy system (or systems) used by the body to resynthesise ATP at any given time depends largely on:

- the intensity of the physical activity being performed
- the duration of the physical activity being performed.

As shown in Source 1, the energy systems can be categorised as:

- **anaerobic** – meaning that the energy system resynthesises ATP without oxygen present
- **aerobic** – meaning that the energy system resynthesises ATP with oxygen present.

We will now learn about each energy system in more detail.

lactic acid system
an energy system that resynthesises ATP anaerobically for use in high-intensity activities lasting 15 to 90 seconds

aerobic system
an energy system that resynthesises ATP aerobically for use in low- to medium-intensity activities lasting longer than 90 seconds

anaerobic
a term used to describe a chemical reaction that takes place without the presence of oxygen

aerobic
a term used to describe a chemical reaction that takes place with the presence of oxygen

The ATP–PC system

The ATP–PC system resynthesises ATP anaerobically (i.e. without oxygen). This energy system is used by the body for short, maximum-intensity activities that last between 10 and 15 seconds, such as:

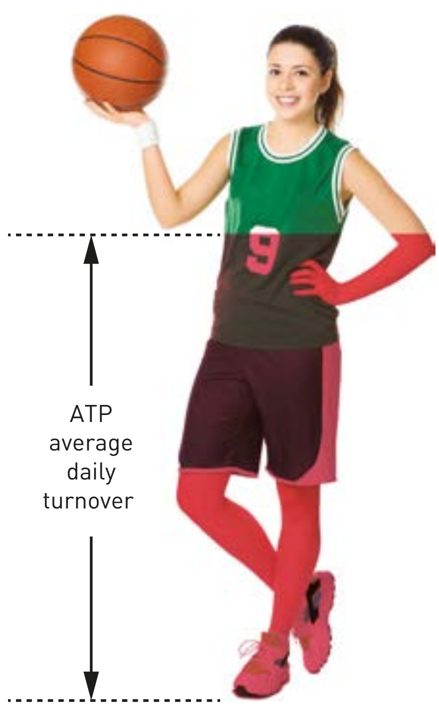
- 50 or 100 metre sprints
- long jump
- shot put
- specialised movement sequences in 'Invasion' and 'Net and court' physical activities, such as making a jump shot in basketball, kicking a goal in Australian football or diving to save a goal in soccer.

phosphocreatine (PC)
a substance found in the body that is broken down via the ATP–PC system in order to resynthesise ATP

How does the ATP–PC system work?

The ATP–PC system resynthesises ATP quickly and efficiently due to the readily available stores of **phosphocreatine** in the muscles. Phosphocreatine (more commonly referred to as PC) is a chemical compound made up of creatine and phosphate. PC is stored in small quantities within our muscle cells. Around half the available stores of PC in our bodies come from the foods we eat, while the other half is manufactured by our liver and kidneys.

Just like ATP, PC can store and release energy via a high-energy chemical bond that binds the creatine and phosphate molecule together (see Source 2). When this bond is broken, energy is released that enables ATP to be resynthesised from ADP and separate phosphate. Once resynthesised, the ATP molecule can break down again – and so the process repeats.

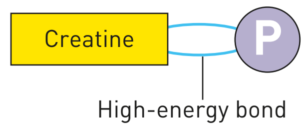


FOR THE RECORD!

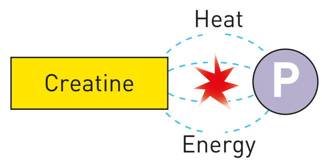
The average person has around 50 to 100 grams of ATP stored in their muscles, but that same person will generally use approximately 50 to 75 kilograms of ATP on a normal day. In other words, the average person will use their body weight in ATP over the course of a normal day. This amount can more than double if they take part in intense physical activity.

To meet this demand, on average, every cell of the body needs to resynthesise around 10 million new ATP molecules every second of the day. That's a lot of ATP!

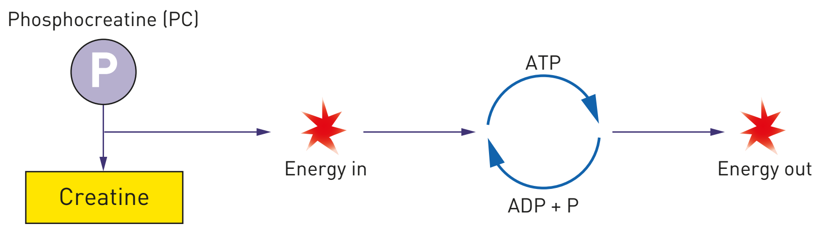
Oxygen is not needed for these reactions to occur, which enables the body to draw on this energy system instantly. In fact, it is often considered our emergency system, allowing us to flee from immediate danger quickly and efficiently, regardless of training.



SOURCE 2 Phosphocreatine (more commonly referred to as PC) is a chemical compound made up of creatine and phosphate. PC is stored in small quantities within our muscle cells.



SOURCE 3 Phosphocreatine is broken into phosphate and creatine, releasing energy to resynthesise ATP.



SOURCE 4 The ATP–PC system resynthesises ATP by breaking down phosphocreatine (PC) into phosphate and creatine. The process releases energy to resynthesise ATP and produce energy for muscle contractions.

The main limitation of the ATP–PC system is that only small amounts of PC are stored in the muscles. Generally, most people store enough PC for between 10 and 15 seconds of strenuous physical activity. The amount of PC stored in a person's muscles is dependent on:

- their genetics
- their diet
- their training.

Once PC is depleted, another energy system must be used by the body to resynthesise ATP. Although the stores of PC are quickly used up, they are also quickly restored within 2 to 3 minutes of resting. This allows for activity to be repeated in intense, short bursts, without immediate exhaustion.

The lactic acid system

As shown in Source 5, the lactic acid system resynthesises ATP anaerobically (i.e. without oxygen). Once PC stores in the muscles have been depleted after about 10 to 15 seconds, the lactic acid system is typically used by the body for high-intensity activities lasting approximately 60 to 90 seconds. This includes activities such as:

- 400 metre sprints
- high-intensity movements in 'Invasion' and 'Net and court' physical activities that need to be sustained for longer periods of time without break (e.g. maintaining continued one-on-one defence in netball or basketball, repeatedly rucking and defending in the middle in touch football or continuing a long intensive rally in tennis).

How does the lactic acid system work?

After 10 to 15 seconds of maximum-intensity activity, PC supplies are exhausted, so the body must rely on another body system to resynthesise the ATP needed to provide the energy for continued physical activity. The lactic acid system provides this energy by using supplies of sugar (i.e. a simple form of carbohydrate) circulating in the blood (i.e. as glucose) and stored in the muscles and liver (i.e. as glycogen).

The chemical reaction that converts glucose or glycogen into the energy required to resynthesise ATP is known as **glycolysis**. Because levels of glucose and glycogen in the body are much higher than levels of PC, these can be used as an energy source for ATP resynthesis over a much longer period of time than PC.

Because the body relies on the lactic acid system for high-intensity activities lasting approximately 60 to 90 seconds, there is generally not enough time for the blood to carry oxygen from the lungs to the working muscles where ATP resynthesis (via glycolysis) takes place. This means that glycolysis takes place without oxygen being present (i.e. anaerobically). This is referred to as **anaerobic glycolysis**.

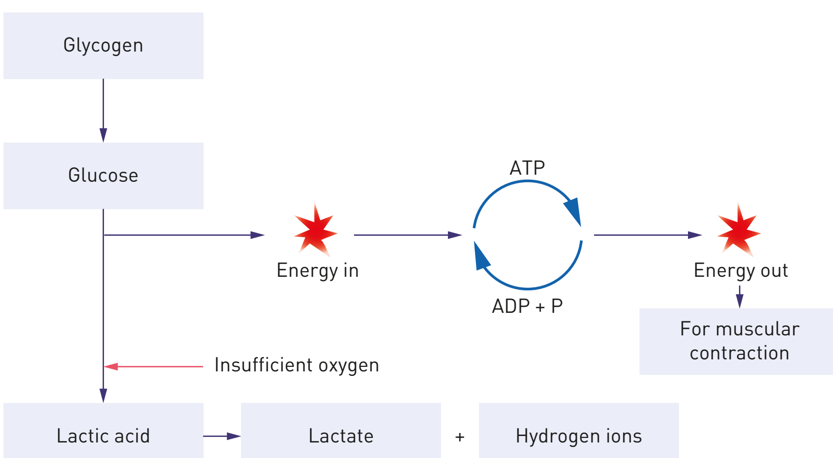
As shown in Source 5, during anaerobic glycolysis, stores of glycogen in the muscles and liver are converted into glucose, which is used to fuel ATP resynthesis. However, because oxygen is not available for this chemical reaction, the glucose is only partially broken down. This partial breakdown of glucose produces a by-product known as **lactic acid**.

The amount of lactic acid produced – and the speed at which it is produced – depends on the intensity and length of the physical activity. The harder a person works, the more quickly lactic acid will be produced.

As soon as lactic acid is produced, it separates into:

- **lactate** – a component of lactic acid that remains after hydrogen ions are removed
- hydrogen ions – the acidic component of lactic acid.

Both of these substances then begin to accumulate (i.e. build up) in the muscles. When very high levels of lactic acid build up, they can prevent the muscle fibres from contracting properly or negatively affect performance by bringing about fatigue. This causes a burning sensation in fatigued muscles that is actually caused by the build-up of hydrogen ions.



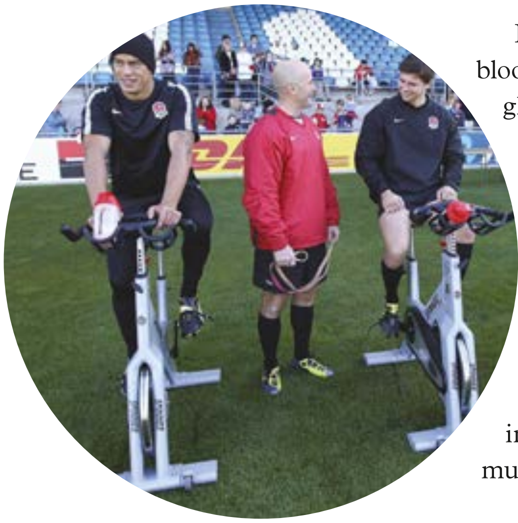
SOURCE 5 The lactic acid system resynthesises ATP by breaking down glucose and glycogen without the presence of oxygen. This process is known as anaerobic glycolysis. It releases energy to resynthesise ATP and produce energy for muscle contractions. It also produces a by-product known as lactic acid.

glycolysis
the process of breaking down glycogen in order to resynthesise ATP

anaerobic glycolysis
the process of breaking down glycogen without oxygen present via the lactic acid system

lactic acid
a by-product of anaerobic glycolysis that is created when glucose is partially broken down to provide energy for ATP resynthesis

lactate
a component of lactic acid that remains after hydrogen ions (i.e. the acidic component of lactic acid) are separated



If lactate is not used as an energy source, it is transported in the bloodstream to the liver where it is converted back to glucose and stored as glycogen. In this form, it can be used again in future as a fuel for ATP resynthesis. In fact, it is estimated that as much as 30 per cent of all glucose used for ATP resynthesis comes from blood lactate that has been 'recycled' into glycogen through the liver.

It can take up to two hours for the breakdown and removal of blood lactate and hydrogen ions from the muscles. However, in extreme cases the effects of the build-up can last a couple of days. An 'active recovery' (i.e. participating in low-intensity exercise after high-intensity activity) helps to remove blood lactate and hydrogen ion levels in the muscles by ensuring that oxygen is resupplied to the working muscles.

SOURCE 6 Athletes often use stationary bikes to participate in active recovery. Active recovery helps the body to remove lactate and hydrogen ions that may have accumulated in the muscles during periods of intensive physical activity fuelled by anaerobic glycolysis.

The aerobic system

The aerobic system resynthesises ATP with oxygen (i.e. aerobically). This energy system is typically used by the body for low- to moderate-intensity activities and those lasting longer than 90 seconds, such as:

- extended periods of walking
- a 15 kilometre jog
- 'Invasion' and 'Net and court' physical activities where movement is slower and more sustained (e.g. a soccer midfielder moving the ball around with his teammates before setting up their attack on goal, or a centre basketball player defending the keyway in a zone defence pattern while the opposition set up their attack outside the key)
- 'Performance' physical activities like aquathlon, triathlon, or 800 metre or 1500 metre events.

aerobic glycolysis
the process of breaking down glycogen in the presence of oxygen via the aerobic system

How does the aerobic system work?

When athletes participate in low- to moderate-intensity activities, the body begins to predominantly use the aerobic system for ATP resynthesis. The aerobic system produces the energy required to resynthesise ATP using the same chemical process used in the lactic acid system (i.e. glycolysis). The only difference is the presence of oxygen. This type of glycolysis is known as **aerobic glycolysis**. Unlike anaerobic glycolysis, aerobic glycolysis does not produce the by-product of lactic acid.

Of all of the energy systems, the aerobic system is able to yield the most ATP through the process of glycolysis.

Another advantage of the aerobic system is that it can use a variety of energy sources to fuel ATP resynthesis. These include:

- **carbohydrates** – (i.e. glucose and glycogen) the most efficient fuel used by the aerobic system and therefore the preferred fuel in moderate exercise, such as the early stages of endurance activities
- **protein** – only used scarcely as it is too inefficient to allow for the movement required in most physical activities

- **fats –** (i.e. triglycerides) the preferred fuel source used by the aerobic system during low-intensity activity such as walking or if exercise continues for more than an hour or so. Fats are broken down via a process known as lipolysis. The benefit of using fat is its abundant availability. Through strategic training, the body can be made more efficient at metabolising fat and the athlete is able to run at a higher intensity while still drawing on fat as the fuel source.

The drawback of the aerobic system is that it takes time to deliver adequate oxygen to the muscles in order to activate the system, so it can only be used in comparatively low- to moderate-intensity activities.

The by-products of the aerobic system are carbon dioxide, water and heat, all of which are harmless and can be eliminated (i.e. expelled) easily by the body.

Comparing energy systems

An example of how the three energy systems can be used at different times is provided in the Theory in action below. A comparision table can also be found on your obook assess.

FOR THE RECORD

The longest continuous tennis rally recorded in competition took place in a match between Vicki Nelson and Jean Hepner in 1984. The 643-shot rally lasted for 29 minutes and by the end, neither player had enough energy left to do anything more than stand on the baseline and lob the ball back and forth. During the rally, both players would have had to lower the intensity of their activity to prevent the fatiguing effects of lactic acid build-up.

Theory in action: The body's energy systems in action

On Monday afternoon, Jason and his friends decide to go for a leisurely 5 kilometre run. They set out slowly, maintaining a steady pace for several minutes, chatting and laughing as they run. Their run finishes after 30 minutes. In this instance, they have predominantly used their aerobic system to resynthesise ATP and provide the energy they need.

On Tuesday afternoon, Jason decides to go for another run. This time he takes a different route, and as he's running along the street a large angry dog races up a driveway, growling and barking. The driveway gate has been left open, so Jason must sprint away from the dog for approximately 100 metres before the owner calls it back and Jason can reduce his speed. This 15 second burst momentarily uses Jason's ATP–PC system. As he returns to a jog, his body reverts to resynthesising ATP aerobically and replenishes his PC stores.

On Wednesday afternoon, Jason goes for another run. He forgets to take a different route and passes the same aggressive dog. Unfortunately, the owner doesn't appear to be home, so Jason must sprint as fast as he can in order to escape. He eventually finds safety about 600 metres down the road. This requires about 2 minutes of maximum effort. Over this period, Jason uses up all of his PC supplies and begins to rely on his lactic acid system. As he slows his pace down to a walk, he reverts to using his aerobic system, beginning the removal of the lactic acid in his muscles and replenishing PC stores. Jason staggers home with 'jelly legs'. He vows never to run down that street again! Intensity and duration are both factors that determine which energy system resynthesises Jason's ATP during his runs.

SOURCE 7 During his daily run, Jason uses all three of his energy systems depending on the intensity and duration of his efforts.

How energy systems interact during physical activity

Although we have been learning about each of the body's energy systems separately, it is important to realise that each energy system does not operate in isolation of the others. Instead, over the course of a particular physical activity (and depending on what we are doing), each system contributes to the production of ATP at different times and at different rates. In other words, there is often a degree of overlap in the types of systems producing energy and the contributions they are making to the body's energy needs.

Source 8 provides general estimates of the contributions of the three energy systems in a variety of 'Invasion', 'Net and court' and 'Performance' physical activities. It is important to note that the qualitative data provided is broadly in line with a U18 representative level

Category of physical activity	General energy system utilisation	Sport
'Invasion' physical activities	'Invasion' physical activities generally run for durations of 40 minutes or more and incorporate a wide variety of specialised movement sequences and movement strategies at varying levels of intensity, interspersed with rest periods. For this reason, there is significant contribution from all three systems in most invasion activities. The percentage contribution depends a lot on the level of competition and an individual's position on the team.	Australian football Basketball Futsal Netball Soccer Touch football Water polo
'Net and court' physical activities	'Net and court' physical activities are usually played for durations of more than an hour. They involve a wide variety of specialised movement sequences and movement strategies. For this reason, energy system contribution is often supplied anaerobically. Frequent breaks in play enable some recovery so anaerobic systems can be used. The percentage contribution depends a lot on the level of competition.	Badminton Tennis Volleyball
'Performance' physical activities	'Performance' physical activities vary in length, ranging from a throw or jump lasting a couple of seconds to a triathlon lasting an hour or more. The contribution of particular energy systems is highly dependent on the duration and intensity of the activity. In shorter events (e.g. a discus throw), the ATP–PC system is the predominant energy system. In longer events (e.g. the 1500 m), there is contribution from all three energy systems depending on specific race situations.	Duathlon, aquathlon, triathlon Swimming (50 m) Track and field – jump Track and field – throws Track and field – 400 m Track and field – 800 m Track and field – 1500 m

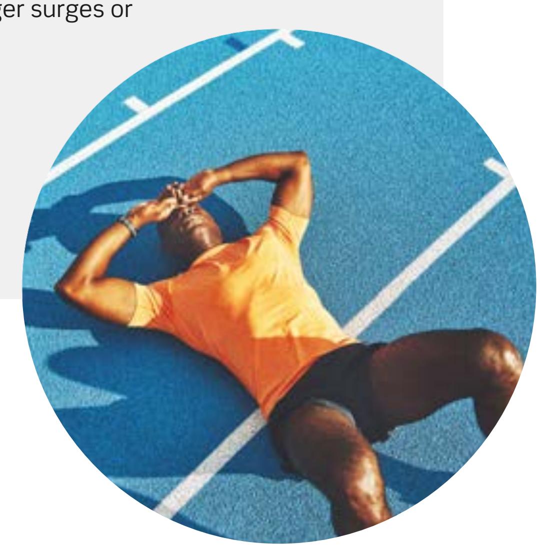
SOURCE 8 A summary of the contributions of energy systems to various invasion, 'Net and court' and 'Performance' physical activities. NB: Percentages provided are approximations are based on an U18 representative level performance for the positions indicated and do not include breaks in play in the calculations. These values should be adjusted for performers and their positions according to their individual circumstances.

performance. When considering this data, remember that the percentage contributions of each energy system can vary widely, depending on:

- the position played by the athlete (i.e. in a team sport)
- the level of fitness of the athlete
- the level of the competition (e.g. beginner versus elite)
- the kinds of tactics and plays executed by the team.

As a result, when determining the contributions of energy systems for your selected physical activity, you will need to make adjustments to reflect the movements you experience (i.e. duration and intensity). Percentage contributions will also differ, depending on whether the data is considering just time in action or breaks in play. For example, if breaks in play are considered, a sport such as tennis would be deemed mostly aerobic. If breaks are not considered, then the game has a much stronger anaerobic contribution.

Approximate contribution of energy systems per sport			Example
ATP–PC system	Lactic acid system	Aerobic system	
50%	20%	30%	In water polo, a wing is required to stay afloat through constant movement, requiring a significant contribution from the aerobic system. This is interspersed with short, intense bursts of movements for passing, lunging, intercepts and repeated sprint efforts (i.e. transitions from attack to defense). These short, intense bursts rely on the ATP-PC system. As there is little recovery time between these high intensity efforts there is a heavy reliance on the lactic acid system.
70%	20%	10%	
70%	20%	10%	
80%	10%	10%	
50%	20%	30%	
80%	10%	10%	
30%	40%	30%	
70%	20%	10%	In tennis, individual explosive shots will predominantly use the ATP–PC system (as will rallies of 8–15 seconds). Individual rallies lasting longer than 20–30 seconds, or a string of intense rallies will utilise the lactic acid system. As the match goes on, if PC supplies are not adequately replenished between points, the body will use the lactic acid system much sooner in the tennis rally, causing fatigue that could impact performance.
70%	20%	10%	
40%	10%	50%	
5%	15%	80%	In a triathlon, race starts or short surges when overtaking a competitor use the ATP–PC system. The lactic acid system contributes during longer surges or accelerations (e.g. in the first two minutes of the swim leg when the body is still trying to adapt to the sudden demand for ATP production) or during hill climbs in the bike and run legs (i.e. where intensity increases over periods of 20 seconds or more). Energy can be provided by the aerobic system during the main body of the swim and the flat components of the bike and run leg.
35%	55%	10%	
98%	NA	2%	
98%	NA	2%	
30%	50%	20%	
20%	30%	50%	
10%	50%	40%	



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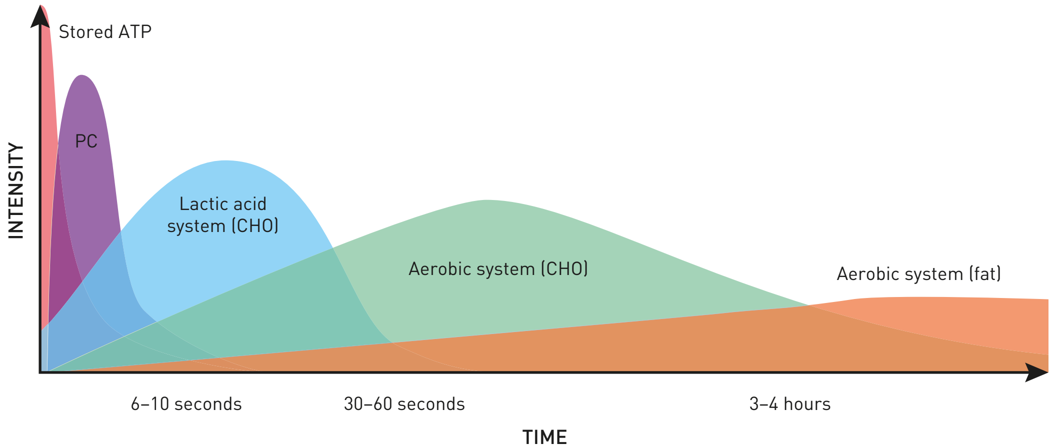
STUDY TIP

Additional information about the interplay of energy systems for a range of 'Invasion', 'Net and court' and 'Performance' physical activities – including a range of examples – is provided on your obook assess.

Source 9 shows how all three energy systems can be working simultaneously to provide the ATP resynthesis required.



SOURCE 9 The contribution of the energy systems is dependent on the intensity and duration of the activity. Although there is a dominant energy system supplying the energy needs during these times, the non-dominant systems are usually also playing a minor role in the resynthesis of ATP.

4.3 Check your learning

Engage and understand

1 **Identify** the three energy systems used to resynthesise ATP.
2 **Describe** the key features of the three energy systems (e.g. their advantages and limitations).
3 **Identify** the factors (e.g. physical activities) that determine the type of energy that is used by the body.
4 **Explain** why the ATP–PC system is only used in efforts lasting 10 to 15 seconds.
5 **Recall** the main limitation of the lactic acid system.
6 **Describe** the main differences between anaerobic glycolysis and aerobic glycolysis.

Analyse and apply

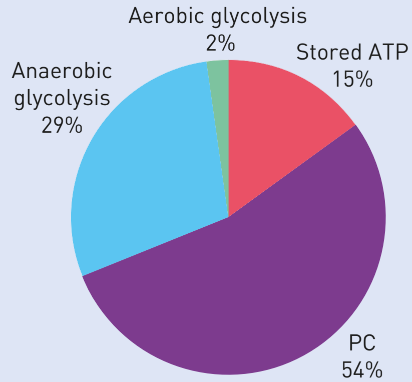
7 Read the Theory in action 'The body's energy systems in action'. **Explain** the cause of Jason's 'jelly legs' after he has been chased by the dog for a second time. Provide as much detail as possible in your response.
8 **Classify** the activities in the table by placing a tick in the box of the energy system that would provide the most energy for ATP resynthesis.

Activity	ATP–PC system	Lactic acid system	Aerobic system
a A basketball jump shot			
b A swimmer completing a 1500 m race			
c A touch football player engaged in a fast rucking pattern for 25 seconds			
d A futsal goalkeeper diving to stop a goal			
e A volleyball setter involved in consecutive ball chasing efforts longer than 1 minute, with little recovery between efforts			
f A netball shooter moving around in the circle while the ball is at the opponent's end of the court			

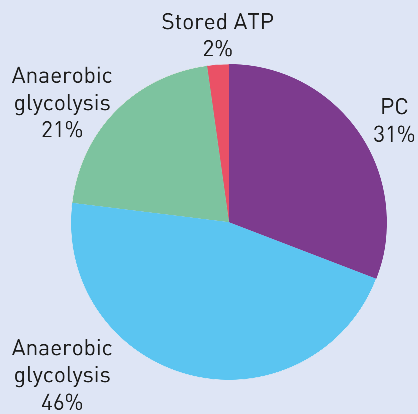
9 **Consider** the interplay of energy systems for the following positions and events. Write a short paragraph describing each one.

- **a** A goalkeeper during a soccer match
- **b** An athlete competing in a long jump event
- **c** A centre during a game of netball
- **d** A winger during a game of touch football

Energy system contribution to a 5 second high-intensity passage of play in Australian football



Energy system contribution to a 20 second high-intensity passage of play in Australian football



SOURCE 10 Energy systems in an Australian football game

Evaluate and justify

10 **Analyse** Olivia's training session outline below and **justify** whether it would be a suitable session for developing her lactic acid system.

> Training session outline
> → 5 minute warm up jog followed by dynamic stretches and run throughs
> → 5 x 30 second fast sprints with 2 minutes rest between each sprint
> → 5 x 45 second fast sprints with 2.5 minutes rest between each sprint
> → 5 minute cool down jog

11 Source 10 shows the energy contribution of an Australian football player who is participating in two different periods of high-intensity physical activity during a game.

- → The first graph (top) shows a 5 second, high-intensity burst of physical activity.
- → The second graph (bottom) shows a 20 second, high-intensity burst of physical activity.
- → Based on the data provided, **discuss** why it is difficult to generalise the energy contributions for different sports.

12 **Assess** one specialised movement sequence and movement strategy within your selected physical activity and determine the contributions of the three energy systems to it. **Justify** your response in one or two paragraphs.

Check your obook assess for the following additional resources and more:

- » **Student book questions** 4.3 Check your learning
- » **Video** Understanding the three energy systems
- » **Student worksheet** Energy systems used in physical activity
- » **Weblink** Energy systems in your body

4.4 Fitness requirements for physical activity

That's a goal!

By the end of Section 4.4, you should be able to:
→ **define** the term 'fitness' and **identify** seven components of fitness
→ **explain** how components of fitness can be used to help determine an appropriate training strategy
→ **determine** personal performance capacities based on position- or event-specific fitness testing.

components of fitness
a series of seven categories used to identify specific aspects of an athlete's overall fitness (i.e. aerobic capacity, power, strength, speed, agility, muscular endurance, flexibility)

power
the ability to exert maximum force in the shortest amount of time; one of the seven components of fitness

strength
the ability of a muscle (or muscles) to exert force by contracting against resistance; one of the seven components of fitness

speed
the ability to move the entire body (or specific parts of the body) quickly; one of the seven components of fitness

aerobic capacity
the ability of the heart, lungs and circulatory system to supply oxygen and other nutrients to working muscles so that an athlete can exercise continuously for extended periods without tiring; one of the seven components of fitness

Defining fitness

In the simplest terms, fitness refers to:

- the condition of being physically fit and healthy
- a person's ability to participate effectively in a particular sport or physical activity.

However, the concept of fitness is actually quite difficult to define because it can mean different things to different people in different contexts. In Senior PE, fitnesss can be defined as the ability of an athlete to perform a range of specialised movement sequences for movement strategies:

- at an appropriate intensity
- for an appropriate length of time.

As different sports and physical activities have different rules, conditions and requirements, being 'fit' for one sport (or one position) does not necessarily make you 'fit' for another. Furthermore, when measuring physical fitness, describing the fitness levels of an athlete in terms of 'fit' or 'unfit' is inadequate. For this reason, exercise physiologists use a number of different perspectives and criteria in order to get a more accurate and holistic understanding of what it means to be fit. These criteria are known as the **components of fitness**.

Components of fitness

The components of fitness are used to identify specific aspects of an athlete's overall fitness so that these aspects can be understood, measured, tested and addressed through training opportunities, as required. The seven components of fitness included in the QCAA Physical Education General Senior Syllabus are:

- **aerobic capacity** – the ability of the heart, lungs and circulatory system to supply oxygen and other nutrients to working muscles so that an athlete can exercise continuously for extended periods without tiring
- **power** – the ability to exert maximum force in the shortest amount of time
- **strength** – the ability of a muscle (or muscles) to exert force by contracting against a resistance
- **speed** – the ability to move the entire body (or specific parts of the body) quickly

- **agility** – the ability to move the entire body from one position to another or from one direction to another, quickly and precisely
- **muscular endurance** – the ability to sustain or repeat a series of muscle contractions without fatigue
- **flexibility** – the ability of a joint to move through its full range of motion.

The components of fitness are useful because different athletes possess different types and levels of fitness, depending on their:

- age
- physical and mental ability
- experience or level of competition
- sex
- lifestyle
- training.

As a result of these differences, it's essential for coaches to identify particular strengths and weaknesses and tailor training opportunities to the needs of individual athletes. Data gathered on each of the different components of fitness allows coaches to develop a **fitness profile** (i.e. a table of fitness-based values) and a **training program** suited to the specific requirements of individual athletes.

Some components of fitness listed above are dependent on the oxygen uptake and delivery to working muscles through the respiratory and circulatory systems, while others are dependent on the structure and function of the body's musculoskeletal system. We will look at each of the components of fitness in more detail in this section, but first it is important to discuss some of the reasons why it is useful to measure the components of fitness and how these results can be used to improve performance.

Measuring and testing fitness

The main reason for measuring and testing the components of fitness is so that a personalised training strategy can be developed and implemented, with the goal of improving the ability of an athlete to perform a specific physical activity.

When fitness data is collected regularly (i.e. through fitness testing), it provides accurate information about an athlete's development and level of fitness over time. Fitness tests can also highlight where improvements have been made or where deterioration has occurred.

It is common for athletes to take part in a series of pre-training and post-training fitness tests. These tests help to identify if any changes in fitness levels have taken place over the course of a training session or training program. This process is generally referred to as 'pre' and 'post' testing.

agility
the ability to move the entire body (or specific parts of the body) from one position to another, or from one direction to another, quickly and precisely; one of the seven components of fitness

muscular endurance
the ability to sustain or repeat a series of muscle contractions without fatigue; one of the seven components of fitness

flexibility
the ability of a joint to move through its full range of motion; one of the seven components of fitness

fitness profile
a table of fitness-based values designed to help individual athletes understand their overall fitness level (by providing data on a range of components of fitness) and design an appropriate training strategy

training program
a series of training events/activities planned over a specific period of time (e.g. 1 week, 2 months, 1 year), designed to help an individual or team achieve a range of energy, fitness and skill goals. The features of training programs include: specific training objectives; game analysis; work volume (frequency and duration), intensity; tapering and recovery

SOURCE 1 Components of fitness can be measured using field or laboratory tests. These tests help athletes develop a fitness profile.

Collecting and recording data on the components of fitness usually involves the use of laboratory or field tests. Measuring physical fitness is important to:

- evaluate progress
- make comparisons with other similar populations
- determine event or position suitability
- develop accurate training strategies
- set realistic, achievable fitness goals
- identify baseline and follow-up fitness levels
- assess individual strengths and weaknesses
- identify medical problems
- motivate athletes to improve results.

SOURCE 2 Designing a specialised fitness test is recommended if you wish to gain more accurate information about an individual's fitness profile.

There isn't one standalone test that will measure all of the components of fitness simultaneously; often a collection of different tests will be required to do this. Performing more than one test for each component can provide more accurate information for individuals wanting to develop a personalised training program.

When testing specific components of fitness, the physical requirements of the physical activity being tested should be taken into account. In many cases, traditional fitness tests are inadequate for assessing the event-specific or position-specific fitness requirements of an individual. In order to get the most reliable and useful data, it is necessary to simulate authentic tasks and performance environments. To do this, you may need to design your own customised fitness tests. An example of this is provided in the Theory in action below.

Theory in action | The best teams use specialised fitness tests

Many elite sporting teams employ strength and conditioning specialists whose job it is to get their team into the best physical shape possible. It is crucial that each player is prepared for the energy and fitness requirements of their particular position in the team. Part of this strength and conditioning side of training is participating in regular testing and evaluation to ensure gains are being made where they are needed. For example, the Wallabies have a test protocol called 'The Australian Rugby Union fitness tests'.

These tests were designed specifically to assess the fitness requirements of the sport and the different positions on the team. Traditional speed tests were inaccurate because rugby players never run in a straight line, or for such long distances, during a game. To address this, a specialised fitness test called the '10–10–20' quickness test was developed. Players are required to run a decelerated 10 metre sprint around a flagpole – turning left to right – followed by a decelerated turn around another flagpole – turning right to left. The advantage of this specialised test is that it simulates the movements required in authentic performance environments and it assesses the ability of an athlete to complete them.

Aerobic capacity

Aerobic capacity is the ability of the heart, lungs and circulatory system to supply oxygen and nutrients efficiently to working muscles and remove waste products. Aerobic capacity is an essential component of fitness in almost all sports. Aerobic capacity not only enables athletes to perform faster for longer – with fewer negative effects from fatigue – it also helps the body to recover after exercise.

Traditional tests of aerobic capacity include:

- the **multi-stage fitness test** (also known as beep tests) – a running test used to estimate an athlete's aerobic capacity and predict their VO_2 max (i.e. maximum amount of oxygen in litres an athlete can use per minute)
- the **Astrand-Rhyming cycle ergometer test** – a submaximal cycle ergometer aerobic fitness test based on the relationship between heart rate during work and percentage of maximal aerobic capacity
- **Cooper's 12 minute run** – a test that requires an athlete to run as far as possible in 12 minutes and can be used to predict VO_2 max
- the **step test** – a test designed to measure an athlete's aerobic fitness by stepping up and down a step for three minutes.

SOURCE 3 Cycling in triathlon and duathlon is an example of a physical activity that requires competitors to have a good aerobic capacity.

STUDY TIP

If you have identified aerobic capacity as an important component of fitness for your selected physical activity, you may decide to include the following training methods in your training strategy:

- **continuous training** – for more information refer to Section 4.9A
- **fartlek training** – for more information refer to Section 4.9B
- **interval training** – for more information refer to Section 4.9D.

When designing an a customised aerobic capacity fitness test that suits the fitness requirements for your physical activity, it is important to consider:

- the time frame for which aerobic capacity is required
- the designated rest periods of the physical activity (if applicable)
- the maximum length of the physical activity.

Power

Power is the ability to exert maximum force in the shortest amount of time. Power is the product of strength and speed. Having power enables an athlete to apply greater amounts of force to either accelerate their body (e.g. from standing to sprinting or jumping) or propel an object (e.g. a ball or javelin).

A volleyball player who can jump high in their spike approach and swing their arm quickly to apply a strong force to the ball is said to have power in their legs for jumping and power in their arms for spiking. Similarly, a swimmer performing breaststroke will use power in two specialised movement sequences to propel themselves quickly down the pool (i.e. the forceful action of the arms during the pull phase and the explosive movement of the legs during the frog kick phase).

Traditional tests of power include:

- the **standing long jump test –** a test that measures the maximum distance an athlete can jump from a stationary position
- the **vertical jump test –** a test that measures the maximum height an athlete can jump from a stationary position
- the **throw test –** a test that measures the maximum distance an athlete can throw an implement (e.g. ball) from a stationary position.

STUDY TIP

If you have identified power as an important component of fitness for your physical activity, you may decide to include the following training methods in your training strategy:

- **resistance training** (specifically **plyometric training**) – for more information refer to Section 4.9C
- **interval training** – for more information refer to Section 4.9D
- **circuit training** – for more information refer to Section 4.9F.

SOURCE 4 During her career, Australian breaststroke swimmer Leisel Jones was able to successfully apply power to her arms (in the pull phase) and legs (in the kick phase) to propel herself quickly down the pool during races.

When designing a customised power fitness test that suits the fitness requirements for your physical activity, it is important to consider:

- the body part requiring power (e.g. the legs or arms)
- the type of action required (e.g. running acceleration, jumping for height, jumping for distance, pulling, pushing or throwing)
- the object (if relevant) to which power is being applied. (i.e. Does the size, shape or weight of the object have an impact on the sub-routines of the specialised movement sequence involved?)

Strength

Strength is the ability of a muscle (or muscles) to exert force by contracting against resistance. In other words, strength measures an athlete's maximum ability to apply a force against an object. Lifting a heavy weight for a single repetition is an indicator of the strength of the muscles involved in this task. It is possible for an athlete to possess strength in some muscle groups and not others (e.g. muscles in the arms may be strong, while muscles in the back and legs may be weak).

A basketball player uses strength in a number of specialised movement sequences, including setting screens and boxing out opposition. It also takes strength to apply the specialised movement sequence of gripping a competition shot put weighing over six kilograms.

Traditional tests of strength include:

- the **one-repetition maximum test –** a test that measures the maximum weight an individual can lift for only one repetition with correct technique (e.g. a bicep curl or dead lift)
- the **strength dynamometer test –** a test using specialised equipment to measure muscular strength (e.g. in the back, legs and hands) in Newtons.

SOURCE 5 Basketball players require muscle strength to build up the endurance and stamina needed for specialised movement sequences.

STUDY TIP

If you have identified strength as an important component of fitness for your physical activity, you may decide to include the following training methods in your training strategy:

- **resistance training** – for more information refer to Section 4.9C
- **circuit training** – for more information refer to Section 4.9F.

When designing a customised strength fitness test that suits the fitness requirements for your physical activity, it is important to consider:

- the muscle groups that require strength
- the specialised movement sequences requiring strength.

Speed

Speed is the ability to move quickly. Speed can be used to describe:

- the movement from one point to another (e.g. the ability to move an entire body quickly across a field or court)
- the movement of specific limbs or muscles (e.g. the ability to move a limb or contract a muscle to complete a specialised movement sequence).

A traditional test of speed includes:

- the **straight line sprint test –** a test that measures the time it takes for an athlete to cover a set distance of 20 or 40 metres.

When designing a speed fitness test that suits the fitness requirements for your physical activity, it is important to consider:

- the maximum distance you will be required to run in a straight line
- the direction you will be required to run quickly (e.g. forwards, backwards or sideways)
- the types of specialised movement sequences that require maximum speed.

STUDY TIP

If you have identified speed as an important component of fitness for your physical activity, you may decide to include the following training methods in your training strategy:

- **resistance – plyometric training** – for more information refer to Section 4.9C
- **interval training** (specifically **high-intensity interval training** and **short interval training**) – for more information refer to Section 4.9D
- **circuit training** – for more information refer to Section 4.9F.

SOURCE 6 A smash in badminton is an example of a specialised movement sequence that requires speed.

Agility

Agility is the ability to move the entire body from one position to another, or from one direction to another, quickly and precisely. An athlete who is agile can successfully dodge opponents, accelerate and decelerate quickly, and rapidly change the position of their body (or body parts), as required.

Touch football players require agility in many of their specialised movement sequences (e.g. sidestep and swerve, slow then fast movements, and the dump and split). Similarly, a volleyball player requires agility to move around the court in transition from defence to attack, in response to receiving a hit.

Traditional tests of agility include:

- the **burpee test –** a test that measures the maximum number of burpees a participant can complete in a set period of time
- the **figure 8 agility run –** a test that records the ability of an athlete to quickly run and turn in a figure 8
- the **shuttle run test –** a test that measures the ability of an athlete to run quickly between two lines that are 10 metres apart to pick up small blocks
- the **Illinois agility test –** a test that measures the ability of an athlete to run quickly in different directions and at different angles

When designing a customised agility fitness test that suits the fitness requirements for your physical activity, it is important to consider:

- the types of movement strategies required in your physical activity (e.g. dodging and marking)
- the characteristics of the movements commonly experienced in your physical activity (e.g. the length of runs, the direction of runs, the angles and changes in direction of runs).

SOURCE 7 A tennis player who repeatedly performs forehand and backhand shots in a long rally will require excellent muscular endurance in their arms.

STUDY TIP

If you have identified agility as an important component of fitness for your physical activity, you may decide to include the following training methods in your training strategy:

- **interval training** – for more information refer to Section 4.9D
- **circuit training** – for more information refer to Section 4.9F.

STUDY TIP

If you have identified muscular endurance as an important component of fitness for your physical activity, you may decide to include the following training methods in your training strategy:

- **continuous training** – for more information refer to Section 4.9A
- **resistance training** – for more information refer to Section 4.9C
- **interval training** – for more information refer to Section 4.9D
- **circuit training** – for more information refer to Section 4.9F.

Muscular endurance

Muscular endurance is the ability to sustain or repeat a series of muscle contractions without fatigue. Having muscular endurance enables athletes to repeat a task over and over without suffering the effects of fatigue or causing injury.

A runner who can sustain repeated muscular contraction in their legs over a long distance, or a tennis player who can repeatedly perform forehand and backhand shots in a long tennis rally are said to have good muscular endurance.

Traditional tests of muscular endurance include:

- the **push up test –** a test that measures the number of push ups an athlete can perform in a set period of time
- the **sit up test –** a test that measures the number of sit ups an athlete can perform in a set period of time
- the **pull up test –** a test that measures the number of pull ups an athlete can perform in a set period of time
- the **flexed-arm hang test –** i.e. a test that measures the period of time in which an athlete can perform a flexed-arm hang.

When designing a customised muscular endurance fitness test that suits the fitness requirements for your physical activity, it is important to consider:

- the muscle groups central to the repeated muscular efforts
- the amount of time in which repeated effort is required
- the level of intensity of the muscular contraction.

STUDY TIP

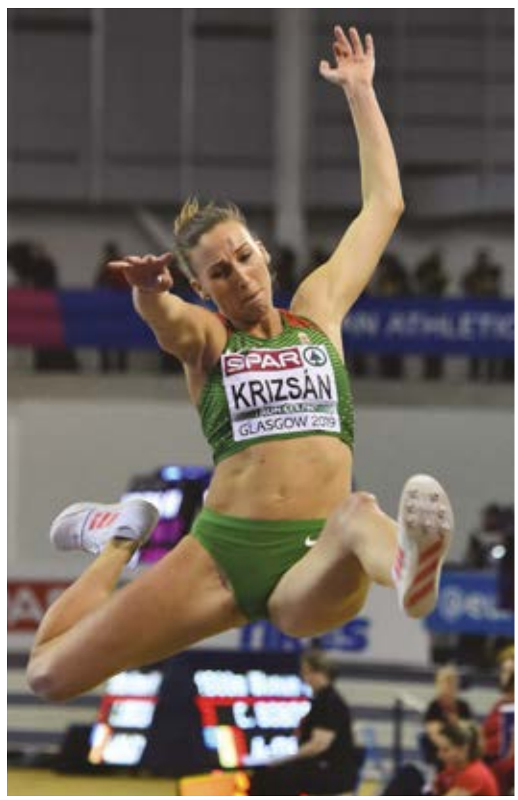
If you have identified flexibility as an important component of fitness for your physical activity, you may decide to include the following training methods in your training strategy:

- **flexibility training** – for more information refer to Section 4.9E.

Flexibility

Flexibility is the ability of a joint to move through its full range of motion. Having flexibility enables an athlete to stretch a muscle (or group of muscles) across one or more joints to perform a wide range of motion. Being flexible also allows an athlete to make biomechanical adjustments to their technique, without stressing muscles and joints. It also reduces instances of injury caused when a joint is stretched and stressed beyond its elastic capacity. Many specialised movement sequences require a degree of flexibility, with some actually requiring increased flexibility for increased quality of movement.

A badminton player lunging to perform a drop shot requires a high level of groin flexibility, while a long jumper requires a high degree of flexibility to withstand the stress on their hamstring muscles during the flight phase of their jump.



SOURCE 8 A long jumper requires good flexibility to handle the stress on their hamstring muscles during the flight phase of their jump.

Traditional tests of flexibility include:

- the **goniometer test** – a test that measures the range of motion of an athlete's joints
- the **sit-and-reach test** – a test that measures how far an athlete in a seated, straight-legged position can reach towards their toes
- the **shoulder rotation test** – a test that measures an athlete's degree of rotational spinal flexibility
- the **ankle extension test** – a test that measures an athlete's degree of plantarflexion
- the **Leighton flexometer test** – a test that measures the angle of movement in a joint.

When designing a customised flexibility fitness test that suits the fitness requirements for your physical activity, it is important to consider:

- the joint actions and muscle involvement in the specialised movement sequences of your physical activity
- the speed of joint movement.

PERFORMANCE | SKILL DRILL 4.4

Determine your fitness profile

>> Turn to pages 340–341 to complete this integrated physical performance activity.

4.4 Check your learning

Engage and understand

1. In your own words, **define** the term 'fitness' as it relates to exercise physiology.
2. **Explain** why it is important to think about fitness in terms of the components of fitness.
3. **Explain** why it is important to measure physical fitness.
4. **Identify** and **describe** one specialised movement sequence from badminton and one specialised movement sequence from long jump that require athletes to have flexibility.

Analyse and apply

5. Read Theory in action 'The best teams use specialised fitness tests'. **Assess** how traditional fitness tests were inadequate compared to the Wallabies' special test protocol.
6. **Determine** which traditional aerobic capacity test would give you the most valid data for your selected physical activity. Explain your choice.
7. **Identify** a specialised movement sequence from your selected physical activity that requires power. **Consider** the features of the specialised movement sequence that make power a necessary component of fitness for successful performance.
8. **Create** a simple diagram that shows the relationship between power, speed and strength.

Evaluate and justify

9. Select a position (if applicable) in your chosen physical activity and **justify** which two fitness components are most necessary for optimal performance.
10. **Design** a fitness test for one component of fitness relevant to your position within your selected physical activity or event. **Justify** your design, referring to the characteristics of the specialised movement sequences or movement strategies used in that position.

Check your obook assess for the following additional resources and more:

- » **Student book questions**
  4.4 Check your learning
- » **Video**
  Components of fitness
- » **Student worksheet**
  Fitness requirements for physical activity

4.5 The role of oxygen in performance

That's a goal!

By the end of Section 4.5, you should be able to:

→ **understand** acute and chronic physiological adaptations
→ **define** what is meant by VO_2 max, the lactate threshold and blood lactate
→ **explain** how oxygen uptake and delivery to working muscles impacts VO_2 max.

Oxygen uptake and delivery to working muscles

As we have learnt, when athletes participate in physical activity for extended periods of time, oxygen must be present in the muscles in order for the aerobic system to resynthesise ATP without suffering fatigue. However, for adequate levels of oxygen to be made available during ATP resynthesis, a number of different body systems need to work together to extract oxygen from the air we breathe (i.e. oxygen uptake) and transport it to the working muscles (i.e. delivery). The body systems involved in oxygen uptake and delivery during physical activity are:

- the **respiratory system**
- the **circulatory system**
- the **muscular system**.

By optimising the delivery of oxygen via these systems, an individual's aerobic capacity increases.

As shown in Source 1, breathing allows oxygen in the air to be extracted by the lungs (i.e. part of the respiratory system) so that it can be transported around the body in the blood (i.e. part of the circulatory system) and delivered to the muscles (i.e. part of the muscular system).

Oxygen passes from the lungs into the bloodstream through the alveoli walls. Once in the bloodstream, oxygen molecules attach to **haemoglobin** in red blood cells. From there, the circulatory system transports the oxygen via blood vessels to the working muscles. Source 2 shows how the heart acts as a pump pushing the blood around the body, delivering oxygen to muscles and removing carbon dioxide (a waste product of the aerobic energy system) to be exhaled via the lungs.

Maximal oxygen uptake – VO_2 max

An athlete's maximal oxygen uptake is a measure of the maximum amount of oxygen they can utilise during intense physical activity. Maximal oxygen uptake considers an athlete's ability to take in oxygen and deliver it efficiently to muscles during activity. Maximal oxygen uptake is more commonly referred to as **VO_2 max** (i.e. 'V' for volume, 'O_2' for oxygen and 'max' for maximal).

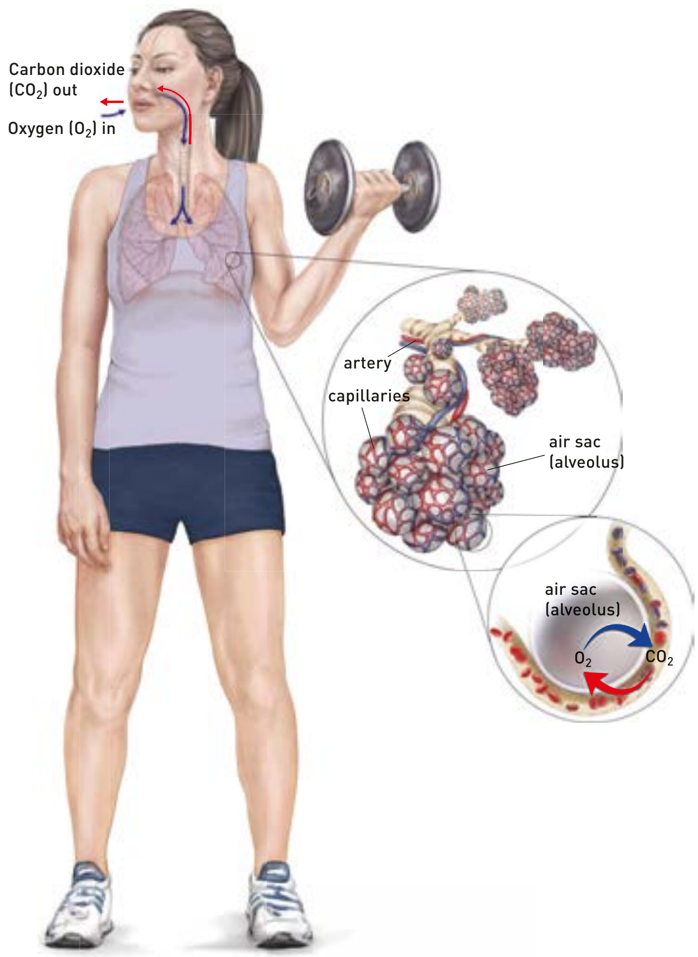
respiratory system
a body system responsible for the inhalation and exhalation of air (i.e. via the lungs, trachea, mouth and nasal passage)

circulatory system
a body system responsible for moving blood, oxygen and nutrients around the body (i.e. via the heart, veins, arteries and blood vessels)

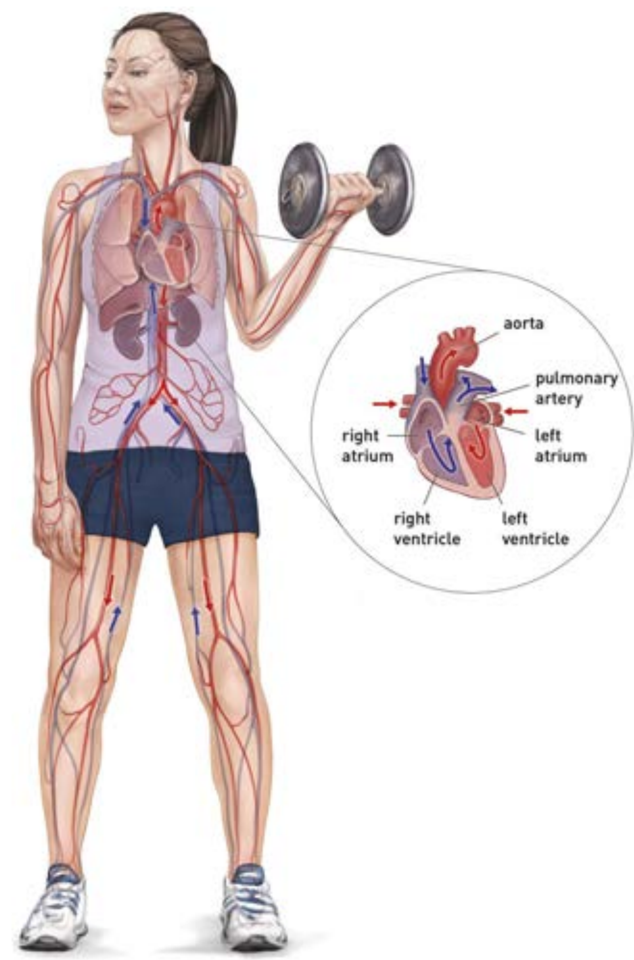
muscular system
a body system responsible for movement (i.e. via the muscles and tendons)

haemoglobin
a protein-based molecule in the blood that carries oxygen

VO_2 max
a measure of an individual's maximum oxygen consumption during intense physical activity



SOURCE 1 Oxygen is breathed into the lungs where it is filtered into the bloodstream and carried in the blood to the heart.



SOURCE 2 Oxygen rich blood is taken from the lungs to the heart where it is pumped to the rest of the body (shown in blue), including the working muscles. Carbon dioxide rich blood travels from the muscles to the heart where it is pumped to the lungs to be exhaled out of the body (shown in red).

The main factors that determine an athlete's VO_2 max are the function and structure of their respiratory and circulatory systems. As we have learnt, when you exercise, it is ideal for your body to resynthesise ATP in the presence of oxygen because no fatiguing by-products (such as lactic acid) are produced when oxygen is present. Therefore, it is beneficial to improve VO_2 max through training your aerobic system.

Determining VO_2 max is important for understanding how effectively your body can access the oxygen needed to produce ATP aerobically. Knowing your VO_2 max can also be useful when planning and developing training programs and training sessions. The main factors influencing a person's VO_2 max results include their:

- age
- physical ability (i.e. genetics)
- sex
- level of physical fitness.

Determining VO_2 max

The only way to measure VO_2 max with a high degree of accuracy is in a sports laboratory. As shown in Source 3, athletes are connected to a breathing apparatus and heart rate monitor and asked to engage in physical activity (e.g. run on a treadmill or ride on a stationary bike) for 10 to 20 minutes at ever-increasing speeds and levels of intensity. Specialised equipment is then used to measure respiratory rate and volume, as well as the concentration of oxygen and carbon dioxide inhaled and exhaled. The difference between these variables determines the maximum volume of oxygen used by the body over the course of the test. Measurements are provided in millilitres of oxygen used in one minute per kilogram of body weight (i.e. mL/kg/min).

FOR THE RECORD!

VO_2 max is measured in millilitres of oxygen used in one minute per kilogram of body weight (i.e. mL/kg/min). For example:

- an average male in his early twenties will have a VO_2 max of around 40 mL/kg/min (with an excellent score between 50 and 60 mL/kg/min)
- an average female in her early twenties will have a VO_2 max of around 30 mL/kg/min (with an excellent score between 40 and 50 mL/kg/min).

SOURCE 3 The only way to measure VO_2 max with a high degree of accuracy is in a sports laboratory.

For most people, accessing this kind of specialised equipment is not possible, so a range of other tests designed to measure VO_2 max have been developed, such as the beep test Cooper's 12 minute run test and the Balke VO_2 max test. While such tests may not be as accurate as those conducted in a sports lab, they are often used to gain an estimate of VO_2 max based on averages.

A number of other (less formal) tests can also be used to predict an athlete's VO_2 max. These will not be as accurate – and therefore should not be relied upon in isolation when determining your VO_2 max – but they are useful for cross-checking against your field test results. These tests include:

- the **race pace test** – a test that measures the distance run (must be greater than 1.5 km) and time it took to complete and then applies a formula to calculate VO_2 max
- the **talk test** – a test that that uses an athlete's ability to hold a conversation to predict VO_2 max based on the fact that breathing rate increases rapidly when nearing the ventilatory threshold.

In addition to these tests, some smart watches provide data predicting an athlete's VO_2 max (as shown in Source 4).

SOURCE 4 A number of smart watches and fitness trackers are available that measure and estimate VO_2 max, but they are not very accurate. However, they can provide accurate heart rate readings, which can be beneficial for people who want to determine the heart rate they should train at.

FOR THE RECORD!

Professional athletes (e.g. those who specialise in cross country skiing, cycling, rowing and marathon running) can obtain VO_2 max scores in the 80s and 90s! In fact, the highest VO_2 max score on record was achieved in 2012 by an 18-year-old Norwegian cyclist by the name of Oskar Svendsen, who had a score of 97.5 ml/kg/min.

PERFORMANCE	SKILL DRILL **4.5A**	Determine your VO_2 max

>> Turn to pages 342–343 to complete this integrated physical performance activity.

The lactate threshold

In order for athletes to perform at maximum efficiency for extended periods of time, it is important for a steady supply of oxygen to be delivered to the working muscles. In situations where the oxygen required by the muscles is higher than the rate at which it can be delivered in the blood (i.e. when the body can't deliver oxygen to the working muscles fast enough), ATP resynthesis takes place via anaerobic glycolysis and lactic acid is produced.

The exercise intensity at which blood lactate begins to accumulate in the muscles at a faster rate than it can be removed (in the blood) is known as the **lactate threshold**. When exercising below the lactate threshold, the blood lactate being produced in the body is able to be removed without building up. If the intensity of physical activity is not reduced when the lactate threshold is reached, then athletes experience an onset of blood lactate accumulation (OBLA) whereby blood lactate begins to accumulate exponentially (more and more quickly. This is also referred to as as the **lactate turn point (LTP)**. When the LTP is reached, the effects of the lactate can prevent the muscle fibres from contracting properly and negatively affect performance by bringing about fatigue.

Finding the balance between levels of lactic acid accumulation that are beneficial and detrimental comes with training and experience. Blood lactate tolerance improves with training, as do removal rates. Even though production rates may be high during intense exercise, high removal rates may ensure that performance is not affected.

Athletes who have a good aerobic capacity, with physiological adaptations facilitating efficient oxygen uptake, generally have a higher lactate threshold than those with a lower aerobic capacity. This is because they are able to clear the lactate produced during anaerobic glycolysis more efficiently, and keep the amount of lactate at an appropriate level for long periods of time. Experiencing the effects of OBLA can also build an athlete's tolerence to this fatiguing by-product indicating the importance of incorporating anaerobic-based training in aerobic-based training strategies.

lactate threshold
the point at which lactic acid (i.e. lactate and hydrogen ions) begins to accumulate in the muscles at a faster rate than it can be removed (in the blood)

lactate turn point (LTP)
a term used to describe the point at which the accumulation of lactic acid (i.e. lactate and hydrogen ions) results in negative effects (e.g. prevents the muscle fibres from contracting properly) and fatigue

STUDY TIP

You will need to determine your heart rate recovery as part of the primary data collection that will inform your training strategy in Summative internal assessment 3: Project – folio. To do this, it is important to measure your heart rate in beats per minute (i.e. bpm):

- immediately following exercise
- after 30 seconds
- after 1 minute.

It is useful to do this several times over the course of your training session to see the impact of fatigue on your heart rate recovery. When evaluating the effectiveness of your training strategy, you can compare your heart rate recovery at 30 second intervals over time to see if it has improved.

Calculating your lactate threshold

The lactate threshold for an average athlete is reached at around 85 per cent of their **maximum heart rate (MHR)**. MHR is the highest number of beats your heart is capable of pumping per minute during exercise.

An estimated MHR can be calculated using one of the following formulas:

- 220 – age in years
- 206.9 – (0.67 × age in years).

The second formula is often more accurate for younger athletes, and it is recommended you use this formula when determining your MHR.

It is helpful to know your own lactate threshold in terms of your heart rate in order to determine:

- training intensities for optimal improvement
- performance intensity to avoid fatiguing effects of working within anaerobic training zones (discussed in Section 4.8).

A Skill drill is also provided to help you determine your lactate threshold.

SOURCE 5 400 metre sprinters must cope with the onset of blood lactate accumulation in order to finish with a burst of high-intensity effort.

PERFORMANCE | SKILL DRILL **4.5B**

Determine your lactate threshold

>> Turn to pages 344–345 to complete this integrated physical performance activity.

The impact of training on VO_2 max and lactate threshold

When an athlete trains, they place their body under stress. This stress causes a number of changes to occur in the body that can increase VO_2 max and lactate threshold. These changes can:

- be immediate – known as **acute physiological adaptations**
- take place over a longer period of time – known as **chronic physiological adaptations**.

acute physiological adaptation
immediate changes in body structures and organs in response to exercise

chronic physiological adaptation
longer-term changes in body structures and organs in response to training

heart rate recovery
a measure of the rate at which the heart returns to normal resting levels (in beats per minute) between periods of exercise

Acute physiological adaptations

Acute physiological adaptations are immediate changes that take place in response to exercise and which result in an increase in oxygen delivery to the working muscles. Acute physiological adaptations take place in the respiratory, circulatory and muscular systems. Acute physiological adaptations include:

- increased heart rate (HR)
- increased respiratory rate (RR)
- increase muscular temperature
- increased muscular fibre recruitment (i.e. when more and more muscle fibres are activated to increase the ability of the muscle to contract and therefore it increases strength)
- dilation of blood vessels near the skin and redistribution of some blood volume to this area (resulting in reddening)
- sweating.

Acute adaptations occur during (and immediately after) exercise and place an athlete's body under stress. It is this stress that sends messages to the body to make changes to the structure and function of the relevant body systems to improve their efficiency and reduce the stress experienced in future performances of the same activity.

After exercise, the body returns to its normal resting state. In fact, **heart rate recovery** is often used as a measure of fitness. Heart rate recovery is the measure of time it takes for the heart to return to normal resting levels.

The average person's heart rate should drop by at least 20 beats per minute in the first minute following exercise. Highly trained athletes with efficient oxygen uptake and delivery can return their heart rate to normal within 30 seconds of finishing exercise. This allows them to participate in episodes of high-intensity activity with minimal recovery periods in between.

During a training session, it will generally take longer and longer for the heart rate to recover between bouts of intense physical activity. The amount of time required for heart rate recovery increases as an athlete becomes more and more fatigued.

However, with physiological adaptation, the heart's ability to recover will improve. This is important in many 'Invasion' and 'Net and court' physical activities that require repeated episodes of high-intensity activity followed by short periods of rest.

PERFORMANCE | SKILL DRILL **4.5C** | **Analyse your heart rate recovery**

>> Turn to pages 346–347 to complete this integrated physical performance activity.

STUDY TIP

For more information about planning and developing training programs and training sessions, refer to the following sections:

- 4.11 The theory of periodisation
- 4.12 Developing a training program
- 4.13 Developing a training session plan.

Although heart rate recovery will differ from one athlete to another, generally speaking an athlete's heart rate should decrease by around 20 beats per minute in the first minute after high intensity. If this is not the case, the athlete's fitness is poor or they may have a medical condition that should be investigated further.

Chronic physiological adaptations

Chronic physiological adaptations are longer-term changes in body systems and organs that take place with training over time. Chronic physiological adaptations improve the ability of an athlete to deliver oxygen around the body during exercise and also help with recovery. The stress placed on a body during training sends a message to the body that adaptation is required. Once the stress is removed (i.e. in recovery), the body makes small changes to the structure and function of organs such as the lungs, heart, blood vessels and muscles so that they are better prepared to deal with this stress the next time. The changes that take place increase the efficiency of the delivery of oxygen throughout the body (i.e. VO_2 max is increased). With greater access to oxygen, athletes can work at higher intensities for longer periods without experiencing the onset of blood lactate accumulation.

Heart function	Measurement of heart rate	Untrained athlete	Trained athlete
Heart rate (bpm)	Rest	74	61
	Submaximal	152	121
	Maximal	194	190
Stroke volume (ml)	Rest	64	82
	Submaximal	111	92
	Maximal	122	142
Cardiac output (L/min)	Rest	4.5	4.6
	Submaximal	19.7	20.6
	Maximal	22.3	25.8
Tidal volume (i.e. volume of O_2 per breath) (L)	Rest	0.6	0.6
	Submaximal	2.5	2.7
	Maximal	2.8	3.1
Respiration (breaths/min)	Rest	14	12
	Submaximal	30	30
	Maximal	42	47
Ventilation (L/min)	Rest	7	6
	Submaximal	75	75
	Maximal	123	142

Source: Adapted from NSCA – National Strength & Conditioning Association, 2016, *Essentials of Strength Training and Conditioning*, 4th edn, Human Kinetics, Champaign

SOURCE 6 A comparison of heart function for a trained and untrained 17-year-old athlete

See your obook assess for a table outlining the types of chronic physiological adaptations that take place over time with appropriate training.

4.5 Check your learning

Engage and understand

1 **Construct** a simple flowchart or diagram to **explain** how the oxygen from the air we breathe is delivered to the working muscles during physical activity.

2 **Identify** three acute physiological adaptations that take place during exercise and **explain** the reasons for these adaptations.

3 **Identify** three chronic physiological adaptations that take place after repeated periods of exercise. **Explain** how these adaptations help to optimise your performance.

4 **Define** the term 'VO_2 max'.

5 **Identify** three tests that can be used to determine your VO_2 max.

Analyse and apply

6 **Reflect on** a time when you accumulated blood lactate. **Identify** the activity you were doing, **describe** the symptoms you experienced and **explain** the chemical process that took place.

7 During a touch football match, a winger scores a breakaway try, running the length of the field. After completing the try, he walks the ball back to the halfway line and notes that his heart rate and respiratory rate are still elevated, despite the fact that he's no longer running.

   a **Determine** which energy system he most likely used during his try.

   b **Consider** some possible reasons for his elevated heart and respiratory rates, providing as much detail as possible.

8 **Interpret** Source 6 in order to explain why the trained athlete's heart rate is lower than the untrained athlete's heart rate in all conditions except for maximal heart rate.

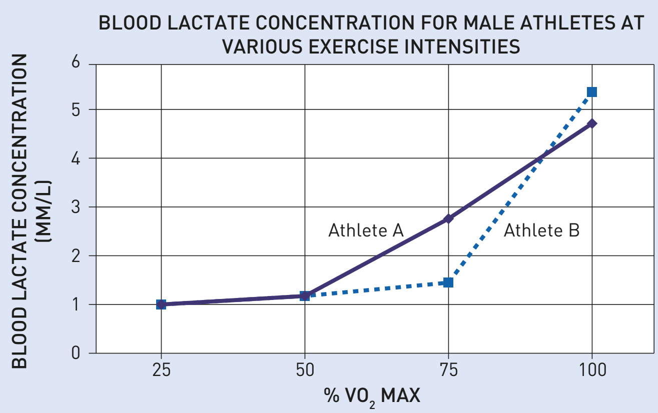
Evaluate and justify

9 Source 7 displays the blood lactate concentrations for trained and untrained males at various exercise intensities.

   a Both lines move along the bottom of the graph for a period of time before turning upwards. **Determine** what this upwards turn represents. **Justify** your response.

   b **Decide** whether line A or B represents the trained athlete. **Justify** your decision.

   c If you were to plot a line on the graph that represented your own blood lactate concentration during the same exercise intensities, **predict** where your upwards turn would be. Copy this graph into your notebook and add your line to it.



SOURCE 7 Blood lactate concentration for male athletes at various exercise intensities

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Check your obook assess for the following additional resources and more:

» **Student book questions** 4.5 Check your learning

» **Video** The role of oxygen in performance

» **Student worksheet** The role of oxygen in performance

4.6 Training requirements for physical activity

That's a goal!

By the end of Section 4.6, you should be able to:

→ **understand** and **define** the terms 'training' and 'training program'
→ **identify** three steps required to develop a training program
→ **understand** that the nature and length of training programs differs depending on the needs of the athlete.

Defining training

Now that you have learnt about how the body produces energy for physical activity, and how fitness is measured and classified, it is time to apply this knowledge to your training. Training is the action of undertaking a course of physical activity in order to:

- prepare for a particular physical activity
- prepare for a particular sporting event or performance
- achieve a personal energy or fitness goal
- encourage chronic physiological adaptations in the body.

Because both energy use and physical fitness vary between athletes, training is not a one-size-fits-all process. Further more, energy and fitness requirements also vary between different sports. In order for training to be effective (i.e. help athletes or teams to meet their individual goals and optimise their performance in their chosen sport), it has to be carefully planned, implemented and evaluated. To achieve this, athletes use a planning tool known as a training program.

In this section we will discuss the concept of training programs and introduce some key terms relating to training that you will need to become familiar with. Developing a training program can be a complex process because there are many factors to take into account. Don't worry if the information provided here seems overwhelming to begin with. Each of these key terms and concepts will be revisited and explained in more detail over the remainder of this chapter. We will also demonstrate how they can be applied to a range of different physical activities and for a variety of timeframes to help athletes optimise their performance (see Source 2).

annual plans
an athlete's overall training plan for the year, which includes an overview of the physical activities that they need to train for and the times at which they must be in peak physical condition for competition. Annual plans can consist of one or more macrocycles

game analysis
the process of observing, recording and analysing performance and skill data from a selected game, sport or physical activity so that this information can be used to design relevant and appropriate training activities

Introducing training programs

A training program is a comprehensive plan that athletes use to map out future training sessions. Having a training plan helps individuals or teams achieve energy, fitness and skill goals over a specific period of time (e.g. one week, two months, one year).

Athletes begin the process of designing a training program by creating an **annual plan**. This is an overview of the year, highlighting the times when the athlete needs to be in optimal physical condition. Annual plans can also help to point out where clashes can occur (e.g. when an athlete needs to be training and competing for two physical activities at the same time).

There are several factors to consider when developing a training program and they will be discussed in more detail later in this chapter. For now, you need to know that there are three crucial steps to follow when drafting a training program.

Step 1 – Determine personal training needs through game analysis

The first step in developing a training program is for an athlete to determine their personal needs by conducting a game analysis. Game analysis is the process of an athlete observing, recording and analysing performance and skill data from a selected game, sport or physical activity and using this to design relevant and appropriate training activities. You will learn more about **game analysis** and how to conduct your own in Section 4.12 pages 258–265.

Step 2 – Identify specific training objectives

The second step in developing a training program is to identify the specific training objectives that an athlete will have to achieve in order to reach their overall goals. It is important to have an understanding of the science of training before setting objectives, especially **principles of training** and **training methods**. These concepts are introduced below and will be discussed in more detail in Sections 4.8 and 4.9.

Step 3 – Develop a training program

Once an athlete has conducted a game analysis and identified their specific training objectives, they must now address some other important features of a training program. These include:

- **work volume** and **training load** – this includes a detailed overview of the frequency (how often), the duration (how long) and the intensity (how hard) of training over time. The frequency and the duration combined is referred to as the work volume. The work volume combined with the intensity is known as the training load
- **tapering** and **recovery** – tapering is the process of gradually reducing the difficulty and intensity of training as an athlete nears competition. All training programs must include a tapering period in order to optimise performance. Recovery is the process of allowing the body to recuperate and return to its normal resting state after training. It is important as it allows for the physiological adaption to take place.

Things to consider when developing a training program

In order to correctly and appropriately plan and construct the core features of a training program, an athlete will need to consider:

- **principles of training** – the seven principles of training are specificity, frequency, intensity, duration, progressive overload, individuality and variety
- **training methods** – the six training methods are continuous training, fartlek training, resistance training, interval training, flexibility training and circuit training

principles of training
a set of guidelines considered in the development, design and evaluation of a training strategy (i.e. specificity, frequency, intensity, duration, progressive overload, individuality, variety)

training methods
forms of exercise that can be selected and used to target particular components of fitness and performance (i.e. continuous training, fartlek training, resistance training, interval training, flexibility training, circuit training)

work volume
a general measure of how much exercise an athlete does; a combination of the frequency and duration of the training activities undertaken

training load
the combination of work volume and intensity; a general measure of the overall difficulty of the training

tapering
the gradual reduction of work volume and/or intensity of training in the lead up to a major competition in order for the athlete to peak

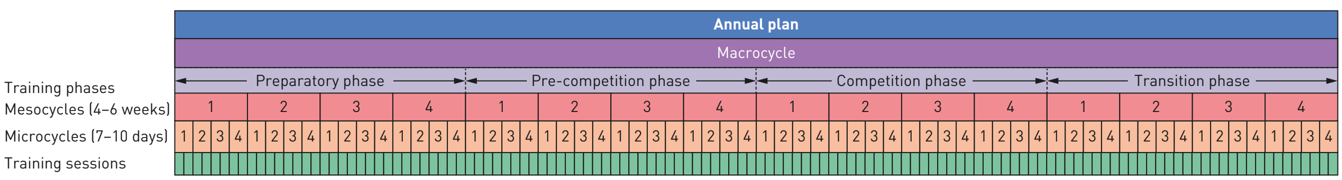
recovery
the process of an athlete's body returning to its normal state; for example, a fatigued athlete's muscles beginning to feel normal again, and their breathing rate slowing to a normal rate

periodisation
the process of dividing an annual training plan into a series of smaller, more manageable periods of time (known as macrocycles, training phases, mesocycles, microcycles and training sessions). Each period of time is designed to target specific training objectives over a specific period of time

training phases
four distinct stages of training that combine to make an annual plan. Each training phase is designed to target a specific training objective over a specific period of time. There are four main training phases: the preparatory phase, the pre-competition phase, the competition phase and the transition phase

- **periodisation** – the process of dividing a large period of time for training into a series of smaller, more manageable periods of time, each with a specific training objective is called periodisation. There are six building blocks, or levels, to the periodisation model:
  - **annual plan** – a term used to describe an athlete's planning over a 12-month period
  - **macrocycle** – a term used to describe the time from when an athlete starts to train for a season or event, to the completion of their post-season or post-event recovery; an annual plan can consist of one or more macrocycles
  - **training phases** – each macrocycle is made up of four training phases, each with its own specific training objective; the four training phases are the preparatory phase, the pre-competition phase, the competition phase and the transition phase
  - **mesocycles** – each training phase is broken into 4 to 6 week blocks known as mesocycles, each with a specific training focus
  - **microcycles** – each mesocycle is further broken down to microcycles, a training period of 7 to 10 days, each with a specific training focus
  - **training sessions** – the smallest component in a training program, the training session is a period of approximately 1 to 2 hours, with a specific energy, fitness or skill development focus.
- **training zones** – the range of intensity within which an athlete should train depending on whether they wish to target the anaerobic energy system or the aerobic energy system
- **fatigue** and **recovery** – fatigue is the tiring of muscles and organs that occurs when bodies are placed under stress during and after training; recovery is the process of an athlete's body returning to its normal state.

This information is provided here so that you can develop a general idea of what training programs are and what needs to be taken into consideration in order to create



SOURCE 1 A visual overview of how periodisation works over the course of an annual plan

macrocycle
the training period from the beginning of the preparatory training phase to the end of a transition training phase within an annual plan

mesocycles
training periods, generally 4 to 6 weeks in duration, with a specific training focus

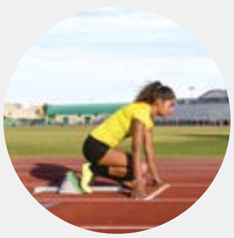
microcycles
training periods, generally 7 to 10 days in duration, with a specific training focus

effective training programs. Over the remainder of this chapter, you will develop a more thorough understanding of each of these concepts and how they relate to each other.

Developing a training program that works for you

In order to be most effective, every training program should be tailored to the needs and wants of each individual athlete.

Source 2 provides some examples of how the needs of three different athletes (competing in different sports) can influence the training goals and the initial planning for their individual training programs. Each of these athletes has a different level of experience and proficiency, and particular areas in which they would like to improve.

Athlete	Category of physical activity	Event/ sport position	Proficiency level	Area for improvement	Training goal	Initial plan for training program
Jayden 	Invasion	Basketball (centre)	Beginner–intermediate	'I feel puffed, with a burning chest after the first quarter of most games. This reduces my ability to keep up with the pace of the game and perform effectively after the first quarter.'	'I want to improve my **aerobic capacity** so that I can be effective for more than the first quarter.'	1 × mesocycle targeting aerobic capacity (specific to the specialised movement sequences and movement strategies of basketball)
Sam 	Performance	100 m sprint	Intermediate–advanced	'I am too slow out of the starting blocks.'	'I want to learn how to drive out of the starting blocks with more **power** in order to improve my start time (first three steps).'	3 × 60 minute training sessions targeting power and technique for block starts
Ada 	Net and court	Volleyball (passer hitter)	Advanced	'I feel fatigued in the legs as the game goes on and I lose effectiveness in attack because I can't maintain a powerful spike approach. My jumps lose height and my spikes go into the net and/or are mistimed.'	'I want to improve my **muscular endurance** so that I can jump higher and my spikes can remain effective for the entire game.'	1–2 × microcycles targeting muscular endurance (specific to the specialised movement sequences and movement strategies of volleyball) Implement as many training sessions as possible within allocated microcycle

SOURCE 2 Training programs should be written specifically for an athlete's individual needs. The length of a training program will depend on the difficulty level of the athlete's goal.

STUDY TIP

The *Physical Education 2019 v1.1 General Senior Syllabus* identifies the features of a training program as:

- specific training objectives to achieve a determined outcome
- game analysis
- work volume (frequency and duration) and intensity
- tapering and recovery to achieve the determined outcome for a particular phase.

You need to be familiar with this information, as you may be required to answer questions about this in the external examination.

4.6 Check your learning

Engage and understand

1 **Define** what is meant by a 'training program'.

2 **List** the key features of a training program.

Analyse and apply

3 **Analyse** Jayden, Sam and Ada's initial planning for their training programs. Using a list of dot points, **contrast** their goals and planned training time.

Evaluate and justify

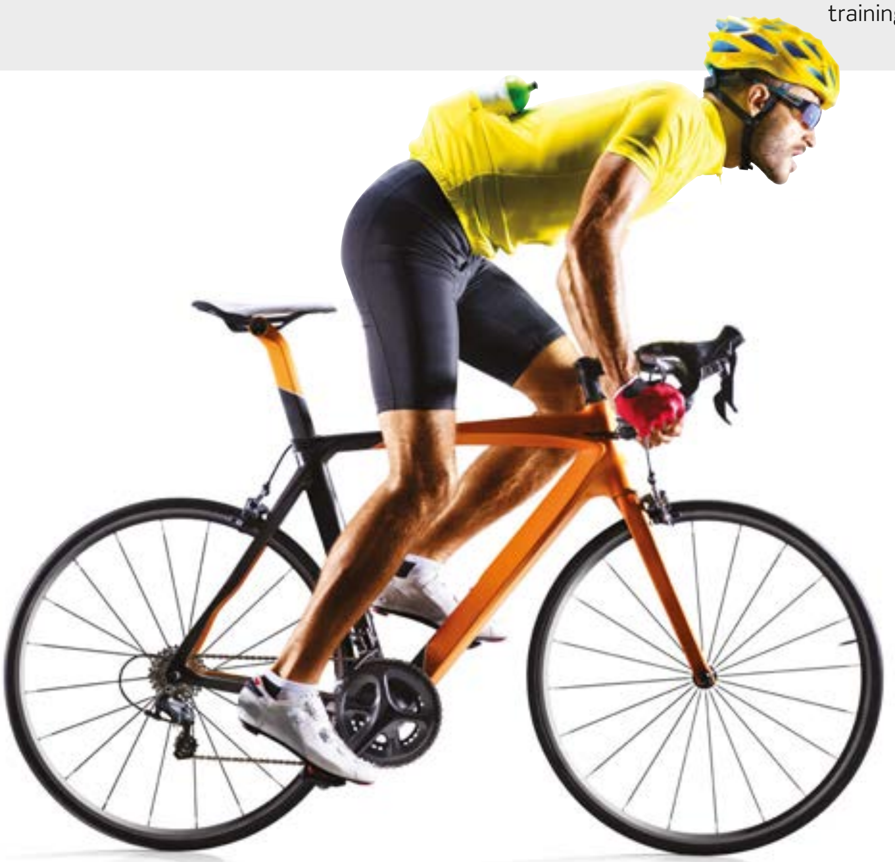
4 In a written response of 150 words, **discuss** why training programs require a high degree of thought and planning in order to be successful. You may need to conduct some additional research online to help you formulate your response.

Check your obook assess for the following additional resources and more:

» **Student book questions**
4.6 Check your learning

» **Weblink**
Training programs explained

» **Weblink**
Sport Australia – sport specific training programs



SOURCE 3 Training programs help athletes to meet their individual goals and optimise their performance.

4.7 Training zones

That's a goal!

By the end of Section 4.7, you should be able to:

→ **define** and **explain** the term 'training zone'
→ **understand** the importance of manipulating training intensity to work in specific training zones
→ **understand** how to **determine** maximum heart rate, target heart rate and lactate threshold.

maximum heart rate (MHR)
the highest number of times (i.e. beats) your heart is capable of pumping per minute during exercise

recovery training zone
a low intensity training zone that allows for the recovery and adaptation of the body's structures following a bout of high-intensity work

aerobic training zone
a medium intensity training zone that allows for the development of the body's circulatory system

lactate threshold training zone
a specific zone in which the athlete trains at or just under their lactate threshold

anaerobic training zone
a high-intensity training zone in which an athlete works above their lactate threshold in intervals

target heart rate (THR)
the heart rate you aim to train at during exercise

In order to ensure that training leads to the desired physical adaptations, one of the first questions an athlete should ask themselves when planning their training is what energy systems they need to use, and at what level they need to exert themselves. In other words, they need to identify what training zone they should work in to optimise their performance and get the most out of their training.

Defining training zones

A training zone is a range that indicates the upper and lower limits of intensity for training. Training zones are used by athletes to ensure they are training at the right intensity for the energy system they wish to train and for the training objectives they have set for the session. Training zones are normally expressed as a percentage of **maximum heart rate (MHR)** and the range given is based on norms and averages. It is important that individuals use the given ranges as a guide only, and make modifications to their training intensity based on their unique needs. Generally, an athlete can train in the following zones:

- **recovery training zone**
- **aerobic training zone**
- **lactate threshold training zone**
- **anaerobic training zone**.

When determining training zones, you will need to know your MHR and **target heart rate (THR)**. MHR is the highest number of beats your heart is capable of pumping per minute during exercise. To estimate your MHR, use the recommend formula: 206.9 – (0.67 × age in years).

Once you have established your MHR, you can use it to determine the heart rate you need to be training at for the physiological adaptations required for success in your physical activity. This is known as your target heart rate (THR) – the heart rate you aim to train at or reach during exercise. THR is a measure of intensity and is based on a percentage of MHR. For example, a 17-year-old who has a MHR of 195 bpm and wants to reach a THR of 75 per cent of their MHR, would need to multiply 0.75 by 195 (to find that their THR would be 144 bpm). Due to its ease of calculation, this is the most popular method for determining THR to achieve a desired intensity.

Recovery training zone

The recovery training zone is a low-intensity training zone that allows for the recovery and adaptation of the body's structures after a bout of high-intensity work. This zone uses the aerobic energy system and allows for the optimisation of physiological adaptation such as muscle fibre stimulation, mitochondrial development and capillary development. Athletes generally stay under 65 per cent of MHR in the recovery training zone. Training in this zone should feel easy, and to achieve the full benefits of a well-planned recovery zone session, athletes should avoid the temptation to push themselves harder.

Theory in action The 'middle of the week' training theory

Professional sports teams, such as the Brisbane Broncos, take recovery training during their competitive season very seriously. In situations where they play a match every weekend, the training in the 24 to 48 hours before and after these high-intensity games is usually conducted in the recovery training zone. This allows the players to repair and regenerate muscle tissue and increase their muscles' ability to store and resynthesise ATP. In fact, it is standard practice for most professional rugby league teams to train at a very high intensity only once in each week of the competitive season. This high-intensity training is reserved for the middle of the week only; several days after the last game and several days before the next.

Energy contribution		
Event	% aerobic	% anaerobic
Marathon (42.4 km)	97.5	2.5
10 km	90	10
5 km	84	16
1 km	80	20

Source: Gastin, Paul B. 'Energy System Interaction and Relative Contribution During Maximal Exercise.' *Sports Medicine* 31.10 (2001): 725–41

SOURCE 1 Distance runners have a high proportion of their energy supplied by the aerobic energy system and need to train their bodies to metabolise fat. Therefore, they should ensure some of their training has them working in the aerobic training zone.

Aerobic training zone

The aerobic training zone is a moderate-intensity training zone that allows for the development of the body's circulatory system. In this zone, the body uses the aerobic energy system, and training here allows the body to become stronger while recovering from harder bouts of training. The aerobic training zone pace is comfortable, placing some stress on breathing, but not so much that the pace cannot be maintained indefinitely.

This training zone is useful for physical activities that have a high aerobic energy contribution. Source 2 shows the aerobic and anaerobic energy contributions for distance runners. It is clear that the aerobic contribution is significant when compared to the anaerobic contribution. Such runners would benefit from training in the aerobic training zone for at least some of their training. In the aerobic training zone, the body is able to metabolise fat for longer, which is desirable in activities with high aerobic contribution because fat supplies are more abundant than carbohydrate supplies.

The aerobic training zone is generally between 60 and 80 per cent of MHR. A good indication of being in the aerobic training zone is the ability to hold a simple conversation during training. If you struggle to catch your breath, it is likely you have entered the anaerobic training zone.

Lactate threshold training zone

The lactate threshold training zone is a specific zone in which the athlete trains at – or just under – their lactate threshold. For example, the aim for a runner in the lactate threshold training zone is to run as fast as possible using the aerobic energy system (i.e. 60–80 per cent of MHR). At this pace, the body has to work hard to clear the lactate from the muscles and bloodstream, but it is capable of doing so. If they run any faster, and the lactate cannot be cleared, they will be running above their lactate threshold (i.e. anaerobically).

Running at this pace trains the body to be more efficient at clearing lactate. This ultimately allows athletes to be able to run faster while still clearing lactate; it raises their lactate threshold.

For most people, the lactate threshold training zone is around 80 to 85 per cent of their maximum heart rate. Like the aerobic zone, training in this zone is comfortably hard, meaning it is harder than moderate but not 'extreme'. It should be possible to maintain the pace for a 10 kilometre run.

SOURCE 2 Training in the lactate threshold zone requires athletes to continually monitor and maintain a steady high intensity that does not exceed their lactate threshold.

Anaerobic training zone

The anaerobic training zone is a high-intensity training zone in which an athlete works above their lactate threshold in intervals. In this training zone, an athlete engages their ATP–PC and/or lactic acid systems. Despite being called the anaerobic training zone, working at these high-intensity intervals helps to improve aerobic capacity by increasing VO_2 max and lactate threshold. Training in this zone means athletes will experience a build-up of lactate in their muscles, which is important because it leads to an increased tolerance to the fatiguing effects of the lactic acid. It also improves the efficiency of the heart to get oxygen to the working muscles.

The anaerobic training zone is between your lactate threshold and your VO_2 max. Training at this intensity can generally only be sustained for small increments of under 2 minutes, followed by rest and then repeated. Section 4.9D on interval training provides more details about this type of training.

If your training objective is to work on your ATP–PC energy system, training would be for no more than 20 seconds and with a 2 to 3 minute rest to ensure PC is replenished between efforts. In this case, you wouldn't need to measure your heart rate, but you would still be technically training in your anaerobic training zone.

4.7 Check your learning

Engage and understand

1 **Identify** and **define** the four training zones.

2 **Explain** why it is important to keep your heart rate within a very small range when training in the lactate threshold training zone.

Analyse and apply

3 **Deduce** the confusion that can arise from the term 'anaerobic training zone'.

Evaluate and justify

4 **Determine** why a coach would ask a 17-year-old 1500-metre runner to ensure that her heart rate remained between 155 and 165 beats per minute during a training session.

5 **Predict** your heart rate for each of the four training zones.

Check your obook assess for the following additional resources and more:

» **Student book questions**
4.7 Check your learning

» **Video**
Training zones

» **Student worksheet**
Training zones

4.8 Principles of training

That's a goal!

By the end of Section 4.8, you should be able to:

→ **identify** and **define** the seven principles of training (i.e. specificity, frequency, intensity, duration, progressive overload, individuality, variety)

→ **explain** how the principles of training can be applied to help ensure that training objectives are met.

specificity
a principle of training that states the type of exercise used in training should be relevant (i.e. specific) to the energy systems, position-specific movements, and the fitness requirements of the selected sport or physical activity

frequency
a principle of training that states the number of times training occurs in a given period should be appropriate for the selected sport or physical activity

intensity
a principle of training that states the magnitude of exertion (i.e. how hard an athlete trains) should be appropriate for the selected sport or physical activity

duration
a principle of training that states the length of training time should be appropriate for the selected sport or physical activity

progressive overload
a principle of training that states that training should be planned to ensure gradual increases in training load to ensure that physiological adaptation is appropriate for the selected sport or physical activity

Principles of training

The principles of training are a set of guidelines that should be considered in the development, design and evaluation of a training program. The principles of training help to ensure that all athletes get the most value and benefit out of their training and are able to achieve their training objectives and performance goals. They do this by assisting athletes and coaches to:

- select training activities that are relevant (i.e. specific) to the energy systems, position-specific movements and the fitness requirements of the selected sport or physical activity (i.e. **specificity**)
- decide how often they should train in order to get the best results (i.e. **frequency**)
- decide how hard they should train in order to get the best results (i.e. **intensity**)
- decide how long they should train for in order to get the best results (i.e. **duration**)
- determine the rate at which training load is increased in order to encourage physiological adaptation (i.e. **progressive overload**)
- decide on the most appropriate training strategies for their individual circumstances (i.e. **individuality**)
- include a range of different training activities, movement options and training contexts so that athletes stay motivated and interested (i.e. **variety**).

We will now look at each of these seven principles of training in more detail.

Specificity

The principle of specificity states that the type of exercises used in training should be relevant to the energy systems, the position-specific movements and the fitness requirements of the selected sport or physical activity. In other words, specificity suggests that the physical demands, skills and contexts of a particular sport or position should be replicated in training activities as much as possible. To do this, athletes need a thorough understanding of the physical requirements of their selected sport or physical activity, so they can tailor their training program and activities to meet those requirements.

For example, the soccer goalkeeper shown in Source 1 requires speed, power, agility and flexibility to be effective. He also relies heavily on his anaerobic energy systems. By comparison, the midfielder requires speed, aerobic capacity, muscular endurance and agility to be effective. He relies more on his aerobic energy system. As a result, the training programs and activities for these two positions would need to differ to ensure the athletes were prepared for their specific positions.

Specificity also encourages athletes to consider the specialised movement sequences required in their chosen sport or physical activity. It is important to ensure that training activities provide opportunities for athletes to practise specialised movement sequences that are specific to their sport or position.

Specificity also suggests that environmental factors (e.g. weather, lighting, playing surface) should replicate (as much as possible) the conditions likely to be experienced during competition. For example, if an athletics competition is going to be held on a tartan track in the middle of the day when it is hot, then the principle of specificity would suggest that training conditions should replicate this, because training on a grass track in the cool of night will not adequately prepare the athlete for this competition.

individuality
a principle of training that states the personal needs, goals, fitness levels, motivation and skills of individual athletes should be considered when designing a training program

variety
a principle of training that states a range of different training activities, movement options and training contexts should be included in a training program

Frequency

The principle of frequency states that the number of times an athlete trains within a given period should be appropriate for their selected sport or physical activity. In other words, the frequency at which an athlete trains needs to be appropriate for their chosen sport or position, as well as their individual circumstances (e.g. general fitness level, level of proficiency, age).

Generally speaking, the frequency of aerobic zone training is recommended at three to five days per week, while the frequency of anaerobic zone training is recommended at three days per week. It is important to note, however, that an appropriate frequency of training – and frequency of particular training activities used within training sessions – will depend on many factors, such as:

- the intensity, duration and type of training activities or training sessions
- the individual characteristics of particular athletes (e.g. level of fitness, skill, experience)
- the specific muscles or body parts being trained
- the fitness components and energy systems being focused on
- the particular training methods being used
- a range of environmental factors (e.g. weather, temperature).

For example, an athlete who participates in three high-intensity training sessions in a week may not be able do more without risking injury and/or negative physiological adaptations. However, if a session targets one particular body part (e.g. legs) on one day, a different body part (e.g. arms) can be targeted the next day. In this way, frequency of training can be increased. When determining frequency of training, it is important to find a balance between stressing the body enough to cause positive physiological adaptation without overtraining (i.e. causing harm or negatively impacting the benefits of training).

SOURCE 1 The frequency of training is dependent on many factors; however, with thoughtful planning, it is possible to train more frequently by targeting different skills, body parts and training methods over the course of several training sessions.

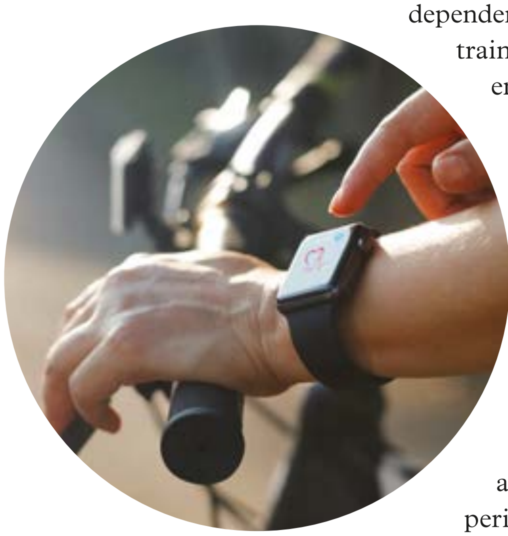
Intensity

STUDY TIP

For more information on the Borg Rating of Perceived Exertion (RPE) scale, refer to your obook assess.

The principle of intensity states that that the magnitude of exertion (i.e. how hard an athlete trains) varies between athletes depending on their training objectives, the training phase they are in, the sport or physical activity they are participating in, and so on. Intensity is generally measured in terms of:

- the relative percentage of maximum heart rate
- the relative percentage of VO_2 max
- lactate threshold
- weight, reps and sets (i.e. in resistance training)
- pace (i.e. speed)
- the Borg Rating of Perceived Exertion (RPE) scale.



SOURCE 2 Heart rate monitors are one tool that can be used to determine intensity in some types of training by measuring the relative percentage of maximum heart rate.

The level of intensity at which an athlete trains is dependent on their training objectives for a particular training session. Intensity can be manipulated to ensure an athlete experiences the desired physiological adaptations. For example, a netball player who wants to improve her fitness to prepare for competitions would need to train at an intensity that replicates competition intensity. Heart rate is a reliable form of intensity measurement in longer forms of exercise; however, it is not useful for measuring intensity in activities designed to develop the ATP–PC system and it doesn't always adapt quickly enough to use as a guide early on in repeated high-intensity periods of exercise. In such cases, perceived effort or rate of exertion can be used, or, in the case of weight training, the weight of the resistance used, the number of reps or sets in a session, or the speed of completion of the reps and sets, can help determine intensity.

When determining intensity, it is also important to consider the principles of frequency and duration. The length of training and how often the athlete intends to train in the week will impact on how appropriate the level of intensity is in any given activity.

Duration

The principle of duration states that the length of training time should be appropriate for the selected sport or physical activity. The length of time spent training can be viewed on many levels. It can refer to the length of an entire training program down to individual training sessions. For example, a year-long training program is a measure of duration in the same way that the number of repetitions of a bicep curl performed within a particular set is a measure of duration.

In order to determine an appropriate duration for training activities, a number of factors need to be considered, such as the athlete's level of fitness, the training method being used and the intensity of the activity. As an athlete's level of fitness improves, they will need to increase the duration of training activities in order to make gains.

The duration of a training program is usually dependent on the amount of time an athlete has available, but it is generally considered necessary for a training program to be a minimum of 8–12 weeks long in order for physiological adaptations to occur that result in measurable improvements to performance. The duration of a training session typically varies between one and two hours.

Progressive overload

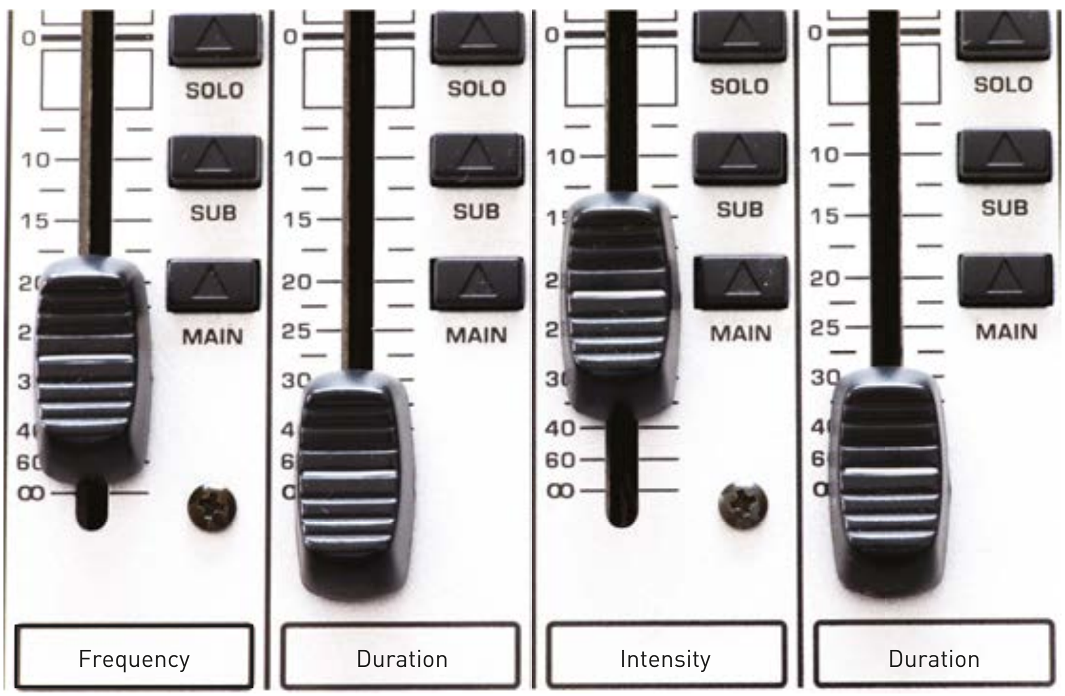
The principle of progressive overload states that training should involve gradual increases in the physical demands on the athlete to drive physiological adaptations. Using the principle of progressive overload ensures that an athlete's fitness does not stagnate as they become accustomed to the demands being placed on them. Rather, through gradual increases in training load, their body continually adapts accordingly, leading to greater overall gains.

These gradual increases in the athlete's training load occur through gently manipulating work volume (i.e. frequency and duration) and/or intensity. This manipulation is known as **loading**.

loading
an increase in work volume and/or intensity of work, placing the athlete's body under stress

It may help you to think of loading being achieved through manipulation of the dials on an audio mixing board (as shown in Source 3). Not all the dials need to be turned up at once to achieve a change. Sliding the 'intensity' control upwards, for example, without touching any of the other controls, may be enough to 'overload' a particular athlete and cause a desired physiological adaptation. Over time, however, that athlete may need to slide the 'frequency' and/or 'duration' controls upwards in order to overload the body and cause a further physiological adaptation. All of this will depend on the individual.

In Sections 4.12 and 4.13, you will learn in more detail about how training loads can be manipulated to achieve a desired physiological adaptation.



SOURCE 3 The principle of progressive overload states that training should be planned to ensure gradual increases in the physical demands of training activities to drive positive physiological adaptations. Just like sliding the controls on an audio mixer up or down, intensity, frequency and duration can be manipulated to overload the body and bring about these adaptations.

STUDY TIP

When making decisions about the duration of training activities within training sessions, it is important to also take frequency into account. As we learnt in Section 4.6, frequency and duration combined make up the total work volume. In other words, if an athlete trains for one hour (duration), once per week (frequency), the work volume is lighter than if she trains for one hour three times per week.

SOURCE 4 The principle of individuality states that the personal needs, goals, fitness levels, motivation and skills of individual athletes should be considered when designing a training program. Whether an athlete is looking to improve their baseline fitness, or training for a one-off event, an ongoing competition or the Olympic Games, this will have an impact on their training program.

Individuality

The principle of individuality states that the personal goals, fitness levels, motivation and skills of individual athletes should be considered when designing a training program or strategy. In other words, it is important to determine how a person's individual circumstances may impact their capacity to complete a training plan when deciding on the specifications of a training program. Individual considerations include:

- **personal goals and training objectives –** these are key factors in the design of an appropriate training program. Whether an athlete is looking to improve their baseline fitness, or training for a one-off event, an ongoing competition or the Olympic Games, their goal is key to determining an appropriate training program
- **fitness level –** an individual's fitness level will impact an athlete's ability to complete certain training activities, so it must be considered in the design of an appropriate training program and training sessions
- **motivation –** motivation levels will impact an athlete's ability to complete certain training activities; for example, more intrinsically motivated athletes may need to plan training activities that are different to more extrinsically motivated athletes. For this reason, motivation must be considered in the design of an appropriate training program and training sessions
- **skill level –** an individual's skill will impact their ability to complete certain training activities and must therefore be considered in the design of an appropriate training program and training sessions
- **personal circumstances –** personal factors (e.g. their work or study commitments, travel requirements, medical history, religious beliefs, financial issues) should also be considered when designing an appropriate training program as they may affect when an athlete can train and the types of training activities they can take part in.

SOURCE 5 The principle of variety states that it is important to include a range of different activities in a training program. Alternating training activities or training with friends can help to keep athletes challenged and motivated, and can stimulate positive physiological adaptations.

Variety

The principle of variety states that it is important to include a variety of different activities in a training program. In order to stay on target, create progressive overload and ensure training meets the objectives, a training program needs to 'mix it up' so that athletes don't get bored and lose motivation.

Alternating between different types of training activities from one training session to another – or training with different people – can help to keeps athletes feeling interested and challenged. It also helps to prevents automation (i.e. when athletes stop thinking about what they are doing because they have done it so often). Automation can result in reduced benefits from training, so it is best avoided through the use of variety.

4.8 Check your learning

Engage and understand

1 **Describe** the purpose of following the principles of training when creating a training strategy.

2 **Identify** the seven principles of training and **define** each one in your own words.

3 **Describe** the factors that an athlete should take into consideration when planning the frequency of activities for a training program.

Analyse and apply

4 **Compare** and **contrast** the energy, fitness and training requirements for the following athletes, with direct reference to the principles of specificity and individuality:

- a basketball player who is new to the sport
- an experienced 1500 m runner who is recovering from injury.

5 **Apply** the principle of progressive overload to the following training example and suggest changes to the training load (i.e. work volume and intensity) to encourage physiological adaptation over time. Assume that there is one week between sessions.

Volleyball training session
Warm up (i.e. light jog and dynamic stretches) 5 × court sprints at 80% intensity (i.e. touching each line and returning to baseline on the way to completing 1 full court sprint) 5 × consecutive squat jumps 5 × clap push ups 5 × court sprints (i.e. touching each line and returning to baseline on the way to completing 1 full court sprint) Pepper drill in pairs (i.e. dig, set, spike) – 10 mins Serving to a target – 10 mins 3 v 3 (single point) king of the court – 10 mins Game play

Evaluate and justify

6 The FITT principle is a tool used by some coaches to help design training programs for athletes. FITT stands for Frequency, Intensity, Time (i.e. duration) and Type. FITT is often thought of as a single principle of training, suggesting that there is a relationship between these factors that needs to be considered when planning a training strategy. Conduct some online research into the FITT principle and **construct** an argument for or against the principles of frequency, intensity and duration being thought of as a single principle of training. **Justify** your position in a 150-word written response using examples from your selected physical activity.

7 **Evaluate** your individual needs through the lens of the individuality training principle to determine how your training program might differ from other members of your class or team who play in the same position as you in your selected physical activity. Consider factors such as your work and study commitments, family circumstance, fitness, skill and motivation levels to answer this question in 150 words.

SOURCE 6 The principles of training are a set of guidelines that should be considered in the development, design and evaluation of training sessions.

Check your obook assess for the following additional resources and more:

- » **Student book questions** 4.8 Check your learning
- » **Video** Principles of training
- » **Student worksheet** Principles of training
- » **Weblink** Principles of training – an overview

4.9 Training methods

That's a goal!

By the end of Section 4.9, you should be able to:

→ **define** what is meant by the term 'training methods'

→ **identify** and **describe** training methods (i.e. continuous training, fartlek training, resistance training, interval training, flexibility training, circuit training).

continuous training
a type of training performed at the same intensity for an extended period of time without periods of rest

fartlek training
a variation of continuous training in which athletes vary the intensity of their exercise by increasing the speed or resistance of their work (e.g. by adding incline, running on sand, running up stairs)

resistance training
a type of training that requires an athlete to work against something that resists the movement of the body (or particular body parts)

interval training
a type of training that manipulates periods of work and rest to enhance a specific component of fitness and target a particular energy system

Defining training methods

Training methods are forms of exercise that athletes can use to target different components of fitness and optimise particular aspects of their performance. As shown in Source 1, there are six main training methods:

- **continuous training** – a form of exercise performed at the same intensity for an extended period of time, without periods of rest (discussed in more detail in Section 4.9A)
- **fartlek training** – a variation of continuous training in which athletes vary the intensity of their exercise by alternating the speed or resistance of their work (e.g. by adding incline, running on sand, running up stairs) (discussed in more detail in Section 4.9B)
- **resistance training** – a form of exercise that requires an athlete to work against something that resists the movement of the body (or particular body parts) (discussed in more detail in Section 4.9C)
- **interval training** – a form of exercise that manipulates periods of work and rest to enhance a specific component of fitness and target a particular energy system (discussed in more detail in Section 4.9D)

SOURCE 1 Training methods are types of exercise that an athlete can use to target particular components of fitness and to optimise performance. There are six main training methods, but several of these have a number of subcategories within them.

- **flexibility training** – a form of exercise that involves stretching the muscles, tendons and ligaments in and around joints (discussed in more detail in Section 4.9E)
- **circuit training** – a form of exercise that combines a variety of different training methods and activities that are performed consecutively (i.e. in a cycle) (discussed in more detail in Section 4.9F).

Each one of these training methods can be used in training programs to target different energy systems and fitness components. For this reason, a single training method – or a number of different training methods used in different combinations – can help athletes from all sports achieve their personal training objectives. However, it is important for athletes to select the training methods that will be most beneficial for them, based on the following factors:

- the goal of their training program and training objectives
- the results of a game analysis
- the results of a fitness assessment
- the desired physiological adaptations.

flexibility training
a type of training that involves stretching the muscles, tendons and ligaments in and around joints

circuit training
a type of training method in which a variety of different activities are performed consecutively (i.e. in a cycle)

4.9 Check your learning

Engage and understand

1. In your own words, **define** the term 'training methods'.
2. **Identify** and **describe** the six training methods discussed in this section.
3. **Explain** the need for different training methods.

Analyse and apply

4. Based on what you have learnt about the six main training methods so far, **determine** which one would be most helpful to you in your selected physical activity. Provide a reason for your choice.

SOURCE 2 Training methods can be used in training programs to target different energy systems and fitness components.

4.9A Continuous training

That's a goal!

By the end of Section 4.9A, you should be able to:
→ **define** the term 'continuous training'
→ **identify** two types of continuous training (i.e. long slow distance training and tempo training) and **describe** the differences between them
→ **explain** how continuous training can be applied to help improve aerobic capacity in athletes.

What is continuous training?

Continuous training is a form of exercise performed at the same intensity for an extended period of time without rest. Continuous training can improve aerobic capacity by increasing the body's efficiency in uptake and use of oxygen, and also improve muscular endurance through the repeated muscle contractions required in this type of training.

long slow distance (LSD) training
a type of continuous training performed at a steady, low- to moderate-intensity over an extended distance or duration

tempo training
a type of continuous training performed just under an athlete's lactate threshold

Types of continuous training

There are two types of continuous training:

- **long slow distance (LSD) training**
- **tempo training**.

Long slow distance (LSD) training

LSD training is a type of continuous training performed at a low to moderate intensity over an extended period of time (i.e. duration) or distance. Examples of long slow distance (LSD) training are running, swimming and cycling. Generally, LSD training is performed at an intensity of around 70 per cent of maximum heart rate (MHR) and carried out for periods greater than 30 minutes. During LSD training, fat is the primary fuel source for the body. This is beneficial because, as learnt in Section 4.2, carbohydrates, while an excellent source of fuel, are limited in supply. By training the body to utilise fat as an energy source, it reserves carbohydrates for the more intense periods of exercise.

Tempo training

Tempo training is a type of continuous training performed just under an athlete's lactate threshold. For most athletes, this is equivalent to approximately 80–85 per cent of their maximum heart rate (MHR). Tempo training trains the body to use oxygen more efficiently and remove lactic acid build-up more quickly by increasing an athlete's lactate threshold. As a result, athletes can maintain a faster pace for longer. Due to the fatiguing nature of tempo training, these sessions will generally be shorter in duration than LSD training. To begin, athletes should aim for a minimum of 20 minutes of activity at approximately 80–85 per cent of their maximum heart rate and gradually increase this over time.

Examples of continuous training

Examples of continuous training activities include:

- swimming laps of a pool at a steady pace (i.e. 70 per cent of MHR) for 40 minutes
- cycling at a moderate intensity (i.e. 70 per cent of MHR) for 60 minutes
- completing a 5 kilometre run at a 'tempo pace' (i.e. 80–85 per cent of MHR).

Applying continuous training

In order to be effective, continuous training should continue for periods greater than 20 minutes. Intensity should stay between 70 and 85 per cent of the athlete's maximum heart rate; however, this is dependent on the training objective of the individual athlete and their fitness level. In any case, intensity needs to keep the athlete below their lactate threshold. When the athlete pushes their intensity to above their lactate threshold, they will no longer be training aerobically and will be unable to sustain continuous physical activity. The training load for continuous training can be manipulated by increasing or decreasing factors, including:

- the duration of the exercise
- the pace of the exercise
- the incline (e.g. if on a treadmill)
- the resistance (e.g. if on a stationary bike).

SOURCE 3 Continuous training is any training performed at the same intensity for an extended period of time without rest. Cycling for 60 minutes at a moderate intensity (i.e. 70 per cent of MHR) is an example of continuous training.

FOR THE RECORD!

Dennis Kipruto Kimetto of Kenya holds the current world record for marathon running. Set in 2014, he ran the Berlin Marathon in a time of 2:02:57. This is an average of 2 minutes and 54 seconds per kilometre. To achieve this, Kimetto would have had to run at a constant speed of greater than 20 km/h. This intensity equates to around 93 per cent of an average marathon runner's MHR. He would have to have a highly efficient circulatory system to achieve this intensity without experiencing lactic acid fatigue. Tempo runs would, therefore, make up a considerable portion of his training program.

4.9A Check your learning

Engage and understand

1 **Define** 'continuous training' in your own words.

2 **Identify** the components of fitness that are most likely to improve as a result of continuous training.

3 **Identify** the two types of continuous training and provide two examples of each type.

Analyse and apply

4 **Consider** the suitability of using continuous training as part of a training program for your selected physical activity. **Reflect on** whether it would help you to maximise your performance and meet your training objectives. Provide reasons to support your view.

Evaluate and justify

5 **Predict** which one of the following athletes would benefit most from continuous training. **Justify** your selection in a 150-word written response.

- A triathlete
- A netball goal shooter
- A volleyball libero
- A 1500 m runner
- A swimmer
- An Australian football midfielder
- A high jumper

4.9B Fartlek training

That's a goal!

By the end of Section 4.9B, you should be able to:

→ **define** the term 'fartlek training'

→ **explain** how fartlek training can be used to help athletes achieve their training objectives.

What is fartlek training?

Fartlek training is a form of continuous training that enhances the aerobic capacity by having athletes vary the intensity of their exercise through increasing their speed and/or increasing their resistance (e.g. by adding incline, running on sand, running up stairs). *Fartlek* is actually a Swedish word meaning 'speed play'. Anything that plays with the intensity during continuous exercise is a form of fartlek training.

The idea of fartlek training is to push the athlete into the anaerobic training zone for short periods of time. This not only helps to increase lactate threshold and VO_2 max, it also more closely resembles the type of stress placed on athletes who compete in 'Invasion', 'Net and court' and long distance 'Performance' physical activities.

SOURCE 4 Fartlek training is a variation on continuous training in which athletes vary the intensity of their exercise. In invasion physical activities like futsal, it resembles the authentic performance conditions more closely than any other type of training.

Examples of fartlek training

Fartlek training can come in many different forms. Examples of fartlek training activities include:

- running for 5 minutes, sprinting for 1 minute, running for 5 minutes, and so on
- cycling slowly for 4 minutes, moderately for 5 minutes, fast for 1 minute, slowly for 4 minutes, and so on

- swimming fast then slow in ever increasing time increments before peaking and slowly decreasing the time increments (e.g. 1 minute fast, 1 minute slow; 2 minutes fast, 2 minutes slow; 3 minutes fast, 3 minutes slow; 2 minutes fast, 2 minutes, slow and so on).

Applying fartlek training

There are many different types of fartlek exercises that athletes can use to enhance aerobic capacity. Source 5 provides more details about three common fartlek exercises.

Time warps	Zone hopping	Pyramid runs
This is the simplest and most common form of fartlek training.	This form of fartlek training is more random and requires the use of a heart rate (HR) monitor.	This form of fartlek training is becoming more popular. You can measure your intensity on your rate of perceived exertion (RPE) or use a HR monitor (as per the 'Zone hopping' activity).
Run for 5 minutes at a comfortable pace. On the 5 minute mark, increase your speed for 1 minute and then return to the previous comfortable pace. Complete this exercise for 30 minutes, with speed bursts every 5 minutes.	Determine your HR zones for your aerobic zone: → Easy: 60–70% MHR (aerobic zone) → Moderate: 80–85% MHR (lactic threshold zone) → Hard: 85–95% MHR (anaerobic zone). Run for 20 minutes in the following pattern of intensity: → 4 minutes easy → 5 minutes moderate → 1 minute hard → 5 minutes moderate → 1 minute hard → 4 minutes easy.	Run for 18 minutes in the following pattern of intensity: → 1 minute hard RPE 7+ → 1 minute easy RPE 2–5 → 2 minutes hard RPE 7+ → 2 minutes easy RPE 2–5 → 3 minutes hard RPE 7+ → 3 minutes easy RPE 2–5 → 2 minutes hard RPE 7+ → 2 minutes easy RPE 2–5 → 1 minute hard RPE 7+ → 1 minute easy RPE 2–5. Note: An RPE of 2–5 is 'easy' (i.e. a conversation can flow without interference). An RPE of 7–10 is 'hard' (i.e. it's very difficult to speak).

SOURCE 5 This table demonstrates different fartlek training strategies. In each case, training is continuous, but modifications are made to the intensity of the workout.

4.9B Check your learning

Engage and understand

1 **Define** the term 'fartlek training'.

2 **Describe** the energy systems and components of fitness that fartlek training is useful for targeting and developing.

Analyse and apply

3 **Determine** two different physical activities that have fitness requirements suited to the fartlek training method. Explain your response.

Evaluate and justify

4 **Design** and **evaluate** a 30-minute fartlek training activity for a beginner water polo player. **Justify** your design by considering how well the activity incorporates 'speed play' and how it would suit the needs of a beginner water polo player.

5 The caption of Source 4 states that fartlek training resembles authentic performance conditions in most 'Invasion' sports. Based on this logic, select a physical activity that fartlek training would not be suited to and **justify** your point in a paragraph of approximately 150 words.

4.9C Resistance training

That's a goal!

By the end of Section 4.9C, you should be able to:

→ **define** the term 'resistance training'
→ **identify** four types of resistance training (i.e. isotonic, isometric, isokinetic and plyometric) and **describe** the differences between them
→ **understand** how to manipulate intensity by establishing 'repetition maximum' and 'repetition duration'
→ **explain** how resistance training can be used to help athletes achieve their training objectives.

What is resistance training?

STUDY TIP

It may help you to revisit and revise the material on **Types of muscle contractions** on pages 109–110 of *Physical Education for Queensland Units 1 & 2* to improve your understanding of these types of resistance training.

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Resistance training is a form of exercise that requires an athlete to work against something that resists the movement of their body or specific parts of their body (e.g. arms, legs, particular muscles).

Pushing or pulling against an external force or weight – such as your own body weight – is the most basic form of resistance training (as shown in Source 6), but there are many kinds of equipment that can be used for resistance training, including:

- free weights (e.g. dumbbells, barbells, kettlebells, medicine balls)
- weight machines (e.g. pin loaded, plate loaded)
- hydraulic resistance machines (e.g. weight machines that use hydraulic cylinders rather than traditional weights)
- elastic resistance bands (e.g. flat bands, resistance tubes).

SOURCE 6 Resistance training is a form of exercise that requires an athlete to work against something that resists the movement of their body (or a specific part of their body). A push up is an example of a resistance training exercise as it requires the athlete to push their body weight against the resistance of gravity.

point of failure
the moment when no more muscle fibres can be recruited to engage in an activity (e.g. the moment an athlete cannot perform any more bicep curls)

Depending on the amount of resistance and the number of repetitions performed, resistance training can be ideal for developing strength, power and muscular endurance. As the first repetition of a resistance exercise (e.g. a bicep curl) is performed, muscle fibres are recruited (i.e. engaged). With every subsequent repetition, it becomes more difficult and more muscular fibres are engaged to continue the exercise. Eventually, when no more muscle fibres can be recruited, the **point of failure** is reached, and the exercise must stop. Reaching the point of failure is important to maximise muscle growth – a process known as hypertrophy.

Types of resistance training

There are four main types of continuous training:

- **isotonic (i.e. dynamic) resistance training**
- **isometric (i.e. static) resistance training**
- **isokinetic resistance training**
- **plyometric training**.

We will now look at each of these types of resistance training in more detail.

Isotonic (dynamic) resistance training

Isotonic (i.e. dynamic) resistance training involves performing movements against a constant resistance. In isotonic training, muscle tension is maintained evenly throughout the length of the movement. Isotonic training can be performed with or without weights and is the most common form of resistance training. Isotonic training is a recommended form of resistance training because it requires little or no equipment. It involves intuitive movements and it can be used to engage and train almost all muscle groups.

SOURCE 7 A bench press is an example of an isotonic (dynamic) resistance exercise.

Examples of isotonic (dynamic) resistance training

Lunges are an example of an isotonic exercise that develops the large muscle groups of the upper legs and buttocks. Isotonic exercises can be varied in **cadence** in order to encourage muscle endurance. For example, lunges can be performed with the same weight, but some can be completed with a single up-down count, while others can be completed with a 3-down, 1-up count. Other examples of isotonic resistance exercises include:

- squats
- stair climbing
- push ups
- pull ups
- bicep curls
- deadlifts
- bench presses.

isotonic (dynamic) resistance training
a type of resistance training in which the muscle contraction is dynamic (i.e. there is tension in the muscle and movement across the joint) against a constant resistance

isometric (static) resistance training
a type of resistance training in which the muscle contraction is static (i.e. there is tension in the muscle but no movement across the joint)

isokinetic resistance training
a type of resistance training in which movement against a resistance maintains a constant speed, no matter how much force is applied

plyometric training
a type of resistance training that involves rapid concentric (i.e. shortening) movements of muscle groups followed by rapid eccentric movements (i.e. lengthening) of the same muscle groups

cadence
the pace, timing or rhythm of an exercise (e.g. performing squats with a 1-down, 1-up or a 3-down, 1-up rhythm)

Isometric (static) resistance training

Isometric (i.e. static) resistance training involves exercise in which the muscle contraction is static. In other words, while the muscle fibres produce tension (i.e. force), they neither shorten nor lengthen and there is no movement across the joint. During isometric resistance exercises, the muscles are held in this state for a nominated length of time.

The benefit of isometric training is:

- the low requirement for specialised equipment
- the ability to target weakness at particular joint angles
- the ability to safely target muscles during rehabilitation.

Examples of isometric (static) resistance training

Holding your body in an extended push up position (i.e. planking) is a common form of isometric resistance training. This exercise develops muscles in and around the abdomen and requires core muscles in the front and back of the torso to hold this position steady. Other examples of isotonic resistance training include:

- wall sit
- bridge
- pushing or pulling against a fixed object
- self-arm wrestle.

Isokinetic resistance training

Isokinetic resistance training uses specialised machines to ensure movement against a resistance is kept at a constant speed, regardless of how much force is applied. In other words, the harder the resistance is pushed, the harder it pushes back.

The maintenance of constant speed during isokinetic resistance training allows specific muscle groups to be targeted with precision. Exercise cadence and range of motion can also be targeted to suit the individual needs of the athlete and develop a particular component of fitness.

SOURCE 8 Isokinetic resistance training involves the use of specialised equipment, such as stationary bikes, to ensure resistance to movement remains at a constant speed. If specialised equipment is not available, it is possible to replicate isokinetic resistance training using a range of commonly available equipment, such as elastic bands.

Isokinetic resistance training is beneficial because:

- it allows muscles to gain strength consistently through the whole range of movement
- it provides more precise information about the muscle groups and fitness component being targeted
- it controls movement and therefore prevents injury.

When isokinetic resistance exercises are evaluated, there is less room for variables to impact the levels of fatigue reached. This means overload can be achieved more accurately. The downside is that such precision requires the use of electronic or hydraulically-controlled equipment, which is not always accessible to athletes.

Examples of isokinetic resistance training

Where specialised equipment is not available, it is possible to replicate isokinetic resistance training using a range of commonly available equipment. In such cases, care must be taken to ensure force is applied constantly and that the speed of movement also remains consistent throughout the exercise. Use of a metronome (pacing device) can help to achieve a steady pace. Some common forms of isokinetic resistance training include:

- training against a high resistance on a stationary bike
- using elastic bands
- using specialised dynamometers
- machine weights with monitored timing
- self-timing reps of non-machine-based exercises.

Plyometric training

Plyometric training uses rapid concentric movements (i.e. shortening) of muscle groups followed by rapid eccentric movements (i.e. lengthening) of the same muscle groups. In other words, muscles are rapidly contracted and then rapidly extended during their natural elastic recoil action, such as when an athlete jumps off a box to the ground and then immediately springs back up onto the box (as shown in Source 9).

The explosive movements demanded by plyometric training exercises are perfect for developing strength and power, but care should be taken to ensure training is performed safely and with adequate recovery time.

Examples of plyometric resistance training

Examples of plyometric training exercises include:

- box jumps
- bounding
- hopping
- clap push ups
- medicine ball throws.

Source 10 offers a guide for practising plyometric resistance activities safely.

SOURCE 9 Jumping from a box to the floor and then using elastic recoil to immediately spring up again is an example of plyometric training.

Rating	Recovery time	Example
1 Very low stress	Very rapid recovery	Jump rope or ankle bounces or other low-amplitude jumps
2 Low stress	Rapid recovery: 1 day required	Tuck jumps, heel kicks, 360° jumps
3 Moderate stress	Moderate recovery: 1–2 days required	Stair jumps, stride jumps
4 High stress	Slow recovery: at least 2 days required	Hops, bounds or jumps for distance
5 Very high stress	Very slow recovery: 3 days required	Depth jumps or other shock jumps

Source: Adapted from V Gambetta, 'Plyometrics: Myths and Misconceptions', *Sports Coach, vol. 20, 1998, pp. 7–12*

SOURCE 10 Guidelines for determining adequate recovery between plyometric training sessions

Applying resistance training

Resistance training can be manipulated to target strength, power and muscular endurance; for example:

- athletes wanting to develop their **strength** are generally advised to use a higher weight and lower repetitions
- athletes wanting to develop their **power** are generally advised to increase the cadence of the movements using a higher weight and lower repetitions
- athletes wanting to develop their **muscular endurance** are generally advised to use a lower weight and higher repetitions.

Source 11 provides an example of how resistance training can be manipulated to train for strength, power or muscular endurance. It is important to remember that these recommendations are simply a guide; it may be necessary for you to adjust them to suit your individual needs.

Training objective	Sample training activities
Build strength	→ Use high resistance, e.g. 4-10 RM → Complete 2–6 reps → Complete 4–8 sets → Use a slow cadence → Allow 3–5 min rest between sets → Use a variety of exercises
Build power	→ Use moderate resistance, e.g. 8-15 RM → Complete 2–8 reps → Complete 2–6 sets → Use a fast cadence, i.e. an explosive force → Allow 10 seconds between reps → Allow 3 –5 minutes between sets → Use a variety of exercises
Build muscular endurance	→ Use a low resistance, e.g. 15 - 35 RM → Complete 15–30 reps → Complete 2–3 sets → Use a fast cadence → Allow 2–5 min rest between sets

SOURCE 11 A guide for using resistance training to train for strength, power and muscular endurance

To overload a weights session, an athlete can manipulate the weight used, the number of repetitions performed or the cadence (pace and timing) of their repetitions. Source 12 shows some commonly used techniques for applying overload to a weight training session.

Techniques	Explanation
Blitzing	The practice of working a muscle or muscle group with different exercises from different angles on one training day.
Forced repetitions	Exercises in which a partner gently supports the athlete through the point where the muscles are weakest.
Cheating	Exercises in which other muscles are used to assist in lifting the weight over the weakest point. The aim is to move past the weak point and overload the strongest part of the muscle. For example, in a very heavy arm curl, the trunk is bent slightly forward and the muscles of the small of the back are used to lift through the weakest point.
Negative repetitions	Exercises that use eccentric isotonic contractions after the muscle is fatigued. For example, after the biceps muscle is tired from performing bicep curls, a partner assists by lifting the weight and allowing further lowering (eccentric contractions) of the weight by the athlete.
Pre-exhaustion	Exercising to isolate and fatigue a muscle, and then once more using the muscle (along with other muscles) in a more complex exercise so that it works further. For example, performing leg extensions to tire the legs and then doing squats.

SOURCE 12 Examples of activities that create overload in athletes participating in resistance training

repetition maximum (RM)
the most weight an individual can lift for a defined number of repetitions

repetition duration
the amount of time it takes to perform one repetition of an exercise (e.g. the repetition duration of a bicep curl is commonly around three seconds)

Key terms and basic principles of resistance training

Before commencing resistance training, it is important to have completed a thorough game analysis and devised a training program that considers the principles of training. It is also important to understand some key terms and basic principles that apply to all four types of resistance training. These include **repetition maximum**, **repetition duration** and **isolated** versus **compound exercises**.

Repetition maximum

Repetition maximum (RM) is the weight an individual can lift for a defined number of repetitions. In resistance training, the point of failure is key when determining an individual's RM. When designing your training strategy, you need to understand what it means to talk in sets and repetitions (i.e. 'reps') and you will need to know what your own RM values are.

In training sessions, reps are referred to as the number of times you are required to repeat an exercise in succession. Sets refer to the number of times you repeat the complete number of repetitions.

For example, if you are instructed to perform three sets of 10RM lifts, you would use a weight that you can lift with good form (i.e. to the point of failure) for 10 repetitions only and you would repeat those 10 repetitions three times. You will often see this written as '3 × 10RM bicep curls'.

If you are instructed to perform three sets of 10 repetitions of your 15RM lifts, you would use the weight you can lift with good form 15 times but lift it 10 times and repeat that for three sets. This is a lower intensity than the previous 10RM exercise. You will often see this written as '3 × 10 15RM bicep curls'.

SOURCE 13 A 10RM would be the heaviest weight you could lift for 10 consecutive repetitions, where you reach the point of failure on your 10th repetition.

It is also common to see instructions to use weights based on a percentage of your 1RM, which is the maximum weight you could lift just once. Working at 75 per cent of your 1RM would mean that if your 1RM is 20 kilograms, you would use 15 kilograms for the exercise. You might see this written as '3 × 10 50% 1RM'. Determining your 1RM is not always easy because of the risks involved with lifting such a heavy weight, especially in untrained athletes. It is often recommended to use estimated 1RM formulas, which use literature based on averages. This means, if you can determine your 5RM, you can estimate your 1RM. Source 14 takes you through the steps for estimating your 1RM safely.

Determining your estimated 1RM (based on averages)

Complete the following steps with 3–4 minutes of rest between each one. You will need to do this for each resistance exercise you perform.

Step 1: 10 reps with the bar only (no weights)

Step 2: 8 reps with a light/easy weight

Step 3: 6 reps with a moderately heavy weight

Step 4: 5 reps with a heavier weight than previously used but still moderately heavy

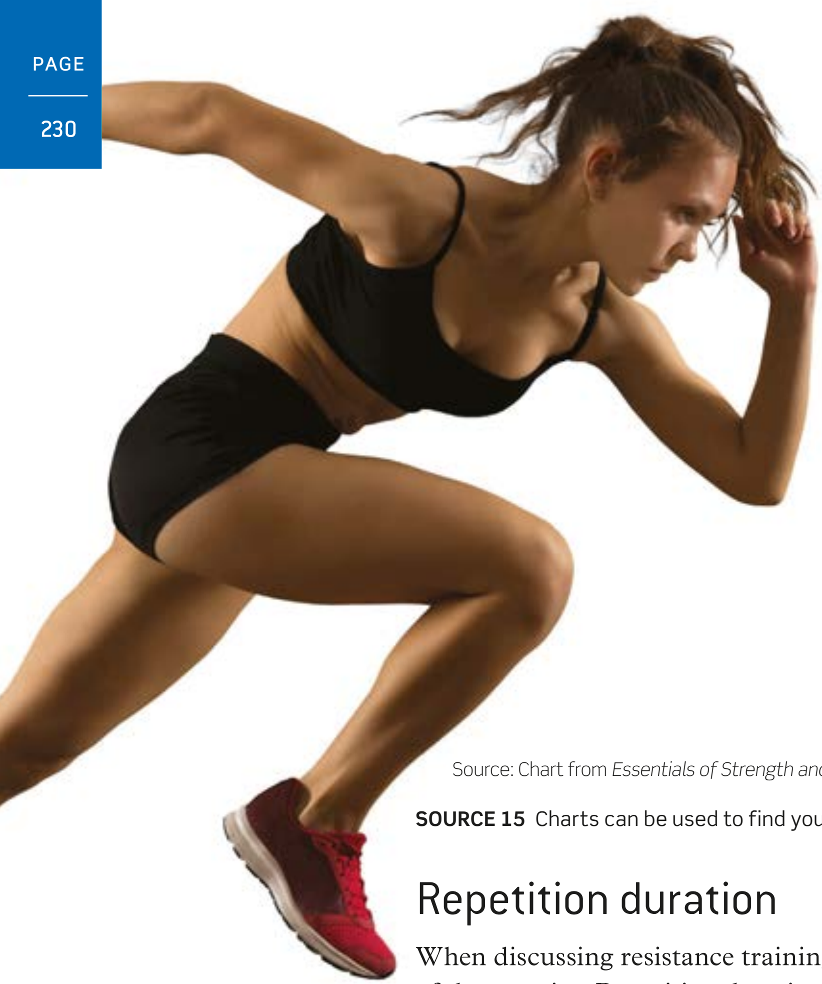
Step 5: 5 reps with a heavy weight

Step 6: 5 reps with a heavier weight than previously used (you should reach the point of failure by the 5th lift and not before)

Step 7: Multiply the weight lifted in Step 6 (5RM) by 1.15 to estimate your 1RM.

Note: At Step 6, if you can continue beyond 5 lifts, do so until you reach the point of failure, taking note of how many repetitions you complete.

SOURCE 14 How to safely estimate your 1RM



Number of repetitions performed	Percentage of 1RM	Multiply weight lifted by:
1	100	1.00
2	95	1.05
3	93	1.08
4	90	1.11
5	87	1.15
6	85	1.18
7	83	1.20
8	80	1.25
9	77	1.30
10	75	1.33
11	70	1.43
12	67	1.49
13	65	1.54

Source: Chart from *Essentials of Strength and Conditioning* 4th Edition, G. Gregory Haff, N. Travis Triplett, Human Kinetics, Inc.

SOURCE 15 Charts can be used to find your 1RM based on the maximum reps performed.

Repetition duration

When discussing resistance training, it is also important to consider the repetition duration of the exercise. Repetition duration is the amount of time it takes to perform one repetition.

This is sometimes referred to as cadence. Repetitions should be performed steadily, without jerking, to ensure muscular tension is maintained.

The speed of repetition depends on the fitness goal of the training. Faster repetitions are important for power development, while strength and muscular endurance require slower movements. Generally, explosive power-based lifts are performed with 1 to 2 second reps, while strength-based training uses 3 to 4 second reps.

isolated exercise
an exercise targeting a single group of muscles over a single joint

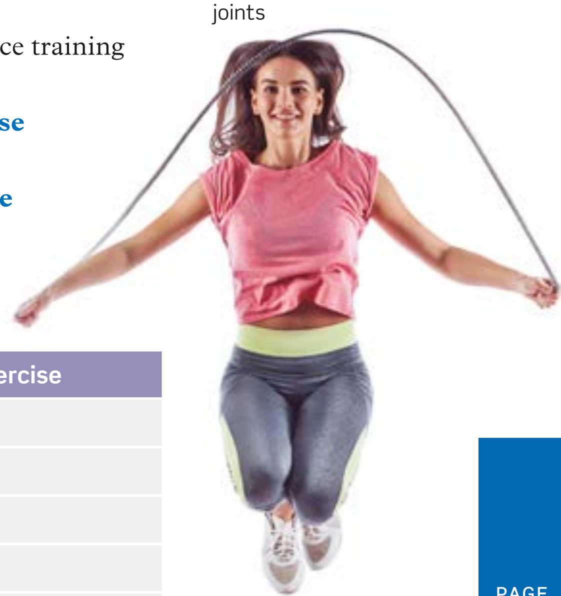
compound exercise
an exercise targeting two or more muscle groups over multiple joints

Isolated versus compound exercises

It is important to identify the muscle groups you want to develop in a resistance training session. Resistance training can target:

- a single group of muscles over a single joint, known as an **isolated exercise** (e.g. abicep curl)
- two or more muscles over multiple joints, known as a **compound exercise** (e.g. a chest press).

Below are some common weight training exercises for particular muscle groups, identified as isolated or compound exercises.



Muscle group	Exercise	Type of exercise
Chest	Flat dumbbell press	Compound
Biceps	Bicep curl	Isolated
Triceps	One arm triceps kickback	Isolated
Shoulder	Chin-ups	Compound
Back	Upright row	Compound
Abdominals	Side crunches	Isolated (can be compound depending on technique)
Quadriceps	Squat	Compound
Hamstrings	Hamstring curl machine	Isolated (can be compound depending on technique)
Calf	Calf raises	Isolated

SOURCE 16 Examples of isolated or compound exercises common in resistance training

4.9C Check your learning

Engage and understand

1 **Define** the term 'resistance training'.

2 **List** the four types of resistance training and provide 2 to 3 examples of exercises that could be used in each.

3 **Explain** the terms 'repetition maximum' and 'repetition duration'. Provide examples of how these concepts can be used as part of a training strategy.

Analyse and apply

4 **Determine** the types of resistance training that would be best suited to a triple jumper, taking the energy and fitness needs of this event into account. Explain your choice.

Evaluate and justify

5 Select one specialised movement sequence you are required to complete in your selected physical activity. **Create** a list of resistance training exercises that would help to develop your strength, power or endurance in the performance of that specialised movement sequence.

4.9D Interval training

That's a goal!

By the end of Section 4.9D, you should be able to:
→ **define** the term 'interval training'
→ **identify** three types of interval training (i.e. high-intensity, sprint and aerobic interval training) and **describe** the differences between them
→ **explain** how interval training can be used to help athletes achieve their training objectives.

What is interval training?

Interval training is a form of exercise that uses alternating periods of work with periods of rest to enhance specific components of fitness and target particular energy systems. Essentially, interval training is completing an exercise (e.g. a run), following it with a rest period and then repeating this pattern for a predetermined number of repetitions. Interval training is an effective method for developing both aerobic and anaerobic fitness. In particular, interval training can work to enhance aerobic capacity, muscular endurance, speed and agility.

There are many benefits of including interval training in a training strategy, such as:

- more efficient workouts, which allow you to get a lot done in a short amount of time
- increased fuel efficiency due to enhanced use of your body's fats and carbohydrates
- increased aerobic capacity
- enhanced power and muscular endurance
- increased lactate threshold
- more fun due to increased variety.

high-intensity interval training (HIIT)
a form of interval training that alternates short, intense, unsustainable bursts of anaerobic zone exercise (lasting less than 20 seconds) with short recovery periods

sprint interval training (SIT)
a form of interval training that alternates periods of high-intensity sprints with rest periods

aerobic interval training (AIT)
a form of interval training that incorporates longer work periods and rest periods than other forms of interval training (i.e. HIIT and SIT)

Types of interval training

There are three main types of interval training:

- **high-intensity interval training (HIIT)**
- **sprint interval training (SIT)**
- **aerobic interval training (AIT)**.

The type of interval training you choose will determine which fitness component is targeted. It is helpful to choose activities that have similar actions to the specialised movements sequences in your selected physical activity.

High-intensity interval training (HIIT)

High-intensity interval training (HIIT) is a form of interval training that alternates short, intense, unsustainable bursts of anaerobic zone exercise

SOURCE 17 High-intensity interval training (HITT) involves very short, unsustainable, high-intensity efforts followed by even shorter rest intervals.

lasting less than 20 seconds with a short recovery session. HIIT is an effective method for improving speed, strength and power but also has a positive effect on aerobic capacity by increasing lactate threshold. Research has shown that effective completion of a HIIT session is just as beneficial as completing a longer, steadier session on raising an athlete's VO_2 max.

The duration of a HIIT session is largely dependent on the fitness of the athlete. The more fitness they have, the longer they can continue repeating the work intervals. HIIT sessions are generally finished once the athlete reaches exhaustion, usually in under 30 minutes.

In HIIT, the rest intervals are short to ensure the athlete remains in the anaerobic training zone. The work:rest (W:R) ratio is recommended to be 2:1. So for 20 seconds of work, there would be 10 seconds of rest. For less fit athletes, this ratio could be modified to 2:2 (i.e. 20 seconds work to 20 seconds rest).

Sample HIIT session for a beginner

Total training time: 20 minutes

Warm up

→ 1 minute fast walking on the spot
→ 30 seconds torso rotations
→ 30 seconds high kicks
→ 1 minute side steps
→ 1 minute squats

HIIT exercises (20 seconds on at 100% intensity, 10 seconds off; repeat each exercise 3 times before moving on to the next)

→ Jumping jacks
→ Running on the spot
→ Elbow to knee sit ups
→ Jump lunges
→ Travelling push ups

Once you have completed all HIIT exercises 3 times each, have a 2 minute active rest (e.g. walk on the spot) before repeating the whole session one more time.

SOURCE 18 A sample HIIT session designed for a beginner athlete

Examples of HITT training

Source 19 shows a sample HIIT session designed for a beginner athlete. You can see that the session is short but intense. Due to the gruelling nature of HIIT, athletes need to have high levels of motivation and a strong sense of purpose when completing these sessions. There is usually significant fatigue experienced in HIIT sessions, so around 48 hours of recovery is recommended before repeating a HIIT session.

Theory in action | HIIT training

Short, intense interval workouts – such as HIIT – can produce similar results to longer, slower cardio workouts in a much quicker time period. They can also stimulate physiological adaptations in the body that help athletes transition from burning fats to carbohydrates more efficiently and help to reduce the need for long rest periods between intervals of work.

Unfortunately, this does not mean that athletes can just ignore less intense, continuous-type exercise completely. Research shows that too much HIIT can lead to overtraining and injury.

SOURCE 19 HIIT is highly effective for stimulating physiological adaptation; however, it must be used sparingly to avoid overtraining and injury.

Sprint interval training (SIT)

Sprint interval training (SIT) is a form of interval training that alternates periods of high-intensity, anaerobic zone training with rest periods. As the name suggests, this type of interval training uses sprints to stress the anaerobic systems. SIT can lead to improvement in activities where aerobic capacity, strength, power and speed are required.

SOURCE 20 In sprint interval training (SIT), short bursts of sprints are alternated with rest periods to develop aerobic capacity, speed and power.

Sample SIT session
Total training time: 20 minutes
Warm up
→ 2 minute continuous run
→ 4 sets of 3 x 20 m run throughs, progressing from 50% to 80% intensity (i.e. set 1: 50%; set 2: 60%; set 3: 70%; set 4: 80%)
SIT activity
→ Set up cones at 5 m intervals, up to 30 m.
→ Sprint shuttles for 30 seconds, starting with 5 m up and back, then 10 m, 15 m, etc. At the end of 30 seconds, walk back to the start line and rest for 2 minutes.
→ Complete 6 sets.

SOURCE 21 A sample SIT session designed to mirror the movements common in 'Invasion' and 'Net and court' physical activities

SIT training is often used for short distance race events and team sports that have moments of high-intensity work followed by less intense periods. It is a convenient form of training due to its ability to develop many components of fitness in a short period of time, without much equipment needed.

When performing SIT, it is important to use maximum or near maximum intensity during the work period and to have adequate rest between efforts. If the rest period is not long enough to restore levels of phosphocreatine in the muscles, then it will be difficult for the athlete to maintain a high intensity due to the onset of blood lactate accumulation (OBLA). In this case, it is generally advised to use a work:rest ratio of 1:4 or 1:5. If the aim is to increase lactate threshold in an attempt to improve an athlete's ability to maintain speed over a greater distance, then the work:rest ratio needs to be lower at around 1:2 or 1:3 to ensure athletes experience the affects of blood lactate and subsequently increase their tolerance to it. Where training aims to target the ATP–PC system only, the minimum rest required is 2 to 3 minutes, with sprint intervals less than 20 seconds.

Examples of SIT training

Source 21 shows a sample SIT session designed to mirror the movements common in 'Invasion' and 'Net and court' physical activities (i.e. lots of changes in direction).

Due to the high stress placed on an athlete's body from performing SIT, and the subsequent fatigue experienced, it is recommended to avoid repeating SIT sessions inside of 48 hours.

Aerobic interval training (AIT)

Aerobic interval training (AIT) is a form of interval training that incorporates longer work periods and rest periods than other forms of interval training. As the name suggests, it has a focus on building aerobic capacity. Generally, work intervals in AIT are greater than one minute and rest intervals either match the work in a 1:1 ratio or, for less fit athletes, a ratio of 1:2 might be more appropriate. During periods of work, athletes will look to enter the anaerobic training zone for short periods (i.e. work between 80 and 90 per cent MHR), while the less intense periods should stay in the aerobic zone (i.e. 60–80 per cent MHR) to ensure they do not continue to accumulate lactic acid.

Examples of AIT training

An example of AIT is to complete a 1 minute (or 400 metre) high-intensity (i.e. 80–90 per cent MHR) run and follow with a 1 to 2 minute walking rest interval, repeated three to four times. Another example is to complete a 1500 metre run just below lactate threshold (i.e. approx. 80–85% MHR) and then walk or jog for 400 metres before repeating the interval two to three times.

Applying interval training

Athletes wanting to improve their:

- ATP–PC system need to use short, high-intensity work intervals of 10 to 20 seconds and allow 2 to 3 minutes of resting recovery between each effort (i.e. HIIT or SIT). When athletes don't allow adequate time for recovery two things happen: performance starts to drop off and the lactic acid system starts contributing greater amounts of ATP
- lactic acid system need to use moderate length, high-intensity work intervals of 30 to 90 seconds and allow a work:rest (W:R) ratio of 1:2 to 1:3 using a light active recovery in the rest periods (i.e. HIIT, SIT or AIT)
- aerobic system need to use longer, moderate to high-intensity work intervals of anywhere from 1 to 4 minutes. The work:rest (W:R) ratio for intervals around 1 to 2 minutes are usually 1:1. For intervals around 3 to 4 minutes, the W:R could become 1:1 or even 1:0.5.

This information is summarised in Source 22.

Energy system	Approximate interval length	Work:rest (W:R) ratio
ATP–PC	10–20 seconds	Always 2–3 minute recovery after every effort (if training ATP–PC system only)
Lactic acid system	30–90 seconds	1:2–1:3
Aerobic system	1–4 minutes	1:0.5–1:1

SOURCE 22 Guidelines for designing an interval training session

4.9D Check your learning

Engage and understand

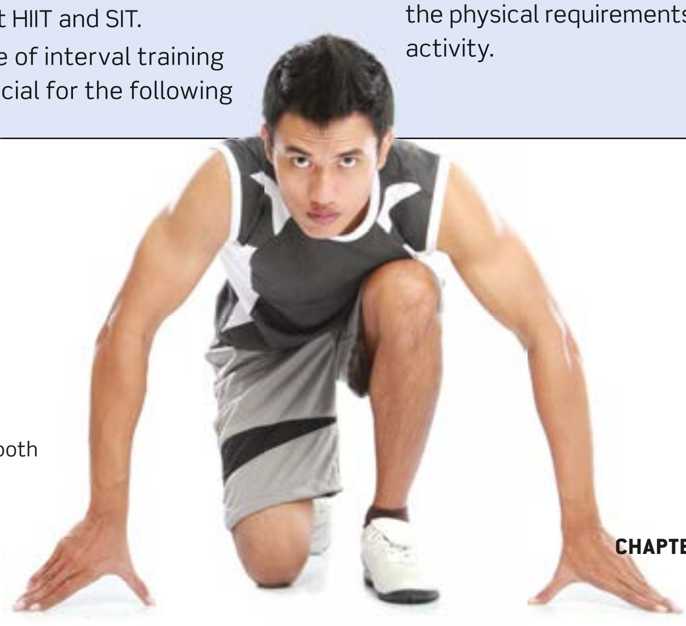
1. **Define** the term 'interval training'.
2. **Identify** the three different types of interval training and provide an example of a training activity for each.
3. **Summarise** the recommended work:rest (W:R) ratios for each type of interval training.

Analyse and apply

4. **Compare** and **contrast** HIIT and SIT.
5. **Determine** which type of interval training would be most beneficial for the following athletes and provide a reason to support your selection.
   a. a volleyball outside hitter
   b. an 800 m runner
   c. a touch football middle player

Evaluate and justify

6. **Evaluate** the need for interval training in your training strategy based on your fitness profile and the physical requirements of your selected physical activity.



SOURCE 23 Interval training is an effective method for developing both aerobic and anaerobic fitness.

4.9E Flexibility training

That's a goal!

By the end of Section 4.9E, you should be able to:

→ **define** the term 'flexibility training'
→ **identify** four types of flexibility training (i.e. dynamic, static, passive and proprioceptive neuromuscular facilitation (PNF) flexibility training) and **describe** the differences between them
→ **understand** the importance of flexibility training for increasing joint mobility and reducing injury
→ **explain** how flexibility training can be used to help athletes achieve their training objectives.

dynamic flexibility training
a type of flexibility training that involves stretching body parts and muscles in a controlled way, gradually increasing reach and/or speed of movement

static flexibility training
a type of flexibility training that involves stretching body parts and muscles through a full range of motion and holding them in that position for a period of time with nothing but the use of the agonist muscle (i.e. no assistance)

passive flexibility training
a type of flexibility training that involves having another person stretch body parts and muscles through a full range of motion and holding them in that position for you

proprioceptive neuromuscular facilitation (PNF) flexibility training
a type of flexibility training that involves stretching body parts and muscles through a full range of motion passively (i.e. with the assistance of another person), followed by the athlete pushing against the resistance, and then another round of passive stretching that pushes the stretch a little beyond the previous range of motion

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What is flexibility training?

Flexibility training is a form of exercise that involves stretching the muscles, tendons and ligaments in and around joints. The aim of flexibility training is to enhance the motion of the body's joints. It is one of the most neglected methods of training; however, stretching muscles and increasing their range of motion is important because it improves an athlete's ability to perform specialised movement sequences fluently and also decreases the risk of injury.

Types of flexibility training

There are four main types of flexibility training:

- **dynamic flexibility training**
- **static flexibility training**
- **passive flexibility training**
- **proprioceptive neuromuscular facilitation (PNF) flexibility training**.

The type of flexibility training you choose will depend on the timing and content of the training in relation to other exercise. It is helpful to choose activities that have similar actions to the specialised movements sequences in your selected physical activity.

Dynamic flexibility training

Dynamic flexibility training involves stretching body parts and muscles in a controlled way through dynamic movement. This type of flexibility training closely resembles the actions of joints and muscles during performance; it should start slowly and increase in intensity as the muscles stretch. Dynamic stretching is recommended before commencing any physical activity.

Examples of dynamic flexibility training

Examples of dynamic flexibility exercises include:

- lunges
- torso twists
- high knees
- side bends
- leg swings
- alternating toe touches.

Static flexibility training

Static flexibility training involves stretching body parts and muscles through a full range of motion and holding them in that position for a period of time using nothing but the agonist muscle (i.e. no assistance).

Examples of static flexibility training

Examples of static flexibility exercises include:

- hamstring stretch
- quadriceps stretch
- gluteus maximus stretch.

SOURCE 24 Static stretching involves holding a position for a period of time.

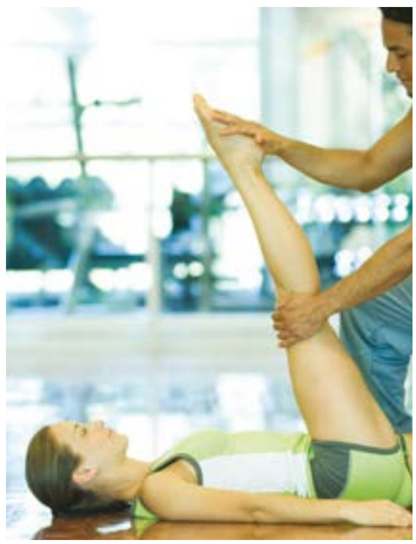
Passive flexibility training

Passive flexibility training involves having another person stretch body parts and muscles through a full range of motion and holding them in that position for you. This type of training is typically done at the completion of exercise or between periods of exercise.

Examples of passive flexibility training

Examples of passive flexibility exercises include:

- partner-assisted chest stretch
- partner-assisted one-leg hamstring stretch
- partner-assisted hamstring and erector spinae stretch. (i.e. athlete sits with legs outstretched and resistance is placed on their upper back, forcing their chest towards feet).



SOURCE 25 Passive flexibility training involves having another person stretch body parts and hold them in position for you.

STUDY TIP

A range of videos demonstrating the four types of flexibility training are provided on your obook assess.

Proprioceptive neuromuscular facilitation (PNF) flexibility training

Proprioceptive neuromuscular facilitation flexibility training (more commonly known as PNF training) involves stretching body parts and muscles through a full range of motion passively (i.e. with the assistance of another person or a resistance band), followed by the athlete pushing against the resistance, and then another round of passive stretching that pushes the stretch a little beyond the previous range of motion. This type of training is often performed outside of training times and not only improves flexibility but also strength.

Examples of PNF flexibility training

Examples of PNF flexibility exercises include:

- partner-assisted groin stretch
- elastic band-assisted hamstring stretch
- wall-assisted gastrocnemius stretch.

Applying flexibility training

Decisions around which flexibility training type to choose depend on a range of factors as outlined in Source 26 below.

Flexibility training	Why	When	How
Dynamic	To warm up or to keep blood flowing during and/or after performance and to increase range of movement	→ Before training or performance → During training or performance → Sometimes after training or performance	Controlled (non-jerky), gentle movements across the entire range of motion are performed in sets of approximately 10 repetitions.
Static	To increase range of movement	→ After training or performance	Without props or a partner, athletes hold a static stretch for 10–30 seconds.
Passive	To increase range of movement	→ After training or performance	A partner holds a static stretch for 10–30 seconds.
PNF	To increase range of movement and increase strength in weak stretched positions	→ After training or performance → During specialised training sessions	Each stretch is conducted in three phases: 1 Partner holds static stretch for 10–30 seconds. 2 Athletes perform an isometric contraction (no movement) against the stretched position. 3 Athlete relaxes and then repeats Phase 1 while exhaling.

SOURCE 26 Guide to applying flexibility training

4.9E Check your learning

Engage and understand

1 **Define** the term 'flexibility training'.

2 **Explain** the four types of flexibility training and provide an example of each one.

Analyse and apply

3 **Determine** which types of flexibility training you would most benefit from in your selected physical activity and/or position. Explain your response.

SOURCE 27 PNF training requires a partner, or a prop such as an elastic band or wall so that the athlete can push against the resistance.

4.9F Circuit training

That's a goal!

By the end of Section 4.9F, you should be able to:

→ **define** the term 'circuit training'

→ **understand** how to manipulate circuit training variables to suit the fitness and energy requirements of a specific physical activity

→ **explain** how circuit training can be used to help athletes achieve their training objectives.

What is circuit training?

Circuit training involves a series of exercises that are performed in a consecutive rotation, with minimal rest periods in between. Circuit training is an excellent training method for enhancing specific fitness components (e.g. power, agility or speed) and skills, and circuit exercises can be varied to fit an individual athlete's needs and fitness levels.

Examples of circuit training

A circuit can have any number of exercises. Generally, ten activity stations are recommended but as few as five and as many as 15 can achieve gains. When training in a group, it is important to take the number of participants into consideration to ensure there are enough stations for everyone.

Circuit training can utilise components of other training methods such as interval training, resistance training and flexibility training. Examples of circuit activities include:

- plyometric activities
- weight lifting activities
- HIIT activities
- flexibility activities.

Circuits can be controlled by time or number of repetitions. For large groups, it is best to control by time so that circuits are completed simultaneously, enabling ease of rotation. However, number of repetitions ensures a certain workload is complete before moving on to the next station.

Applying circuit training

Activities chosen for circuit training can target different components of fitness and different energy systems, depending on the duration of the exercises and the intensity. It is recommended to choose exercises that target the fitness components identified in your physical activity's specialised movement sequences. Manipulating the work:rest (W:R) ratio can impact the energy system that is targeted in circuit training. It is ideal to consider the W:R ratios and exercise intensity experienced in your physical activity when designing this training method.

SOURCE 28 Circuit training involves setting up a variety of exercise stations that aim to target different fitness components or skills.

When designing a circuit, it is important to determine how much time you have overall – anywhere from 10 to 45 minutes is suitable. The less time you have, the fewer exercises you will need in the circuit and the more intensely you will need to work. Once you have set the time, you will need to structure the circuit so that you are working on different fitness components and different body parts in consecutive exercises. This way, very little rest will be needed between stations.

Futsal is a fast, explosive sport requiring speed, power and agility, as well as muscular endurance and aerobic capacity. Most of the work completed in a futsal game uses the aerobic system with the ATP–PC system contributing in short spurts in a ratio of about 1:1.

Upper body	Lower body	Compound	Travelling motion	Core
→ Push ups → Triceps dips → Bicep curls → Chin ups → Russian twist	→ Lunges → Squats → Calf raises → Superman leg raises → Step ups → Leg curls	→ Jump lunge → Jump squat → Tuck jump → Mountain climbers → Bench overs → Jumping rope	→ Shuttle sprints → Stair climbs → Hill sprints → Power skipping → Hopping/jumping over cones → Cycling → Rowing	→ Sit ups (with or without variations) → Planking → Bridge → Dish

SOURCE 29 An example of circuit training activities suitable for a futsal player

Source 31 shows a sample circuit training session for a futsal player. Due to the high W:R ratio in futsal, the rest time between each station has been set at 1:1. So, athletes will rest for the same amount of time they work. They should be working at an intensity of 8–9 RPE at each station to match the high intensity of the sport. In this sample circuit, some skill work has also been included, which keeps it interesting for participants while developing their specialised movement sequences.

SOURCE 30 Futsal is a high-intensity sport with a variety of fitness and energy requirements, which makes circuit training an ideal component of a training strategy.

Sample circuit training session for a futsal player

Time: 60 minutes

Follow the repetitions prescribed for each station.

Use a W:R ratio of 1:1.

Aim for an intensity of 8–9 RPE.

Repeat the circuit 3 times with a 1 minute rest/drink break between each set.

- → 5 m shuttle runs (10 reps): speed
- → Clap push ups (10 reps): power
- → Tuck jumps (10 reps): power
- → Crunches (30 reps): muscular endurance
- → Dribble zig zags (5 reps): agility
- → Leg swings (groin and hamstring stretches; 20 reps): flexibility
- → Lunges (10 reps): muscular endurance and flexibility
- → 3 m side to side cone touches (10 reps): agility
- → Ball keepy uppy (aim for 10 touches): agility
- → Mountain climbers (10 reps): aerobic capacity and muscular endurance

SOURCE 31 A sample circuit training session for a futsal player

4.9F Check your learning

Engage and understand

1 **Define** the term 'circuit training'.

2 **Explain** how you might determine the amount of time spent at each exercise station during circuit training.

3 **Describe** the impact of group size on the structure of a circuit.

Analyse and apply

4 **Compare** and **contrast** the two circuits below. **Determine** some of the training objectives for each circuit, considering target components and fitness and energy systems. **Deduce** the physical activity or category of physical activity each circuit has been designed for.

Evaluate and justify

5 **Design** a circuit training session that considers the fitness and energy requirements of your physical activity. **Justify** your design in a 100-word paragraph.

Have a 2 minute rest between each exercise. Aim for an intensity of 9–10 RPE.	Each station goes for 1 minute. Have a 1 minute rest between stations. Aim for an RPE of 7–8.
Repeat the circuit twice. → 5 x box jumps → 5 x one arm medicine ball throws (4 kg minimum) → 5 x high cone hops forwards → 5 x hops backwards → 5 x clap push ups → 5 x squat jumps	Repeat the circuit twice. → 15 m sprints with walk back between → 5 second up downs (patter feet then drop to push up every 5 seconds) → 3 m side shuffles between cones → Medicine ball chest passes → Squat jumps → 10 m agility zig zag run between poles

Check your obook assess for the following additional resources and more:

- » **Student book questions** 4.9 Check your learning
- » **Video** Training methods
- » **Student worksheet** Training methods
- » **Weblink** Training methods – an overview

4.10 Fatigue and recovery in training

That's a goal!

By the end of Section 4.10, you should be able to:

→ **explain** the need for an athlete's training to cycle them through fatigue and recovery
→ **differentiate** loading from unloading
→ **understand** how the General Adaptation Syndrome (GAS) and the fitness–fatigue model underpin good training strategy design
→ **understand** the concept of preparedness
→ **compare** and **contrast** active and passive recovery.

Defining fatigue

Fatigue is defined as the reduction in the efficiency of a muscle or organ that occurs when the body is placed under physical stress. For example, when an athlete's muscles burn from a series of sprints and they find it difficult to go on, they are experiencing fatigue. Breathlessness experienced due to a workout is also a form of fatigue.

As we have learnt, when training places the athlete's body under stress in order to stimulate a physiological adaptation, this is called loading. Loading can be achieved and manipulated by stressing the body in the following ways:

- increasing work volume (a combination of frequency and duration)
- increasing intensity.

Defining recovery

Recovery is defined as the process of an individual returning to their normal physiological state after a period of physical activity. For example, when a fatigued athlete's muscles begin to feel normal again, and their breathing slows to a normal rate, this is a form of recovery. Recovery occurs in various physiological ways, depending on the part of the body stressed. These include:

- respiratory system recovery – when breathing rates regulate after exercise
- circulatory system recovery – when heart rates return to a resting level after exercise
- endocrine system recovery – when hormones are released to stimulate body repair and growth
- nervous system recovery – when neurochemical functions are restored, allowing for normal bodily functioning
- muscular system recovery – when the muscles remove waste and 're-fuel', ready for contraction.

When an athlete's training load reduces or training stops, the absence of stress placed on the body promotes recovery. This is called **unloading**. Unloading, can be achieved by:

- reducing work volume (the combination of frequency and duration)
- reducing intensity.

Cycling the body through periods of stress and recovery (i.e. loading and unloading) is the foundation of any training program; without it, we would not adapt.

unloading
a decrease in work volume and/or intensity of work, reducing the stress placed on the athlete's body

Why fatigue and recovery are important

The human body has self-healing mechanisms in place that respond to all kinds of stress. However, when it heals, it doesn't just restore to its previous level of functioning; rather, it betters itself, putting mechanisms in place to prepare for a return of the initial stressor. As discussed throughout this chapter, this idea is known as physiological adaptation. When the athlete's training load is appropriate, and they have adequate time to recover, the body doesn't just compensate for the stress, it goes beyond that level. For example, muscle soreness is the result of micro-tears forming when a muscle is placed under strain during physical activity. With adequate recovery, the muscles not only heal, they strengthen.

The phenomenon of stress being essential for physiological adaptation is best described by Hans Selye's General Adaptation Syndrome (GAS) (1936).

The science behind fatigue and recovery

General Adaptation Syndrome (GAS) is a theory that explains how the body responds to stress. It states that the human body goes through three phases when placed under stress:

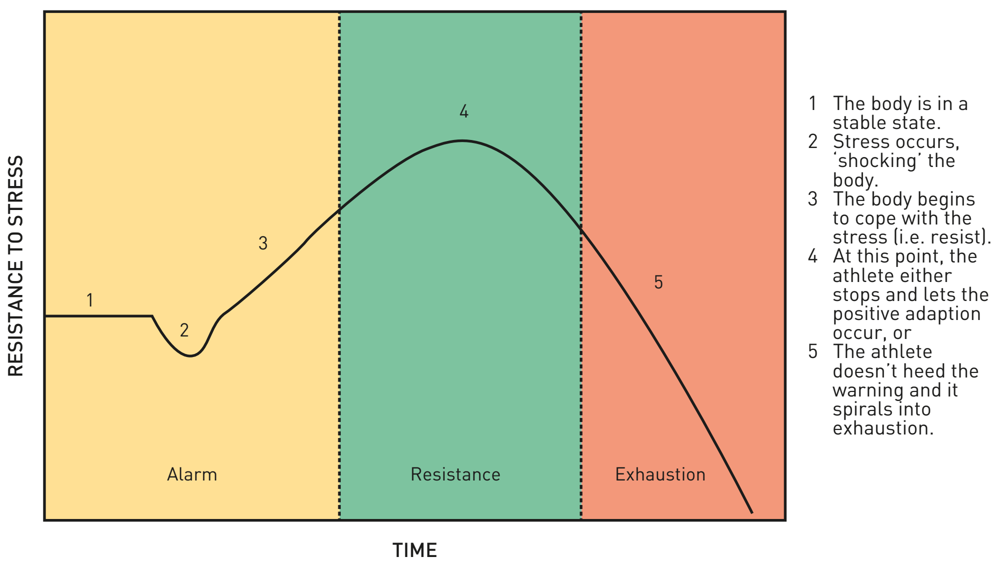
- the alarm phase
- the resistance phase
- the exhaustion phase.

The alarm phase takes place when the body first encounters physical stress (i.e. at the beginning of physical exercise). Acute physiological adaptations such as increased heart rate and increased respiratory rate occur during this phase. The body then attempts to draw on all of its existing resources in order to cope with the stress and bring it back to a stable state during the resistance phase. If the body does not cope with the stress, and the athlete does not stop exercising at this point, they will enter the exhaustion phase. In this phase, the athlete is said to be experiencing a negative form of stress, known as **distress**. However, if the body copes with the stress during the resistance phase, this is referred to as the body being under positive stress, or **eustress**. When an athlete's body is put under eustress, the athlete will experience chronic physiological adaptation once they cease exercising and recovery begins.

General Adaptation Syndrome (GAS)
a theory that explains that the body responds to stress in three phases – alarm, resistance, exhaustion; it states that positive stress (i.e. eustress) results in chronic physiological adaptation and that negative stress (i.e. distress) results in exhaustion

distress
a bad form of stress that leads to injury, illness or exhaustion

eustress
a good form of stress that leads to physiological adaptation



Source: A diagram of the General Adaptation Syndrome model adapted from Myers, D. G. (2008). *Exploring Psychology* (7th ed.). New York: Worth Publishers

SOURCE 1 Good training programs manipulate training variables to keep the athlete out of the exhaustion (grey) phase of GAS.

fitness–fatigue model
a theory that explains that the body responds to every training session by experiencing a 'fitness effect' and a 'fatigue effect' simultaneously, and it is the relationship between the two that determines when an athlete will benefit from training again

While the GAS model looks at a body's responses during exercise, the **fitness–fatigue model** explains how a body's response impacts how much recovery is needed before it is ready to train again in order to optimise physiological adaptation. The fitness–fatigue model explains that while the body experiences fatigue during training, it simultaneously experiences fitness gains. According to this model it is important to allow the body time to recover, and the fatiguing effects to dissipate, in order to make these gains. It is generally recommended that the body is allowed approximately 48 hours of recovery time between training sessions in order to build on the fitness gains achieved in the previous training session. Source 3 shows that there are three zones for training. In the red zone (0–48 hours), the body is still experiencing fatigue and therefore training should not occur. In the green zone (48–72 hours), the body is highly prepared to train again, and in the orange zone (72+ hours), fitness gains have been lost and the window of opportunity for building on any fitness gains from the prior training session is closed.

intra-session recovery
the recovery that takes place within a single a training session (e.g. between sets)

inter-session recovery
the recovery that takes place in between one training session and another training session

active recovery
recovery through low-intensity movements that helps reduce heart rate

passive recovery
recovery where the body is inactive

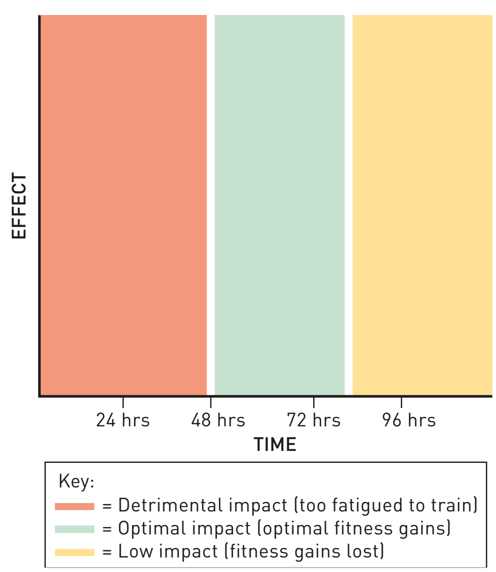
Methods of recovery

The term 'recovery' can refer to two things:

- **intra-session recovery** – the recovery that takes place within a single a training session (i.e. between sets of activities)
- **inter-session recovery** – the recovery that takes place in between sessions (i.e. from one session to the next).

Intra-session recovery

Most training methods involve a series of activities or intervals that aim to fatigue the athlete. Intra-session recovery (also known as immediate recovery) is the recovery that happens between these activities or intervals; after each repetition or set. Intra-session recovery between intervals is expressed within the work:rest (W:R) ratio. For example, if an athlete's W:R is 1:3, then 1 minute of work would be followed by 3 minutes of recovery time. Intra-session recovery can also be expressed as a stated rest period between sets. For example, a training session might state that an athlete performs '3 sets of 4 intervals with 3 minutes recovery'. There are two ways that intra-session recovery can occur: **active recovery** and **passive recovery**.



SOURCE 2 The fitness–fatigue model explains that for optimal physiological adaptation after high-intensity training, athletes should ensure enough time for recovery has been allowed before training again.

Active recovery

Active recovery is the process of recovering while moving. It includes performing light tasks such as slow running, walking and stretching. In general, after an all-out exhaustive effort, an active recovery is recommended to restore ATP–PC stores and to remove lactic acid by continuing to send oxygen to the working muscles. In most cases, active recovery is more beneficial than rest recovery due to its ability to quickly remove lactic acid from the muscles.

Passive recovery

Passive recovery is a period of no movement. It is sometimes employed during sessions where an athlete has to complete many high-intensity repetitions of short duration. For example, a sprinter performing six repetitions of a 60 metre sprint at 100 per cent intensity would typically use a passive recovery between each repetition.

Whether using active or passive recovery, it is recommended that athletes monitor their fatigue by considering their RPE at the end of each set and adjusting their intensity and work volume accordingly. For example, if a particular set aims for an athlete to work at 70 per cent but they score themselves a 9 on the RPE scale, then they should reduce the intensity and/or work volume.

Inter-session recovery

Inter-session recovery refers to the rest that must take place between one session and the next. After any fatiguing session or competition, the time required to fully restore the body to as close to its pre-exercise state as possible will depend on the type, intensity and duration of the activity, recovery techniques and the athlete's accumulated oxygen debt. Source 3 shows how recovery times can vary for different physiological functions. It is recommended that athletes use the Rating of Fatigue (ROF) scale (see page 269 of, Section 4.13, and find a copy on your obook assess), along with the preparedness flowchart (see page 269 of Section 4.13) at the end of every training session to assist them to make decisions about how much recovery they need between sessions, so they can train in the green zone (as per the fitness–fatigue model).

Function	With active recovery	With rest only
Restoration of ATP–PC	Not recommended	PC stores mostly restored by 2–3 minutes
Replenishment of muscle glycogen	10 hours (continuous exercise)	46 hours
Replenishment of liver glycogen	5 hours	24 hours
Reduction of lactic acid in muscles and blood	30–60 minutes	12 hours

SOURCE 3 Recovery times vary for different physiological functions.

FOR THE RECORD!

It could be argued that a key contributor to the success of the New Zealand All Blacks is their approach to recovery. They do not consider the end-of-game siren the finish of the game. Rather, the game is truly finished when they get changed out of their playing gear. In other words, they take their post-game recovery routine very seriously.

FOR THE RECORD!

The elliptical machines you commonly find in gyms were invented so that fatigued or injured runners could do the closest thing to running, without actually having to run and bear weight. These machines are often used as a means of active recovery, particularly during gym-based circuits.

4.10 Check your learning

Engage and understand

1 **Explain** what is meant by the terms 'loading' and 'unloading'.

2 **Define** the term 'eustress' in the context of training.

3 **Describe** the relationship between fitness and fatigue in the fitness–fatigue model.

Analyse and apply

4 **Compare** and **contrast** the General Adaptation Syndrome and the fitness–fatigue model.

5 **Differentiate** between active and passive recovery.

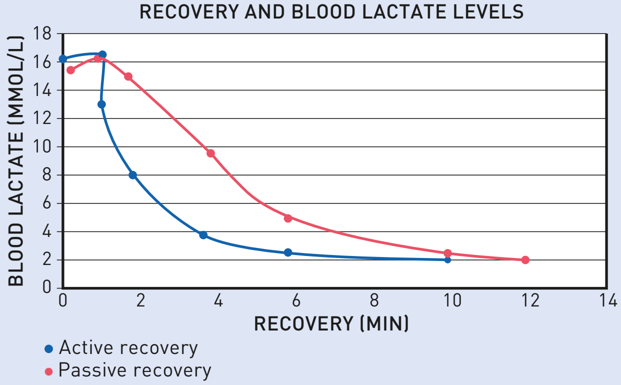
6 Review the Rating of Fatigue scale (available on your obook assess). **Determine** how it can assist an athlete when training.

7 **Reflect on** the different ways an athlete might determine when they are in the 'green zone' in training. Present your thoughts as a list.

Evaluate and justify

8 **Justify** why an applied knowledge of General Adaptation Syndrome and the fitness–fatigue model can help you make decisions about the frequency of your training. Present your answer in one or two paragraphs.

9 The following secondary data shows the difference in post-exercise blood lactate removal between passive and active recovery. In 150 words, **discuss** why this occurs, conducting additional research where necessary.



SOURCE 4 Recovery and blood lactate levels

Check your obook assess for the following additional resources and more:

» **Student book questions**
4.10 Check your learning

» **Video**
The importance of fatigue and recovery in training

» **Student worksheet**
Fatigue and recovery in training

4.11 The theory of periodisation

That's a goal!

By the end of Section 4.11, you should be able to:

→ **understand** and **define** the term 'periodisation'
→ **understand** that phases of training within a training year can be divided into smaller cycles, with each cycle targeting a specific energy and/or fitness need
→ **identify** the various blocks of a training program – annual plans, macrocycles, training phases, mesocycles, microcycles and training sessions and **explain** the purpose of each
→ **identify** the four phases of training and describe the features of each.

Defining periodisation

Athletes who take their energy and fitness goals seriously usually write training programs, often on a year-by-year basis. These programs ensure that athletes can train with purpose and structure, as they help guide the decisions made over a long period of time. Just like when a builder takes the design plan for a home and builds one section at a time, an athlete takes the training program and divides it into smaller blocks of time to achieve specific energy and fitness goals. This process of breaking the training program down into smaller and smaller blocks so that energy, fitness and skill can be built over time is called periodisation. The building blocks of a training program include:

- **annual plans**
- macrocycles
- **training phases**
- **mesocycles**
- microcycles
- **training sessions**.

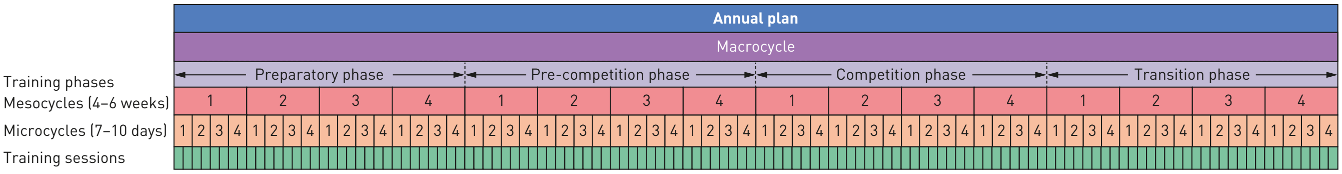
We will now discuss these building blocks in more detail.

Annual plans

The starting point when building a training program is to develop an annual plan. This term is used to describe an athlete's planning over a 12 month period. Annual plans can be very helpful because they allow the athlete to:

- see how competitions are spread across the year (for one or more sports)
- determine when they need to start and finish training for each sport, allowing them to identify any overlaps
- determine times in the year when a particular sport must take priority over all others
- identify times in the year when they will need to pay special attention to avoiding excessive fatigue and injury.

SOURCE 1 To help athletes achieve their energy and fitness goals, annual plans are broken down into smaller blocks of time. This process is called periodisation.



SOURCE 2 An annual plan is broken into smaller parts. Firstly, the plan is divided into macrocycles; one for each sport (or season). Each macrocycle is then divided into the four training phases. Each phase is divided into mesocycles, microcycles and individual training sessions.

Macrocycles

SOURCE 3 Typically, senior PE students participate in multiple sports across the year. Some students, like rugby player and national 400 m champion Carter Blades, will need more than one macrocycle to be in optimal physical condition for these different sports.

Annual plans can consist of one or more macrocycles. Macrocycle is a term used to describe the period of time from when an athlete starts to train for a season or event, to the completion of their post-season or post-event recovery. Athletes who train over one long season, such as Australian football players working towards a grand final, will only have one macrocycle in their annual plan. Athletes who compete regularly throughout the year, like a marathon runner with a number of international races, will need more than one macrocycle in their annual plan to ensure that they are at the top of their game at competition time and have sufficient time to recover after each race.

Athletes who compete in multiple sports, each with its own season, will also have more than one macrocycle in their annual plan. One example of such an athlete is Carter Blades (see Source 3). Blades is both a track runner and a rugby player. In order to optimise his performance in both of these sports, his annual plan consists of two macrocycles; one for track and one for rugby. To ensure that he stays fit during the off-season, Blades might have a third macrocycle for participation in social sports; however, this third macrocycle would not always be formally planned. See Source 5 for an example of what Blades' annual plan might look like.

preparatory phase
a set period of time within a macrocycle dedicated to increasing the athlete's general level of fitness

pre-competition phase
a set period of time within a macrocycle dedicated to optimising the athlete's position or event-specific energy, fitness and skill levels

competition phase
a set period of time within a macrocycle dedicated to maintaining and optimising an athlete's energy, fitness and skill levels to enable them to compete

Training phases

After establishing the structure and length of an athlete's macrocycle, the next step in the periodisation process is to divide each macrocycle into four training phases, each with its own goals for energy and fitness development. The four training phases in a macrocycle are:

- the **preparatory phase** – a set period of time during which an athlete focuses on increasing their general level of fitness (also known as the general preparation phase)
- the **pre-competition phase** – a set period of time during which an athlete focuses on optimising their energy, fitness and skill levels for their specific sport, position and/or event (also known as the specific preparation phase)
- the **competition phase** – a set period of time during which an athlete focuses on maintaining their energy, fitness and skill levels for their specific sport, position and/or event and maximising their performance in authentic game or performance environments (also known as the in-season maintenance phase)
- the **transition phase** – a set period of time during which an athlete focuses on rest and recovery from the physical and mental stress of training and competition (also known as the off-season or post-season phase).

Subtle and important differences in training exist in each of these phases. From one phase to the next, the work volume, training intensity and skill work are adjusted to target specific energy, fitness and skill needs. From the moment an athlete begins training, to the moment they finish their last competition, the general rule is that work volume of training should decrease while intensity increases. This opposite relationship between work volume and intensity (also called an inversely proportional relationship) applies to all physical activities. Precisely how and why you adjust work volume and intensity will be explained later in this chapter. For now, we will look at the general features of each phase of training.

transition phase
a set period of time within a macrocycle dedicated to giving the athlete a physical and mental rest from energy and fitness training

The preparatory phase

The preparatory phase is a set period of time dedicated to increasing the athlete's general level of fitness. More specifically, training within the preparatory phase should aim for athletes to:

- build a base level of aerobic fitness
- build general strength
- increase flexibility
- rehabilitate from injury
- prevent excessive weight gain
- recuperate physically and mentally.

The preparatory phase typically involves loading the athlete by training them at higher work volumes (i.e. long, frequent training sessions) at a lower intensity. Regardless of the sport, variety is the key to training within the preparatory phase in order to keep the athlete motivated. Aerobic activities typically performed during the preparatory phase include running, cycling, swimming, boxing and cross training.

SOURCE 4 Rehabilitation from injury is one of the key focuses in the preparatory phase of training.

In the preparatory phase, almost all training is run by a strength and conditioning coach. The skills coach plays a supporting role only as there are very few, if any, game-specific drills and skills practised in this phase. For example, Carter Blades might spend

Term 4			Term 1			Term 2			Term 3		
October	November	December	January	February	March	April	May	June	July	August	September
Annual plan											
Macrocycle 1 Track						Macrocycle 2 Rugby union					
Preparatory phase	Pre-competition phase	Competition phase			Transition phase	Preparatory phase	Pre-competition phase	Competition phase			Transition phase

SOURCE 5 This annual plan shows multiple training phases for an athlete like Carter Blades, who competes in multiple sports. Note that annual plans sometimes involve an overlap from one macrocycle to the next. For example, Blades might commence preparatory phase training for athletics towards the end of his rugby macrocycle.

January–March				April–June				July–September				October–December			
Annual plan															
Macrocycle 1				Macrocycle 2				Macrocycle 3				Macrocycle 4			
Preparatory phase	Pre-competition phase	Competition phase	Transition phase	Preparatory phase	Pre-competition phase	Competition phase	Transition phase	Preparatory phase	Pre-competition phase	Competition phase	Transition phase	Preparatory phase	Pre-competition phase	Competition phase	Transition phase
		Marathon				Marathon				Marathon				Marathon	

SOURCE 6 A marathon runner with four competitions per year might need to have four macrocycles in her annual plan.

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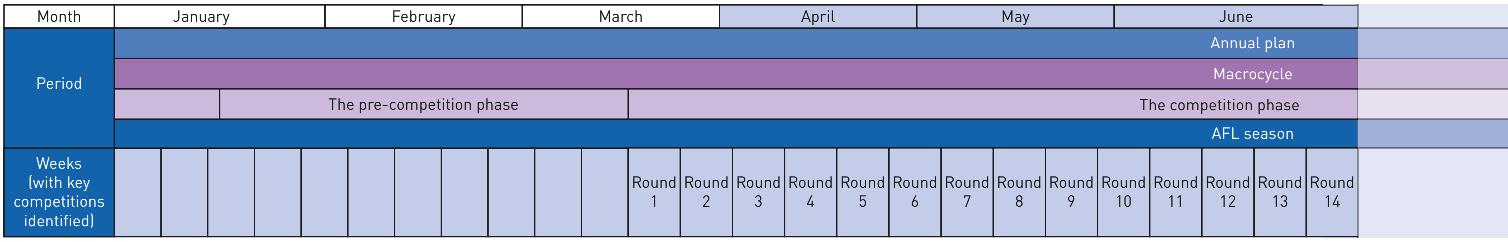
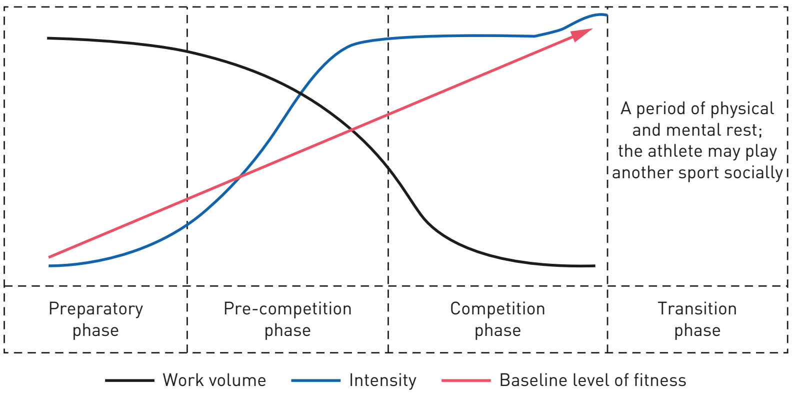


SOURCE 7 An Australian football player's annual plan will consist of one macrocycle, with the athlete aiming to maintain an optimal fitness and skill level across a long competition phase.



SOURCE 8 For an athlete to reach peak fitness by the end of the competition phase, the work volume should progressively decrease and intensity should increase.

the preparatory phase of his rugby season going for long runs or swims but keep his rugby-specific training to a minimum.

The pre-competition phase

The pre-competition phase is a set period of time dedicated to optimising the athlete's position or event-specific energy, fitness and skill levels. During the pre-competition phase, the athlete moves from general training to that of a game-specific nature. The art and science of periodisation is more apparent now, because the athlete's training must increase in intensity, in increments, while the work volume drops off. There is also an increased emphasis on skill during this phase.

If the preparatory phase was effective, the athlete should come into the pre-competition phase adequately prepared for their sport – for example, at ideal weight, with ideal muscle mass and with a high aerobic capacity (for aerobic-based physical activities). Consequently, they can now begin to adapt speed and power. They can also start engaging in skill work that develops muscular endurance.

By the end of the pre-competition phase, the athlete should be in excellent physical condition, with a high degree of technical prowess, and be completely ready to compete.

Carter Blades might benefit from continuing his running during this phase, but he will also introduce rugby-specific skills such as on-the-ball and off-the-ball agility and acceleration/deceleration activities. He will also need to increase his muscle mass by performing resistance work through a short hypertrophy (muscle growth) phase, in order to be in the best possible physical shape for the start of the season.

The competition phase

If a team or athlete has periodised correctly, they should begin the competition phase in prime physical form. Their job now is to maintain this level of conditioning. The competition phase still requires progressive overload; however, the athlete must factor the physical and mental stress of competing into their training plan, carefully manipulating training work volume and intensity to ensure that a perfect balance is found between keeping their optimal fitness level (i.e. not losing any of their gains from the preceding months) and being fresh for each match or event. Intensity of energy, fitness and skill

	July	August	September	October	November	December
				The transition phase		The preparatory phase

Round 15	Round 16	Round 17	Round 18	Round 19	Round 20	Round 21	Round 22	Round 23	Elimination finals	Semi finals	Preliminary finals	Grand final

training is high during this phase, but the work volume should be low. Because of the demands of competition, it is critical that athletes allow their bodies ample time to return to a pre-exercise state and repair after each match or event.

During the competition phase, the skill and strategy coach will run most of the training sessions. The strength and conditioning coach will now step back to run warm ups, provide top-up conditioning when the break between matches/events is too long and supervise resistance training. Strength and conditioning coaches who work with professional teams spend much of their time within the competition phase rehabilitating injured players, to speed up their return to play.

For Carter Blades, during his rugby season, the competition phase is when all his practice and training gets tested in the field. If he is a regular player in the line-up, he will keep his weekly training sessions short and at high intensity, but with sufficient time to recover before game day. If he is benched, he might need to add an extra training session during the week to maintain his level of conditioning. In other words, he needs to stay as close as possible to his peak performance level throughout this phase.

Peaking

A **peak** is an optimal state of athletic readiness aimed at the highest possible performance. An athlete's peak is a temporary state that occurs when the athlete's psychological and physical capacities, and technical and tactical preparation, are optimal. An athlete's peak is characterised by:

- good health
- an ability to cope with training workloads and stress
- quick recovery
- extreme efficiency at producing energy for performance
- excellent technique and strategic awareness
- self-confidence
- high motivation and aspirations.

peak
an optimal state of athletic readiness aimed at the highest possible performance

A well-constructed training program should see athletes reach peak physical and psychological performance at the critical stages of competition. Some athletes' journey to peak performance takes place over a long period of time. For example, an elite swimmer might plan their training so that they peak two years down the track, in time for the 200 metre final at the Olympic Games.

SOURCE 9 Periodisation ensures athletes are in prime physical form in the competition phase.

Tapering

To achieve peak performance in major competitions, many athletes reduce aspects of their training, notably the work volume, in the weeks leading up to the event. This is known as the 'taper period' or tapering. Tapering allows the body and mind to have a break from vigorous physical exertion, and provides an opportunity to heal injuries and recharge energy reserves. It also allows the body to increase muscle glycogen stores in preparation for a match or competition. To help build energy stores, tapering should be accompanied by rest and good nutrition, including a high-carbohydrate diet.

The time to begin tapering varies from sport to sport, with a taper period of approximately seven to ten days being appropriate for most sports. Note that speed, endurance, strength and power cannot be improved within three days of a match and that any training session held in the 36 hours before competition needs to be brief and intense, so as not to significantly deplete glycogen reserves.

Because of the lighter work volume during the tapering period, athletes typically experience a physical freshness that allows for improvements in their performance – for example, they may be able to lift more weights, run a little faster or generate more power. They must, however, be cautious to monitor their dietary intake during this time because they are not burning the usual levels of energy. If they continue to consume the same amount of food despite their training load reducing, they run the risk of gaining excess weight.

Theory in action How the Australian swim team was rewarded by changing their periodisation model

In the lead up to the 2016 Rio Olympic Games, the Australian swim team held their Olympic trials nine weeks out from the games. This meant that the selected swimmers had to maintain peak condition for two months, and the timing backfired. Despite a few success stories (such as Mack Horton and Kyle Chalmers), for the most part, the Australian team failed to deliver. This prompted Jacco Verhaeren, head coach of the Australian swim team, to make sweeping changes to the timing of the selection process for major events. He modelled the Australian program on that of the ever-successful American team, who hold their team selections as little as two weeks out from a major event. The result was overwhelmingly positive, evidenced by the record haul of 28 gold medals by the Australian team at the 2018 Gold Coast Commonwealth Games. Many swimmers posted personal best results.

SOURCE 10 Under a new periodisation model, the Australian swim team secured a record haul of 28 gold medals at the 2018 Commonwealth Games. Queenslander Ariarne Titmus contributed three of those gold medals.

The transition phase

The transition phase is a set period of time dedicated to giving the athlete a physical and mental rest from energy and fitness training. It occurs after the competition phase has ended. This break from training can involve the athlete stepping away for complete rest and relaxation or playing a different sport.

This is particularly important for children and adolescents, as **specialising** and **overtraining** from too young an age can lead to demotivation or burnout. Many coaches of adolescents engaging in individual sports will suggest they play a team sport during the transition phase, as adolescence is a time where social needs and conformity is high. Without this, the athlete may feel isolated, which can also reduce the chances of them continuing in their chosen sport.

specialising
concentrating on, and becoming good at, one physical activity only

overtraining
training excessively

If the athlete plays a sport socially during the transition phase, it is crucial that their game/training load occurs at a low intensity to give them sufficient time to recover. The overall focus of this phase should be on enjoyment, not performance.

SOURCE 11 Playing a team sport during the transition phase can provide much needed social support for an athlete who is engaged in an individual sport as their main physical activity.

Mesocycles

So far we have learnt that annual plans are made up for one or more macrocycles. A macrocycle is, in turn, made up of four distinct training phases: the preparatory phase, the pre-competition phase, the competition phase and the transition phase. These training phases can be further divided into a series of 4 to 6 week blocks known as mesocycles. This allows athletes to work towards the general goals of each training phase (e.g. increasing basic fitness in the preparatory phase, focusing on specific game-related fitness work in the pre-competition phase) through a series of smaller goals over a specific period of time. Each mesocycle should aim to develop:

- a predominant energy system (e.g. the ATP–PC system)
- a set of specialised movement sequences to improve a particular movement strategy (e.g. outside shooting in basketball for the movement strategy of advancing team play and scoring)
- one or more fitness components (e.g. power and strength).

If we look at Carter Blades' competition phase for his rugby macrocycle (see Source 5), we can see that this period runs for approximately 12 weeks, from the beginning of June until the beginning of September. This means that Carter can fit two 6 week mesocycles into his competition phase. In these two mesocycles, Carter can target more specific goals. As you will recall, the competition phase is about maintaining a high level of conditioning. To achieve this, Carter's coach might set the following competition phase mesocycle plan:

- mesocycle 1: major focus – strength; minor focus – power
- mesocycle 2: major focus – power; minor focus – strength.

It is important to note that training phases may sometimes be comprised of one mesocycle only. This is particularly true for short macrocycles and shorter training phases.

FOR THE RECORD!

Some National Rugby League (NRL) clubs impose a 'no footballs (or limited footballs) until January' rule. This is designed to break up the vast amounts of ball work required of NRL players, preventing physical and mental fatigue.

Microcycles

Mesocycles can be further divided into shorter blocks called microcycles. Microcycles are usually 7 to 10 days in length. This shorter period allows athletes to work towards the general training objectives of each mesocycle (e.g. improving strength while enhancing power or mastering a defensive strategy in the pre-competition phase) in individual training sessions.

In order to achieve the larger goals of the mesocycle, the microcycle will need to state detailed information, such as:

- the type of training to be completed (i.e. training method/s)
- how many times per week training should occur (i.e. the frequency)
- how hard the training should be (i.e. the intensity)
- how long training sessions should last (i.e. the duration).

In Section 4.12 we will discuss the development of microcycles in more detail.

Training sessions

A training session is the smallest building block in the periodisation model. A training session is a short period of time within a day (e.g. 1 hour) that is devoted to energy, fitness and skill training. Every training session should include three phases:

- a **warm up phase** (using the **RAMP approach**)
- a **conditioning phase** that outlines the activities performed and **training load** (e.g. specialised movement sequences, fitness components, training methods used, repetitions, work volume, intensity, W:R and sets), while following the relevant principles of training
- a **cool down phase** to gradually return the body to a resting state.

warm up phase
a period, or act, of preparation for a match, performance, or exercise session, involving gentle exercise or practice

RAMP approach
a specific warm up technique aimed at: raising body temperature, heart rate, respiration rate and joint viscosity; activating and mobilising key muscle groups, joints and range of motion; and preparing for exercise by incorporating dynamic stretching

conditioning phase
a section within a training session devoted to targeting specific energy, fitness and skill objectives; the main part of a training session

cool down phase
a period of low to moderate physical activity (e.g. walking or jogging) conducted after vigorous exercise in order to reduce the chance of injury

The warm up phase

The objective of the warm up is to prepare athletes physically and mentally for the demands of the training session. A framework for facilitating an effective warm up was developed in 2007 by international strength and conditioning coach Ian Jeffreys. Known as the RAMP approach, it suggests that warm up activities should:

- **R**aise – the athlete's body temperature, heart rate, respiration rate, blood flow and joint viscosity through low-intensity (increasing to moderate-intensity), sport-specific activities (e.g. movements such as jockeying, sidestepping, back peddling and skills such as catching, throwing or kicking)
- **A**ctivate – the athlete's muscles
- **M**obilise – the athlete's joints through activities that move them through their full range of motion, while maintaining body temperature and heart rate (e.g. glute bridges, shoulder rotations, squats or lunges)
- **P**repare – the athlete's body for the potential stress of explosive and high-force performances. Activities should reflect the skills and actions specific to their position or event (e.g. sprinting, bounding, jumping or dodging). This phase is considered a rehearsal and should gradually build up intensity to near maximum.

The principle of specificity is key to a good warm up. For example, if your conditioning phase involves fast running, the warm up should prepare you for this. One of the most common mistakes made in warm ups is moving through generic activities and then performing a completely different skill-set during the conditioning phase.

The conditioning phase

The conditioning phase of the training session is sometimes referred to as the main part of the training session; where the major energy, fitness and skill training goals for the session are achieved. Activities conducted during the conditioning phase can involve:

- energy and fitness work only – the training does not have an explicit focus on skills (e.g. a soccer player doing energy and fitness work might not use a ball)
- skill and strategy work only – the activities are selected purely on the basis of their ability to facilitate skill and strategy work
- combined energy, fitness and skill work – the activities are designed to target specific energy and fitness needs while incorporating skill and strategy.

Sometimes, a conditioning phase might begin with an energy and fitness focus and conclude with a skill and strategy focus; while other times, the order is reversed. The general rule is that skill and strategy work should occur first, when the athlete is not fatigued. However, if a game analysis reveals that a drop in skill performance correlates with fatigue, then it might be preferable to perform skill and strategy work last, to address this weakness.

Every conditioning phase must meet the energy and fitness intentions of the training phase wherein it sits – for example, if the training phase is preparatory, the intentions of the training session will need to meet more general fitness goals (such as to build muscle or lose weight) than if the training session was held during the competition phase, where the goal is to maintain the conditioning that took place in the preparatory and pre-competition phases.

The conditioning phase of a training session should always follow the relevant principles of training and specify:

- the fitness components being developed
- the training methods being used
- the intensity and work volume
- the work:rest (W:R) ratio
- the number of repetitions.

The cool down phase

The cool down phase is the period of activity at the end of a training session that aims to:

- reduce the athlete's heart rate, respiration rate and body temperature
- allow the oxygenated blood to flush out the waste products that form during activity
- relax the muscles
- begin to rebuild the energy stores required for the next performance.

A typical cool down might involve light jogging or movement followed by a period of static or dynamic stretching that enables working muscles to be stretched to their original length, thereby reducing muscle soreness and aiding recovery.

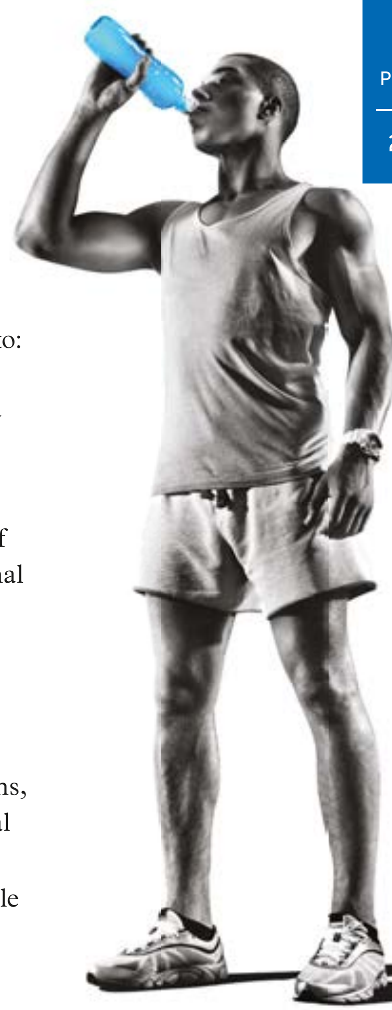
Putting it all together

At this stage of the chapter it is important to understand the relationship between an annual plan, macrocycles, training phases, mesocycles, microcycles and training sessions, and how the duration of the various cycles can differ depending on the athlete's physical activity and performance level.

Source 12 shows an example of an annual plan for a PE student participating in multiple sports, with the relationship between all parts in the plan illustrated. Note the second macrocycle is the focus for Summative Assessment Instrument 3. You will be required to devise a strategy for a mesocycle, microcycle or single training session within this period.

FOR THE RECORD!

In the past, it was common for athletes to finish their warm ups with static stretching. However, this practice is now discouraged as static stretching sends messages that tell the brain: 'It's time to relax and repair now.' Performing static stretching before a game or event can decrease your power by up to 30 to 40 per cent. Static stretching should only be used during the cool down or to increase range of movement during a flexibility stretching session.



SOURCE 12 This example provides a closer look at the relationship between the various cycles within a full annual plan, including three macrocycles, nine training phases, 12 mesocycles and 52 microcycles. A customised version of this template can be found on your obook assess.

School calendar		Summer holidays										Term 1										Holidays	
Months		December–January										January–April										April	
The annual plan		Macrocycle 1																					
		Competitive non school sport																					
Phase		Preparatory phase				Pre-competition phase								Competition phase								Transition	
Training load																							
Load: Contribution of volume & intensity																							
Mesocycle		Mesocycle 1: 4 weeks				Mesocycle 2: 4 weeks				Mesocycle 3: 4 weeks				Mesocycle 4: 4 weeks				Mesocycle 5: 4 weeks				Mesocycle 6: 2 weeks	
Movement strategies in focus																							
Specialised movement sequences in focus																							
Energy systems in focus																							
Microcycle		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Loading week (L) or unloading week (U)																							
Fitness components in focus D = Develop M = Maintain I = Improve S = Secondary focus R = Rest	Aerobic capacity																						
	Muscular endurance																						
	Speed																						
	Strength																						
	Power																						
	Flexibility																						
	Agility																						
Training session plan																							

4.11 Check your learning

Engage and understand

1 **Define** the terms 'annual plan', 'macrocycle', 'training phase', 'mesocycle', 'microcycle' and 'training session'.

2 **Describe** the main aims for each phase of training.

3 **Explain** the roles of the following coaches in the competition phase:
- a strength and conditioning coach
- b skills coach.

4 **Explain** what each letter stands for in the acronym RAMP, which is used in warm ups.

Analyse and apply

5 **Determine** which level of periodisation the examples below fit into (e.g. annual plan, macrocycle, mesocycle, microcycle or training session).
- a 1 hour of plyometric work
- b An Australian football team's training plan for the year
- c 4 weeks of training
- d A 2 year block in preparation for the Commonwealth Games
- e 1 week of training
- f A 3 month training program for a school student's winter sport

6 Use an illustration, chart or electronically generated diagram to **differentiate** between annual plans, macrocycles, training phases, mesocycles, microcycles and training sessions.

7 **Organise** the following training aims into their correct training phase(s):
- a Athlete should be at the ideal weight and musculature
- b Athlete should be in excellent physical condition
- c For the first time, work volume is lower than the intensity of training
- d Athlete recuperates mentally and physically
- e Emphasis is now largely on skill and strategy
- f Athlete takes a break altogether or plays a different sport
- g Athlete aims to maintain level of physical conditioning
- h Athlete begins to adapt speed and power
- i Work volume must be low
- j Athlete aims to prevent unnecessary weight gain

8 **Predict** problems that might occur if an athlete doesn't systematically work through the four training phases in a macrocycle.

	Term 2 April–June								Holidays June–July				Term 3 July–September								Holidays September–October		Term 4 October–December							
	Macrocycle 2																						Macrocycle 3							
	PE Unit 4 Physical activity: Basketball																						Term 4 Social sport: Futsal							
	Preparatory phase				Pre-competition phase				Competition phase												Transition		Competition phase (social – no training)							
	Mesocycle 1: 4 weeks				Mesocycle 2: 4 weeks				Mesocycle 3: 4 weeks				Mesocycle 4: 4 weeks				Mesocycle 5: 4 weeks				Mesocycle 6: 2 weeks		No formal training; just one weekly game							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	1	2	3	4	5	6	7	8
	See individual training session for details (each session within a separate template)																													

Evaluate and justify

9 A futsal player records the following journal entry after a training session. **Assess** their primary data and **make a decision** about which training phase they are most likely working within.

> **My training journal**
>
> Date: 29th of March
> Venue: Beach
>
> Today we did a long beach run. The intensity wasn't high but I ran 10 kilometres. It was pretty gruelling in the heat. I don't really love these sorts of training sessions, but I know I have to build up my aerobic capacity over the coming months, so I need to grin and bear it. I can't wait until we can start doing some actual ball work!

10 Refer to Source 6. **Predict** what would happen to a marathon runner's overall performance if they were to follow one macrocycle, like the Australian football player, whose periodisation pattern is shown in Source 7.

11 **Assess** the usability of a single macrocycle for your senior Physical Education needs (e.g. from January to November of Year 12). **Justify** why it might, or might not, be suitable.

Check your obook assess for the following additional resources and more:

» **Student book questions**
4.11 Check your learning

» **Video**
Periodisation

» **Weblink**
Periodisation – an overview

4.12 Developing a training program

That's a goal!

By the end of Section 4.12, you should be able to:

→ **identify** the purpose of a game analysis
→ **understand** the stages and features of a game analysis
→ **recognise** the tools and methods used in conducting a game analysis
→ **analyse** a physical activity and determine its energy, fitness and skill requirements
→ set training objectives for each training phase
→ set up your training program template
→ **develop** a mesocycle:
  – showing how your training objectives will be met in a mesocycle
  – showing how you will apply the principle of progressive overload
→ **develop** a microcycle.

STUDY TIP

Throughout the next few sections, several templates will be referred to. All of these can be found on your obook assess and can be customised to suit your needs.

Now that we have discussed the theoretical concepts of energy, fitness and training, it is time to learn how athletes apply these to the development of training programs. As your training strategy will need to show an understanding of periodisation, a knowledge of training program design is important. There are three important steps that need to be taken in the development of a training program, to ensure an athlete is adequately prepared for their performance:

Step 1 – Conduct a game analysis – athletes analyse the physical activity to determine fitness, energy and movement requirements, and assess their ability to meet those requirements.

Step 2 – Set **training objectives** – athletes determine the fitness and skill-based aims of the training program.

Step 3 – Apply periodisation – athletes determine how the set time will be divided into phases and cycles to ensure the work volume and intensity is ideal, according to their schedule of competitions or events.

We will now discuss each of these steps in more detail.

training objectives
the specific energy, fitness and skill outcomes that athletes aim to achieve through training

Conducting a game analysis

A game analysis allows for the objective study of movement patterns, energy and fitness demands, and skills, strategy and tactics. The data gathered during game analysis can support the improvement of both individuals and teams. Ultimately, the aim of a game analysis is to gather a set of data that can be analysed and evaluated so that athletes can make decisions about how to develop or modify training strategies to improve their performance. Source 1 outlines what the data collected during a game analysis should reveal.

What a game analysis should reveal about the game	What a game analysis should reveal about the performer
→ Game-related energy, fitness, skill and strategy needs → Position- or event-related energy, fitness, skill and strategy needs, including the frequency, direction and intensity of movements → The energy, fitness and skill needs for specialised movement sequences (for different movement strategies).	→ An individual's energy, fitness and skill-based performance in a specific: – position – event – specialised movement sequences for a movement strategy.

SOURCE 1 The data gathered during a game analysis should reveal information about both the game and the performer.

There are three components to consider in a thorough game analysis. These are:

- **primary data collection** – which can be done through observation of, and participation in, the physical activity. A GPAI can be created and used to record position- or event-specific information such as necessary skills and movement strategies and the frequency, duration and intensity of movement. It can also record athlete-specific information such as work to rest (W:R) ratios, heart rate and rate of perceived exertion. A list of tools to facilitate the collection of primary data is shown in Source 2.
- **secondary data collection** – which provides a general overview of the movement, energy and fitness requirements of a physical activity and can be collected from online or printed publications. While this information can be a good starting point for a game analysis, it is important to be discerning about the validity of the data gathered from secondary sources, particularly when looking to apply it to an individual with their own unique requirements. To increase the validity of data, it is helpful to seek information about performers of similar age, gender and ability as the person for whom the game analysis is being conducted.
- **primary and secondary data analysis** – which is preformed once data has been collected. This analysis determines an athlete's specific performance requirements and training needs; information that is then used to set training objectives for the training program.

STUDY TIP

For this unit, you are required to devise a personal competition phase training strategy for a mesocycle or microcycle. To do this, you will need to start by conducting a game analysis. To perform well in this task, it is important for you to know what the specialised movement sequences and movement strategies for your physical activity are. You can find this information on pages 68–88 of the QCAA Physical Education Syllabus.

Tool	What is it?	What is its purpose?	Where do I find it?
Rating of perceived exertion (RPE) scale	A scale used to give performers a rating of exertion on a scale from 1–10	To determine the impact of a training activity or session on fatigue at the time of performance	Available on your obook assess
Rate of fatigue (ROF) scale	A scale designed to give a fatigue rating after a complete session on a scale from 1–10	To determine the impact of an entire training session on an athlete's fatigue, with a view to understand when to next perform the same activity	Available on your obook assess
Rating of session effectiveness GPAI	A difficulty of training scale from 1–5	To determine the impact of the training session on physiological adaptation	Available on your obook assess
Heart rate (HR) monitor	A watch (with or without chest strap) that digitally measures heart rate	To monitor heart rate before, during and after exercise	See the manufacturer's instructions
GPS tracker	A device that tracks movement, including distances, speed and direction	To monitor and record movement data	See the manufacturer's instructions
Game analysis summary GPAI	A template for recording qualitative and quantitative data	To collect, collate and summarise data from a number of other GPAIs (i.e. a master document for game analysis)	Available on your obook assess
Frequency, direction and duration of movement GPAI	A template for recording quantitative data	To record data about an athlete's frequency, direction and duration of movement	Available on your obook assess
Specialised movement sequence GPAI	A template for recording quantitative data	To record data about how effectively or ineffectively an athlete performs specialised movement sequences	Available on your obook assess
Reflective journal template	A template for recording qualitative data	To record qualitative information about training and performance	Available on your obook assess

SOURCE 2 Some of the many tools available to gather primary data for a game analysis

Identifying specific training objectives

Training objectives are the specific energy, fitness and skill goals that athletes aim to achieve through the implementation of their training program. Training objectives are more specific than goals – for example, if an athlete's goal is to become a better basketball player, one training objective might be: 'To remain effective at performing rebounds in the second half of games by increasing muscular endurance.'

Training objectives are closely linked to an athlete's game analysis, as the game analysis has identified both the physical requirements of a physical activity (e.g. the need to accelerate fast out of the blocks in track) and the strengths and weaknesses of the athlete (e.g. the inability to keep the same amount of power throughout the race). For a training program to effectively prepare an athlete for competition, it is important that the training objectives target the areas where the game analysis has identified weaknesses.

Training objectives will differ depending on what training phase or cycle an athlete is in. This is because each training phase has a different purpose and recommends a different volume and intensity of work, as well as different skill-to-fitness ratios.

As we have learnt, the preparatory phase recommends a high work volume at a low intensity. Fitness training should have a 50 to 100 per cent contribution to this training phase, with skill training having a 0 to 50 per cent contribution.

The pre-competition phase recommends a decreasing work volume at increasing intensity. Fitness training should have a 30 to 60 per cent contribution to this training phase, with skill training having a 40 to 70 per cent contribution.

The competition phase recommends a low work volume at a high intensity. Fitness training should have a 0 to 30 per cent contribution to this training phase, with skill training having a 70 to 100 per cent contribution.

The recovery phase recommends a low work volume at a low intensity There is no specific suggestions for distribution of fitness and skills training in this phase.

Training objectives are usually evaluated regularly to ensure they are still relevant – for example, an injury, change of playing grade or playing position, or unexpected fitness increases might mean that previous training objectives are no longer appropriate.

Source 4 shows the training objectives for a tennis player, laid out over all the four training phases. As you can see, many of her training objectives change from one training phase to the next, to reflect the preferred split between work volume and intensity.

Note that once objectives have been set for a particular training phase, they will remain the same for each cycle within it, from the mesocycle, to the microcycle, and right down to the individual training session. This is because the aspect of your performance that you wish to improve over the given training phase doesn't change, only the level of detail you provide. In other words, as the blocks of time shorten, your plan must become more and more detailed.

SOURCE 3 Athletes, including Australian football players, require specific training objectives.

STUDY TIP

You should be gathering data about your performance in a specialised movement sequence and conducting game analyses on a regular basis. If too much time has passed since your last game analysis, you may wish to consider performing some of the tests Section 4.4 again.

STUDY TIP

Skill drill 4.12 has been designed to help you conduct a game analysis. It is highly recommended that you watch the video in your obook assess, which walks you through the method for completing this task. Conducting a game analysis is time consuming, so it is critical that you are well prepared and understand exactly what it is that you need to do and how much time you can allocate to gathering the different data.

<table>
<tr><th colspan="4">TENNIS SEASON: MAJOR TRAINING OBJECTIVES</th></tr>
<tr><td colspan="4">Movement strategy: Strategies for defending against attack and setting up attack
Specialised movement sequences: All baseline and net specialised movement sequences
Energy system/s: Aerobic and ATP–PC systems
Fitness components: Aerobic capacity, speed, agility and muscular endurance</td></tr>
<tr><td>Preparatory phase training objectives
Each mesocycle, microcycle and training session in this phase will focus on one, some or all of these objectives.</td><td>Pre-competition phase training objectives
Each mesocycle, microcycle and training session in this phase will focus on one, some or all of these objectives.</td><td>Competition phase training objectives
Each mesocycle, microcycle and training session in this phase will focus on one, some or all of these objectives.</td><td>Transition phase training objectives
Each mesocycle, microcycle and training session in this phase will focus on one, some or all of these objectives.</td></tr>
<tr><td>Movement strategies:
None; general technique work only</td><td>Movement strategies:
Build fitness to improve defence:
→ move the opponent to the back court and create space in the front court through variations of ground strokes
→ draw the opponent from the baseline to the front court to allow time to return to ready position (e.g. use drop shot)
→ hit the ball from the attacker's front court into the rear court of the opponent (e.g. use crosscourt forehand or backhand passing shot)</td><td>Movement strategies:
Maintain fitness and improve attack:
→ force the opponent to the baseline or to the corners of the court (e.g. use variations of ground strokes)
→ control a rally and draw the opponent to a specific area on the court (e.g. use lob)</td><td>Movement strategies:
None</td></tr>
<tr><td>Specialised movement sequences:
None; foundational movement skills only (e.g. footwork and positioning)</td><td>Specialised movement sequences:
All baseline and net specialised movement sequences</td><td>Specialised movement sequences:
All baseline and net specialised movement sequences</td><td>Specialised movement sequences:
None</td></tr>
<tr><td>Energy system/s:
Aerobic system</td><td>Energy system/s:
Aerobic system</td><td>Energy system/s:
Aerobic system and ATP–PC system</td><td>Energy system/s:
Aerobic system</td></tr>
<tr><td>Fitness components:
A high work volume of aerobic capacity work at a low intensity</td><td>Fitness components:
Increasing intensity while decreasing work volume focused on aerobic capacity, speed and muscular endurance</td><td>Fitness components:
Low work volume, high-intensity work on aerobic capacity, speed, agility and muscular endurance with a lot of recovery time</td><td>Fitness components:
None; a complete rest from the sport or choose a different physical activity</td></tr>
</table>

SOURCE 4 This is an example of a tennis player's training objectives per training phase. Notice that this player has used four categories for her objectives: movement strategies, specialised movement sequences, energy system/s and fitness components.

Once objectives have been set, the next step is to write the training program and/or individual training sessions that address the objectives.

STUDY TIP

When establishing training objectives, it is important to be organised and to record your training program from the broadest level down (i.e. annual plan). A training program template is available on your obook assess. Once you have filled it out, you will be able to use your training program to help guide and justify your training strategy decisions, and you can refer to this document in your assessment.

SOURCE 5 Your training objectives for any given training phase may need to change in response to unforeseen circumstances – for example, an injury might force you to reduce both your work volume and intensity.

Compiling the training program

Once a game analysis has been done and training objectives set, a training program – or annual plan – can be compiled. The training program is the masterplan for an athlete's training as they prepare for performance. As we have seen, a training program is usually presented as a detailed table that includes information about:

- macrocycles
- training phases
- mesocycles
- microcycles
- training sessions.

It is important to note that the training program document is a planning document. The information included in the training program document is usually general in nature, with room for flexibility and modifications to the implementation of training sessions.

Macrocycles

The training program needs to show the length of the macrocycle and an estimated beginning and end date. Remember, depending on the type of sports the athlete is practising, their annual plan might consist of one or more macrocycles of varying length.

Training phases

Once the macrocycle has been established, the training program should show the length of the four training phases – the preparation phase, the pre-competition phase, the competition phase and the transition phase. The length of these will vary depending on the length of the macrocycle and the training objectives of the individual athlete. For example, an athlete who already has a good baseline level of fitness may not need as much time in the preparatory phase as someone who does not.

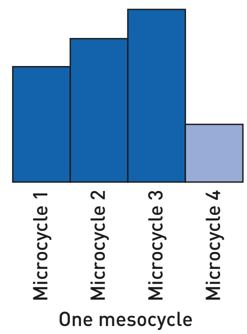
Mesocycles

At the mesocycle level in training program development, you should include information about the length of the cycle, the training objectives and the **loading–recovery pattern**.

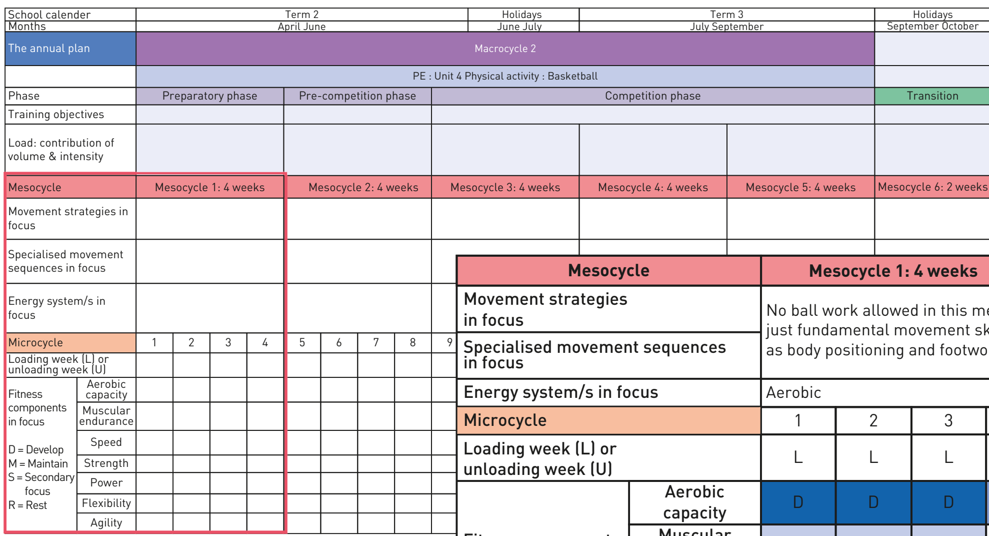
As shown in Source 6, the length of a mesocycle is affected by the length of the macrocycle that it sits in, but mesocycles are generally 4 to 6 weeks long.

Training objectives should be stated for each mesocycle and athletes should indicate whether the focus is on energy, fitness or skill, or all three. The loading–recovery pattern across a mesocycle should ensure that the difficulty level increases from one week to the next in the loading weeks, and that it allows time for the body to recover in the unloading weeks. The loading–recovery pattern is normally expressed as a ratio. For example, an athlete wishing to load for two weeks and recover every third week is said to be using a 2:1 loading–recovery pattern. As shown in Source 7, 4 week mesocycle consisting of three increasingly difficult weeks followed by one easier week, is called a 3:1 loading–recovery pattern, and so on.

loading–recovery pattern
the relationship between loading and recovery, expressed as a ratio



SOURCE 6 This mesocycle uses a 3:1 loading–recovery pattern. The principle of progressive overload is evident in the increasing training load over weeks 1, 2 and 3. In week 4, the training load reduces significantly.



Mesocycle		Mesocycle 1: 4 weeks			
Movement strategies in focus		No ball work allowed in this mesocycle; just fundamental movement skills such as body positioning and footwork			
Specialised movement sequences in focus					
Energy system/s in focus		Aerobic			
Microcycle		1	2	3	4
Loading week (L) or unloading week (U)		L	L	L	U
Fitness components in focus D = Develop M = Maintain S = Secondary focus R = Rest	Aerobic capacity	D	D	D	M
	Muscular endurance	S	S	S	R
	Speed	S	S	S	R
	Strength	S	S	S	R
	Power	S	S	S	R
	Flexibility	M	M	M	M
	Agility	S	S	S	S

SOURCE 7 This mesocycle plan for the preparatory phase shows the four microcycles and their focus. In this case, the entire mesocycle is focused on developing aerobic capacity. This fitness objective is developed over the first three microcycles and maintained in the fourth.

Microcycles

At the microcycle level of a training program, the length of the microcycle and its training objective and loading information should all be stated. Microcycles are generally 7 to 10 days long and each microcycle should have a specific fitness and/or skill focus.

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Due to its limited time, not all fitness objectives can be given the same focus within the microcycle. Instead, an athlete will select one or two fitness objectives (e.g. power or agility) as a primary focus for a microcycle, with the other fitness objectives taking a backseat. To show which objectives are in focus in any given microcycle, athletes can list them all and indicate whether each objective is being developed, maintained, improved, viewed as secondary or rested by adding a letter (i.e. D, M, S or R) next to it in the training program.

- **D**eveloped means that you will select appropriate training methods to achieve physiological adaptation by increasing work volume and/or intensity, as per the principle of progressive overload.
- **M**aintained means that this fitness component will not be the main focus of training but the adaptations that have already occurred in this component must not be lost.
- **S**econdary focus means that this fitness component is not deemed important for the sport you're doing right now, but it may be trained as a side-effect of the component being developed or maintained.
- **R**ested means that a decision has been made to rest this component completely at this time.

At the microcycle level, it is also important to indicate whether the week is to be a loading or an unloading week.

STUDY TIP

Presenting your loading–recovery pattern as a bar graph (as in in Source 6), makes planning easier. It is recommended that you do this in a separate training journal using different colours to map your planned relative contribution for work volume versus intensity across the mesocycle. This will allow you to visualise the difficulty of a week in relation to the one before and the one after. You should then transfer this information to your planner. When a week is harder than the one before it, place an 'L' for loading in the relevant cell. Alternatively, a 'U' for unloading should be recorded to reflect recovery weeks.

Training sessions

At the training session level of training program development, athletes need to include information about frequency, intensity and duration of training, as well as the training objectives for each training session. This will ensure that physiological adaptation is planned for and fatigue is managed. A 7 day microcycle should consist of 3 to 5 training sessions. Source 8 provides an example of how planning can look at the training session level. Note that this training session planner shows the intended training days, as well as the length of the session, the intended load (i.e. very high, high, moderate, low or very low) and the training objectives, showing the major fitness and skill focus for the sessions..

STUDY TIP

When planning training sessions, it is important to determine how often to train. As a rule, athletes should aim to train on non-consecutive days, as per the fitness–fatigue model, which states that the fatigue effect from the most recent session is gone by around the 48 to 72 hour mark. Thus, the number of training sessions considered 'average' for a microcycle is three. However, if a training session involves low-intensity work, the fatigue effect will disappear sooner, meaning an athlete can train more frequently – sometimes four to five times per week.

DAY		MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
TRAINING SESSION (Y/N)								
LENGTH OF SESSION								
LOAD (VERY HIGH, HIGH, MODERATE, LOW, VERY LOW)								
Specific training objectives	Movement strategy							
	Specialised movement sequence							
	Energy system/s							
	Fitness components							

SOURCE 8 A training session planner can help to guide decisions around individual training session design.

4.12 Check your learning

Engage and understand

1 **Identify** the aims of a game analysis and **list** the information an athlete can gather from a game analysis.

2 **Explain** why a game analysis should always be conducted before setting objectives for training.

3 **State** the importance of establishing training objectives when attempting to devise a training strategy.

4 When an athlete is devising a strategy for a mesocycle, they must make decisions about the degree to which they will use each fitness component (e.g. power or strength). **List** the four ways in which an athlete can approach how they will focus, or not focus, on the various fitness components in each mesocycle.

Analyse and apply

5 **Analyse** the following athlete's training objectives and **organise** them into the four categories of (a) movement strategy, (b) specialised movement sequence, (c) energy system/s and (d) fitness components:

- **i** Forwards and backwards movement based on ball movement
- **ii** Aerobic energy system
- **iii** Setting up attack
- **iv** Agility
- **v** Passing
- **vi** Aerobic capacity
- **vii** Defending against attack
- **viii** Shooting

Evaluate and justify

6 **Assess** your own skill level (in your current physical activity) and state three implications this will have on your future energy and fitness training.

7 The following mesocycle belongs to a netball player. **Evaluate** the data and **predict** which training phase they are working within.

Mesocycle 1: 4 weeks					
Movement strategies in focus		No ball work allowed in this mesocycle; just fundamental movement skills such as body positioning and footwork.			
Specialised movement sequences in focus					
Energy system/s in focus		Aerobic			
Microcycle		1	2	3	4
Loading week (L) or unloading week (U)		L	L	L	U
Fitness components in focus D = Develop M = Maintain S = Secondary focus R = Rest	Aerobic capacity	D	D	D	M
	Muscular endurance	S	S	S	R
	Speed	S	S	S	R
	Strength	S	S	S	R
	Power	S	S	S	R
	Flexibility	M	M	M	M
	Agility	S	S	S	S

8 **Assess** the results of the game analysis you conducted in Skill drill 4.12 and **devise** a set of training objectives for your current physical activity. These objectives should be categorised as:

- **a** movement strategy objectives
- **b** specialised movement sequence objectives
- **c** energy systems objectives
- **d** fitness components objectives.

9 Imagine that you will be training for a five month macrocycle. **Modify** your objectives from Question 8 to show how they should either remain the same or change over the four training phases of a macrocycle. Hint: You might need to refer back to Section 4.11 to refresh your understanding of the difference between these phases.

PERFORMANCE | SKILL DRILL **4.12**

Conduct a game analysis

>> Turn to pages 348–351 to complete this integrated physical performance activity.

Check your obook assess for the following additional resources and more:

- **» Student book questions**
  4.12 Check your learning
- **» Video**
  Developing a training program
- **» Weblink**
  Tips for developing a training program

4.13 Developing a training session plan

That's a goal!

By the end of Section 4.13, you should be able to:

→ **develop** plans for individual training sessions:
- deciding on the intensity and work volume of each training session
- deciding on the frequency of training sessions
- deciding on the activities within each training session.

STUDY TIP

If your training strategy involves the development of several training sessions in a microcycle, you will need to show how the specific training objectives for these sessions meet what has been set by the training program.

preparedness
an athlete's level of readiness to achieve physiological adaptation from training

While a training program can be considered a masterplan for an athlete in preparation for their ultimate competitive performance, training session plans are the detailed instructions used on a day-by-day basis to let athletes know exactly what they need to do in each training session. The development of a training session plan should be guided by the training program, taking into consideration the phase and cycle where the training session sits, as well as the athlete's **preparedness** to train.

What to include in a training session plan

Training sessions are generally presented in tabular form and commonly include:
- general information such as the date, time and phase of training
- training session objectives such as the energy, fitness and skill objectives
- warm up activities using the RAMP approach
- conditioning phase activities
- cool down activities
- space for data collection and reflection.

A template has been provided in your obook assess to support you in developing your own training sessions. You can see a detailed example of a training session plan in Source 8 on page 264.

General information

General information is beneficial from an administration perspective. General information should include:
- the date, time and location
- the equipment needed
- the phase and cycle of training.

Filling out a general information section of a training session plan can come in handy later, when the athlete might want to go back and reflect on past sessions and identify trends.

SOURCE 1 Planning and preparing for training sessions helps athletes become competition ready.

Training session objectives

Every training session should communicate which specific training objectives will be met on the given day. These objectives will be guided by the microcycle objectives indicated in the training program. Training session objectives should take into consideration:

- energy systems
- fitness components
- specialised movement sequences
- movement strategies.

It is important to note that not every objective for that microcycle needs to be targeted in every single training session. In other words, the current microcycle may have identified energy, fitness and skill objectives for an athlete to meet during the week; however, there may be a particular training session where they will focus on fitness only.

Warm up activities

When designing a warm up, the RAMP approach should be applied (see Section 4.11) to ensure that the movements used in the warm up reflect the movements the athlete's body will experience during the conditioning phase of the session.

Conditioning phase activities

The conditioning phase is the most important part of the training session. It is here that the athlete participates in activities that will satisfy principles of training, contribute to physiological adaptation and prepare them for performance. In the conditioning phase, the following components should be explained:

- activity (including training method and task description)
- load (including sets, repetitions, volume, intensity, work:rest ratio and type of recovery).

The design of training activities within the conditioning phase is the most complex and important part of developing a training session, so we will now focus on how to determine the activity and load for a training session in more detail.

Activity (including training method and task description)

There are many different ways to begin developing activities for the conditioning phase of a training session. For example, some people like to start by considering what skills are needed and then work out how they can incorporate fitness needs. Others switch that approach and start by deciding what fitness needs they will target before finding a way to include a skill focus.

Regardless of the approach taken, the important thing is that the activities meet the identified training objectives, including energy system objectives, fitness component objectives and skill objectives.

Load (including sets, repetitions, work volume, intensity, work:rest ratio and type of recovery)

Once athletes have determined what their activities will look like, they must decide on the appropriate difficulty level to assign to each activity. In other words, they must decide how they will make the activity's difficulty level very high, high, moderate, low or very low. This is called setting the load. Setting the load involves the use of measurable quantities, as

SOURCE 2 It is important for training sessions to communicate which specific training objectives will be met on a given day.

shown by the examples in Source 5. The overall load experienced by the athlete depends on the manipulation of five variables. These are:

- sets
- reps
- volume
- intensity
- work rest (W:R) ratio.

Knowing how to manipulate these variables can be challenging. It is a process that takes time to master and involves trial and error. There are different approaches that athletes can take to determine the load. For the purposes of senior Physical Education, we have categorised these into two groups: using secondary data to determine the load and using primary data to determine the load.

Using secondary data to determine the load

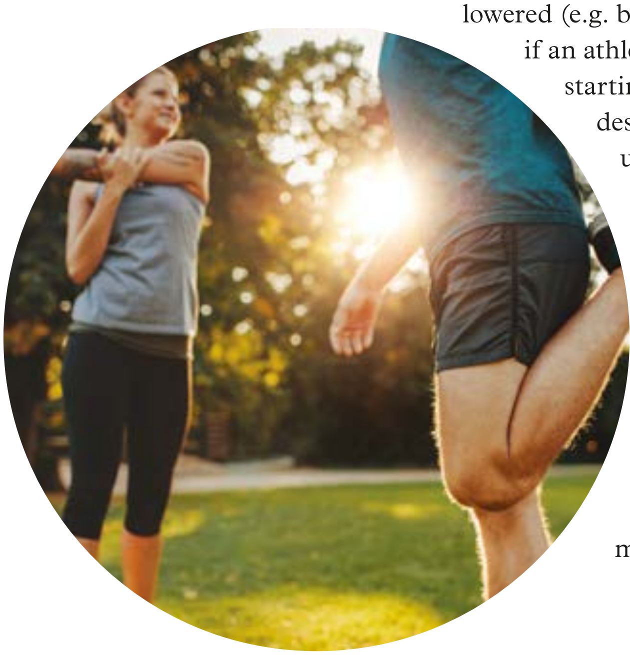
initial training values
the quantitative measurement of training that you can realistically manage at the start of any training program (number of repetitions, work volume, intensity, W:R, duration, sets)

An abundance of information from credible secondary sources exists on the **initial training value** suggested for athletes of varying fitness levels. Initial training values are the quantitative measurement of training that an athlete can realistically manage at the start of any training program. In other words, these values refer to a load that would be considered moderately difficult for an athlete. For the purposes of senior Physical Education, Source 6 provides a general set of guidelines that athletes can follow to determine their initial load.

Using primary data to determine the load

Another way that athletes can determine their load is to attempt an activity and reflect on the difficulty level of the quantities set. This process is known as conducting an initial training values test.

Initial training values tests can be performed for each activity that the athlete plans to perform. The tests are designed to be moderately difficult. Therefore, when an athlete finds them difficult, this allows them to determine that their training values need to be lowered (e.g. by performing fewer sets or repetitions). On the other hand, if an athlete finds a session easy, then they can conclude that their starting values need to be increased. Skill drill 4.13 has been designed to help you determine your initial training values. It uses aerobic interval training, but you can substitute this for any training method relevant to your training. It is highly recommended that you complete this Skill drill before you decide on the load for the activities within your training sessions.



SOURCE 3 Stretching after training helps reduce muscle fatigue and support muscle recovery.

Cool down activities

Cool down activities are low-moderate intensity activities that help to bring the athlete's heart rate down steadily while keeping the flow of oxygen moving through the muscles. A cool down should consist of the following elements:

- at least 5 minutes of aerobic activity such as a light jog (known as an active recovery)
- a range of dynamic and static stretches.

Space for data collection and reflection

Regular data collection and reflection is important throughout a training program implementation. Leaving space to note this data collection and reflection on the training session document will allow you to determine the effectiveness of the training session, make any necessary modifications to activities and load for future sessions.

Data to be collected for each activity during a training session includes:

- rating of perceived exertion (RPE)
- heart rate (HR)
- respiratory rate (RR)
- level of motivation.

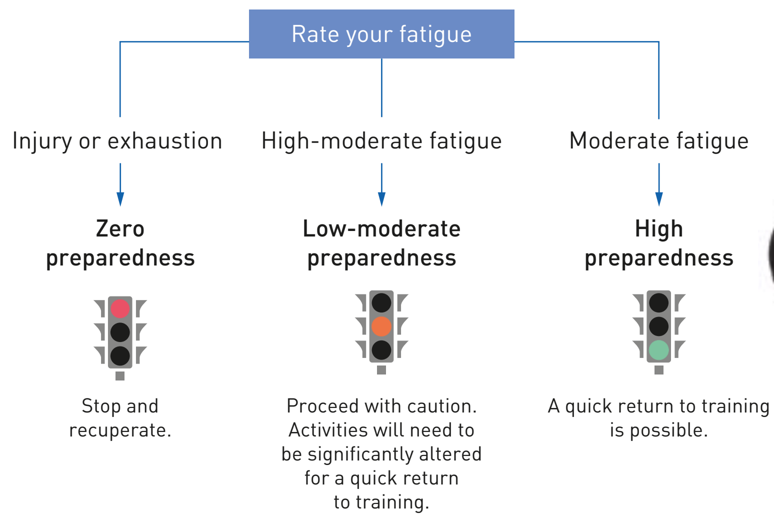
Data to be collected after a training session has been completed includes:

- rating of fatigue (ROF)
- rating of session effectiveness (RSE)
- overall reflections in a training journal.

While athletes commonly have a number of training sessions ready for implementation, it is important that they don't follow the plan without considering their body's preparedness to safely train again. Failing to do so can lead to exhaustion, illness and injury.

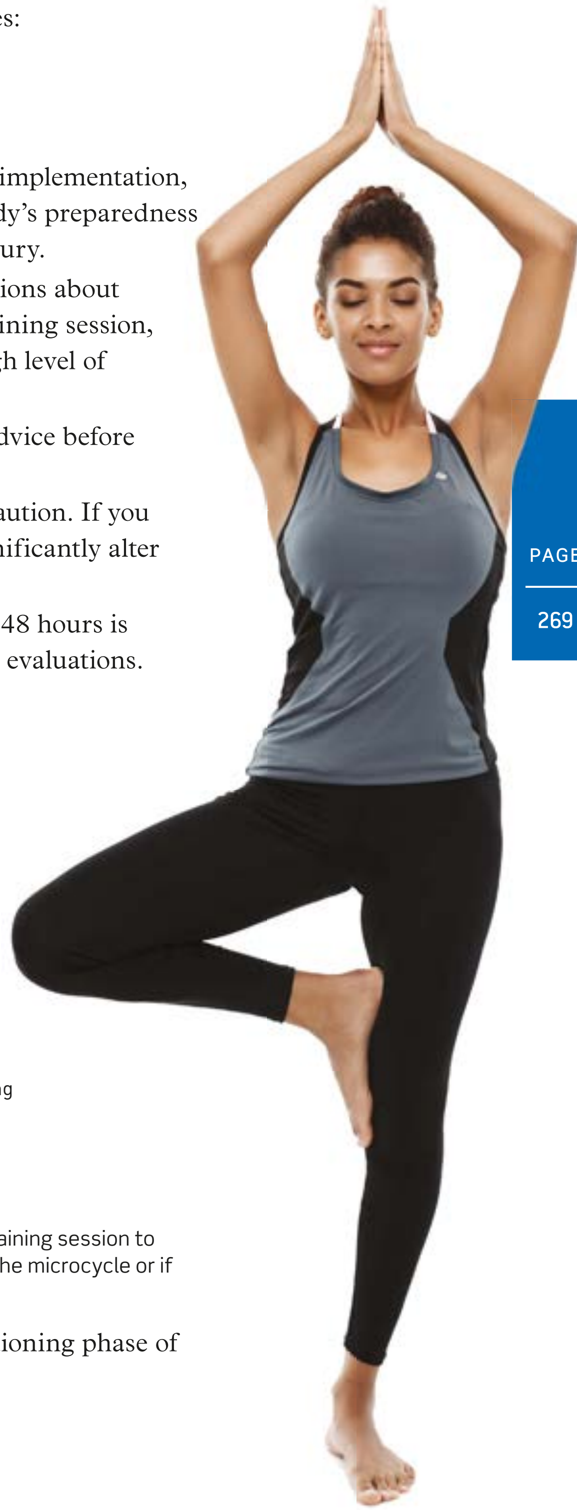
The preparedness flowchart (Source 4) can help athletes to make decisions about when they can safely train again. At the completion of every individual training session, an athlete should determine whether they have a zero, low-moderate or high level of preparedness to retrain.

- Zero preparedness (injury or exhaustion) – stop, recuperate and seek advice before training again.
- Low-moderate preparedness (high-moderate fatigue) – proceed with caution. If you wish to train again within the next 24 to 48 hours, you will need to significantly alter your activities so that different physiological capacities are stressed.
- High preparedness (low fatigue) – training again within the next 24 to 48 hours is possible but you may need to slightly alter your activities based on your evaluations.



SOURCE 4 It is important for an athlete to take stock of their level of fatigue after each training session to determine if they can continue with their initial plan for training session frequency within the microcycle or if they need to make adjustments.

Source 5 gives an example of three different activities to suit the conditioning phase of three different sports.



	Activities for netball (invasion)	Activities for tennis (net and court)	Activities for track and field (performance)
Training objectives	**Movement strategy**: Driving into space **Specialised movement sequences:** Passing **Energy system:** Lactic acid system **Fitness component:** Agility	**Movement strategy:** n/a **Specialised movement sequences:** n/a **Energy system:** Lactic acid system **Fitness component:** Speed, agility	**Movement strategy:** n/a **Specialised movement sequences:** n/a **Energy system:** Lactic acid system **Fitness component**: Power, speed
Activity (including training method)	**Netball running box drill (high-intensity interval training)** Players form a square. Ball carrier passes to player to their left, following the pass in a clockwise direction and waiting at the corner to receive the ball and continue around the square.	**Tennis run-shuffle-run drill (sprint interval training)** Player moves from sideline A to sideline B, back to A and then back to finish at B; this would be one repetition. Throughout this movement, they must alternate between running steps and shuffling steps to mimic typical movement during points.	**Hill sprints (resistance training – plyometrics)** Repetitive sprinting up a steep incline
Sets, repetitions, work volume and intensity	1 x 10 minute drill completion at 90% intensity	3 sets of 5 x run-shuffle-run drills at 100% intensity (4 minutes of passive rest between each set)	2 sets of 3 x 80 m hill sprints at increasing intensities: 90% (3 minute passive rest between sets)
Work:rest ratio (if applicable)	1:3 (approximately)	1:2. (e.g. 10 seconds work to 20 seconds active rest)	1:3. (e.g. 15 seconds work to 45 seconds active rest)

SOURCE 5 When choosing activities for a training session, there are two key questions athletes need to ask themselves: What do I want to achieve with this activity? (objectives) How will I do it? (elements)

Guidelines for activity design			Guidelines for load			
Component of fitness	Specificity	Variety	Frequency	Duration	Intensity	Progressive overload
Strength	Resistance training with 1–8 repetitions that should be of both a specific (i.e. specific sport movements) and general nature	Free weights, cables, machines and own body weight to train isotonically, isometrically and isokinetically	3 times per week with 48 hours minimum rest between each session if training a whole-body program On a split routine (i.e. concentrating on specific muscle groups), training can occur every day.	Untrained athletes: a maximum of one 1 hour per session Duration can also be determined by number of reps and sets (e.g. 12 exercises x 2 sets, or 8 exercises x 3 sets is common). Advanced lifters can spend up to 2.5 hours per session; sometimes with as few as 4 exercises x 8 sets; normally 6 exercises x 4 sets or 5 exercises x 5 sets (especially in split routines) 4–6 minute rest between sets	Untrained athletes: 8–12RM*; slow–moderate speed Advanced athletes: 1–8RM; slow–moderate speed	Gradual increases in weight lifted and gradual reduction in number of repetitions

SOURCE 6 Use the principles of training to guide decisions about activity design and load (per fitness component). *(Continues on next page.)*

Guidelines for activity design			Guidelines for load			
Component of fitness	Specificity	Variety	Frequency	Duration	Intensity	Progressive overload
Power	It is necessary to have adequate strength before one can develop power. Therefore, it is recommended that a power program includes a strength program. Where possible, actions should mimic those of the sport.	Plyometrics, ballistic training, resistance towing or pushing, Olympic weight lifting	2–3 sessions per week	Sessions usually last no more than an hour. Advanced athletes could train for up to 1.5–2 hours. Usually 2–3 sets of each exercise, with no more than 6 reps. (Note: If you go past 6 reps, you decrease speed and lose power – allow 10 seconds between reps. Allow 4–6 minutes rest between sets.)	30–60% of 1RM or 6–12RM performed with explosive force	Gradual increases in power output required (e.g. increase height of bench jump or number of claps between each push up)
Muscular endurance	Any activity requiring the muscle to repeatedly contract against a resistance	Free weights (e.g. barbells, dumbbells, kettlebells), own body weight or a moveable object (e.g. medicine ball)	Up to 7 sessions per week if muscle groups and exercises are varied; usually, 3 times per week for a whole-body program	Sessions should be approximately 45 minutes to 1.5 hours. The repetition range is often greater than 15 reps, 2–3 sets. Often, these activities are measured by time, not repetition (e.g. number of chin-ups in a minute). Aim for 20–60 seconds per set. 10 minutes rest between sets.	Less than 70% of 1RM or 15–20RM	Gradual increase in the weight lifted but reps are kept the same, or the weight is kept the same and the reps increase; also an option to increase the number of sets
Aerobic capacity	Continuous training, LSD training, fartlek training	Vary the venue or the type of training occasionally	Aerobic capacity gains can be achieved with as few as 2 sessions per week in beginner athletes; however, 3–5 sessions per week are recommended.	Continuous training: 20–60 minutes (not including warm up and cool down); less time for beginners; more for advanced athletes Interval training: 30–60 minutes in total; bouts of 1–4 minutes with active rest with a W:R of 1:0.5 to 1.1	Continuous training: 50–85% of MHR** Interval training: moderate duration, high-intensity pace training at above 85% MHR	Gradual increases in intensity (increasing lactate threshold), distance or number of intervals

Guidelines for activity design			Guidelines for load			
Component of fitness	Specificity	Variety	Frequency	Duration	Intensity	Progressive overload
Speed	Sprint interval training (SIT) and high-intensity interval training (HIIT)	Track, sprinting, cycling, swimming, machines	2–5 sessions per week, usually in conjunction with power sessions	Team sports: no more than 40 minutes Individual sports (e.g. track): up to 1 hour Duration can also be determined by number of reps and sets. Intervals developing the ATP-PC system should be 10–20 seconds with a 2–3 minute recovery. Intervals targeting the lactic acid system (e.g. to improve athlete's ability to maintain speed for a longer period of time) should be 30–90 seconds with a W:R 1:2–1:3.	85–100% of MHR	Gradual increases in intensity or distance
Flexibility	General warm up and cool down stretching should focus on whole-body range of movement. Targeted flexibility training should focus on sport/position-specific joint movements.	Passive, dynamic, static and PNF stretching	Usually done before and after competition, but can also be done as specific flexibility training sessions; there is no maximum number of flexibility sessions	Warm up and cool down sessions: 10–15 minutes Specific flexibility training sessions: 30–60 minutes	For static, passive and proprioceptive neuromuscular facilitation (PNF): low intensity; no jerky movements For dynamic: gentle movements associated with the sport	Gradual increases in range of movement across joint Be careful not to over-stretch when using the proprioceptive neuromuscular facilitation (PNF) technique.
Agility	Movements should mimic those required by the sport	Performing team-based drills in an authentic environment will promote variability. Individual agility drills should be varied regularly.	There is no maximum number of agility sessions.	When combined with speed training, sessions should be no more than 40 minutes in team sports and 1 hour in individual sports.	In drills: usually 85–100% In authentic environments: dependent on sport/position being played	Drills can become more challenging (e.g. perform the drill for longer or faster, or increase the success rate before completing the drill).

*RM is the most weight an individual can lift for a defined number of repetitions

**MHR is maximum heart rate

SOURCE 6 Use the principles of training to guide decisions about activity design and load (per fitness component). *(Continued)*

The following Theory in action expands on the idea of initial training values, showing how one student has gathered this information to determine an appropriate starting point for the activities within her training strategy.

Theory in action | Determining initial training values

Mickey is a 17-year-old senior PE student who has decided to develop a microcycle consisting of three training sessions. She is rapidly learning the specialised movement sequences needed for her position of passer-hitter in volleyball, and she has identified that she needs to improve her muscular power to optimise her performance in the movement strategy of using different attack, serve or hit options. Her game analysis reveals that she is on the court for approximately 20 minutes each set, with the occasional time out. This shows that she mostly uses the aerobic system, regularly interspersed with the ATP–PC system each time she explosively spikes, blocks and serves. Rallies seldom last long enough to tax the lactic acid system. Mickey knows what phase she is working within; she knows that her training load must consist of high-intensity, low volume work and she has identified that the mesocycle wherein her microcycle lies is a 3:1 loading pattern. She establishes that she will train for 3 days and devises a list of the activities that would meet her training objectives for the week, taking into account the movement strategies, specialised movement sequences, energy systems and fitness components to be developed.

It is now time for her to decide the repetitions, volume, intensity and W:R for each activity; however, she is struggling to know what these exact values should be. In other words, how many repetitions, what volume, what intensity and what W:R ratio should she use? To help find a starting point, she completes the power initial values test in Skill drill 4.13. At the completion of the Skill drill, she uses the 5-point session evaluation scale, rating the session as a 4 (i.e. 'too difficult – struggled to complete'). This result implies that she should reduce these values when starting her own training. Thus, she now has a starting point.

SOURCE 7 A volleyball player requires muscular power and must therefore incorporate relevant training methods with suitable training loads to reflect this. The player will need to determine their initial values to establish an appropriate starting point.

General information			
Date: *29th of August*		Location: *Field*	
Time: *During a PE lesson*		Equipment: *balls, cones, measuring tape, stopwatch, bibs*	
Position within annual plan: *Microcycle 1 of Mesocycle 1 in the pre-competition phase*			
Training session objectives: **Movement strategy (if applicable):** Maintaining possession of the ball **Specialised movement sequences (if applicable):** Forwards and backwards movement based on ball movement, defensive and offensive play, and passing **Energy system:** Aerobic **Fitness component:** Aerobic capacity and agility			
Warm up (applying RAMP approach): The official FIFA 11+ warm up (visit the FIFA website for details)			
Conditioning phase (3 activities)			
Specific training objective of activity	**Activity details (including training method, load and equipment)**	**Data collecton (RPE, RR, HR, level of motivation)**	**Reflection**
Movement strategy (if applicable): n/a Specialised movement sequences (if applicable): n/a Foundational movement sets Energy system: Aerobic Fitness component: Aerobic capacity	Activity (including training method): Shuttle runs with ball Training method: Aerobic interval training (AIT) Load (sets, reps, volume and intensity, W:R): 4 x shuttle running/dribbling at 80% intensity over 20 m, 40 m and 60 m (i.e. when you finish the 60m shuttle, start again at 20 m) W:R ratio: 1:1 Equipment: a football per person, cones, measuring tape, stopwatch	Rate of perceived exertion: 5/10 Respiratory rate: 45 breaths per minute Heart rate at end: 140 bpm Level of motivation: Moderate	The first 3 repetitions of the shuttle runs were relatively easy; however, during the fourth repetition, I began to lose control of the ball. I also found the last 2 repetitions more difficult, and I found my legs became heavier.
Movement strategy (if applicable): Maintaining possession of the ball Specialised movement sequences (if applicable): Forwards and backwards movement based on ball movement, defensive and offensive play, and passing Energy system: Aerobic Fitness component: Agility	Activity: Keep possession in small grids Training method: High-intensity interval training (HIIT) Load (sets, reps, volume and intensity, W:R): 8 x '4 v 2' 1 minute games at 80% intensity W:R ratio: 1:1 (e.g. 1 minute of work = 1 minute of rest) Equipment: 10 m x 10 m grid, 1 ball per grid, 4 markers per grid, 2 bibs per grid, stopwatch Other: • 4 attackers vs 2 defenders • 5 successful passes between attackers = 1 goal • Aim is for defenders to trap ball or intercept • Once defender intercepts, swap with attacker	Rate of perceived exertion: 6/10 Respiratory rate: 61 breaths per minute Heart rate at end: 160 bpm Motivation level: High	When working as a defender, the intensity was much closer to 100% than it was when working as an attacker. It was much more difficult to intercept the ball as fatigue began to set in. As an attacker, it was important to keep my mind on my skills, especially as the conditions were imposed. The small area meant that even though my heart rate was increased, my cardiovascular endurance was not tested as much as it could be.

SOURCE 8 A sample soccer training session plan for a senior PE student in the pre-competition phase is available on your obook assess. The student has stated their objectives, applied the RAMP approach to their warm up, provided very clear details in the conditioning phase and shown how they will cool down. The student has recorded data about their performance in the 'Reflection' column.

PERFORMANCE

SKILL DRILL **4.13**

Determine your initial training values

>> Turn to pages 352–355 to complete this integrated physical performance activity.

4.13 Check your learning

Engage and understand

1 Refer to the Theory in action 'Determining initial training values'. **List** one type of qualitative primary data and one type of quantitative primary data that Mickey could use to evaluate her performance.

2 **List** the factors you should take into account when deciding on the frequency of training sessions within a microcycle.

Analyse and apply

3 You look at a training session plan written by a basketball player who has not learnt the theory behind designing training sessions. When you ask him about his training, you find out that he is trying to improve his speed when transitioning from defence to attack and he wants to incorporate skill work into this objective. For the conditioning phase of this particular session, he writes: 'Lots of short distance sprinting while dribbling'. **Apply** your knowledge of training session design to rewrite this description, clearly outlining the activity and load.

4 A 400 m runner trains on the first day of a microcycle using the following activity: *Sprinting: Power training using the sprint interval method focusing on drive, recovery and breaking phase of leg action.* She then evaluates her level of fatigue to find out when she can train again. She rates the training load as 'high' and her level of fatigue as 'high'. **Consider** what you know about fatigue and recovery to **judge** when she should train again.

5 Select one specialised movement sequence that you have set training objectives around. **Determine** an activity that might target the energy, fitness and skill elements required.

Evaluate and justify

6 A netball player has entered the competition phase with a close-to-optimal level of fitness. His teacher has asked him to devise a training strategy and he has decided to design three training sessions for one microcycle. He compiles his initial training values for sprint interval training (SIT). **Evaluate** the DCIs (below) from this session and **propose** a starting point for his first SIT session.

Rating of perceived exertion (RPE)

	Rate of perceived exertion (RPE) immediately after run (1–10)	Heart rate (HR) immediately after run	Heart rate (HR) 30 seconds after run	Heart rate (HR) 2 minutes after run
Interval 1				
Interval 2				
Interval 3				
Interval 4				
Interval 5				

Rating of session effectiveness (RSE)

RSE scale		Your rating (i.e. tick the relevant box)
1	It offered no chance for adaptation	
2	It may have caused a slight adaptation	
3	It provided an optimal opportunity for adaptation	
4	It caused a detrimental effect	
5	It caused a catastrophic effect	

7 **Analyse** the secondary data in the microcycle below for the sport of triathlon, which is suggested as a starting point for individuals who possess a moderate degree of fitness. **Predict** whether it would be suitable for you, imagining you were about to commence training for triathlon. **Explain** your prediction.

WEEK	1
MON	Swim 30 min
TUE	Bike 30 min
WED	Run 40–45 min
THU	Swim 30 min
FRI	
SAT	Bike/Run 30 min/5 min
SUN	Swim 30 min

Check your obook assess for the following additional resources and more:

» **Student book questions**
4.13 Check your learning

» **Video**
Developing a training session plan

» **Weblink**
Link to FIFA 11+ warm up

4.14 Assessment support – Summative internal assessment 3: Project – folio

That's a goal!

By the end of Section 4.14, you should be able to:

→ **devise** a personal training strategy
→ **evaluate** and **justify** a personal training strategy
→ **understand** how to evaluate and justify your personal performance
→ **create** a video of supporting evidence of your personal performance.

Overview of Summative internal assessment 3: Project – folio

As part of your assessment for Unit 4 of the QCAA Physical Education General Senior Syllabus, you will be required to complete a Project – folio. The Project – folio is a complex task with many different parts. This section of the chapter is designed to support you as you complete your own Project – folio. 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 Project – folio is made up of two sections:

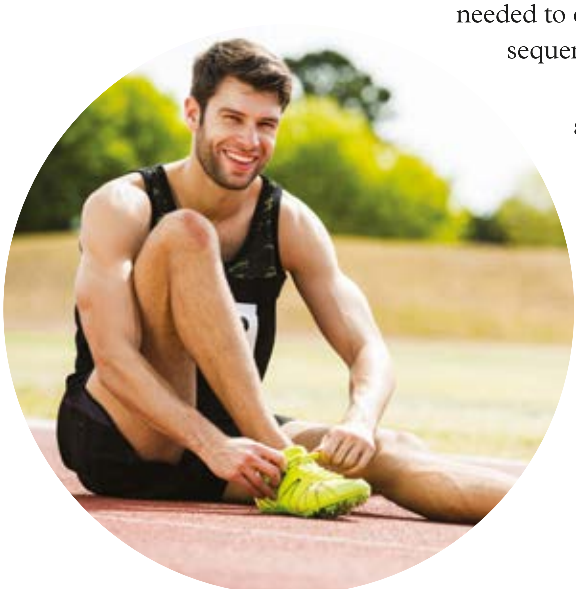
Section 1 – Folio

- Devise, analyse, evaluate and justify your personal training strategy
- Evaluate and justify the effectiveness of your personal performance using body and movement concepts.

Section 2 – Supporting evidence

This section is separate to your multimodal presentation (i.e. it provides the information needed to confirm your ability to demonstrate and apply specialised movements sequences for two movement strategies from two principles of play).

Each part of the task will be assessed and marked against the assessment objectives contained in the instrument-specific marking guide (ISMG). This means that all parts of the task must be completed in order to maximise your chances of success.



Section 1 – Folio

Section 1 of this task requires you to prepare and present a multimodal presentation of 9 to 11 minutes. Examples of multimodal presentations include:

- a pre-recorded presentation submitted electronically
- 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 narrative voice.

Detailed information on how to structure, create and present your Project – folio is provided on pages 10–15 of Chapter 1 – Physical Education Toolkit. In addition to this, Skill drill 1.2A Plan, create and present a Project – folio (available on your obook assess) provides a number of useful tips and instructions to help you.

Devise, evaluate and justify your personal training strategy

First, are required to devise, evaluate and justify a personal training strategy. This is the largest and most significant part of the Project – folio. It requires you to apply the theory that you have learnt in this topic.

Devise your personal training strategy

A training strategy is any approach for a non-specified timeframe that assists you to optimise your performance of specialised movement sequences, for one movement strategy, through the application of training methods, principles of training and periodisation. Because of this non-specified timeframe, and the fact that individuals have vastly different energy, fitness and skill needs, the concept of a training strategy is open to interpretation. For example, while one person might choose to devise a training strategy for three training sessions (i.e. one microcycle), another person's training strategy might involve the development of a 4 week training program (i.e. one mesocycle). Both examples are legitimate training strategies, as long as they effectively apply training methods, principles of training and periodisation.

Source 1 outlines the steps you need to work through in order to devise your personal training strategy. The time needed to work through these steps will depend on how much time you are permitted to spend implementing your strategy. We will now explore each of these steps in more detail.

Step 1 – Conduct a game analysis

The first step in devising your personal training strategy is to conduct a game analysis for the selected physical activity. You do this in order to identify which specialised movement sequences for your specific movement strategy require improvement.

A game analysis has to involve the systematic, organised gathering of primary and secondary data to ensure the information you collect is substantial and relevant. This is important for two reasons: first, because when you synthesise this data, you will have a more valid and reliable picture of the game and yourself as the performer; and second, because the data you gather will inform your decisions around training strategy design. Accurate and reliable data equals a justifiable strategy. It is advisable that you use a GPAI to gather your data.

To assist you with this process, an example GPAI for 'Performance' physical activities has been provided for you in Source 2. A digital version of this GPAI (along with two others for 'Invasion' and 'Net and court' physical activities) is available on your obook assess. You can customise these GPAIs to suit your individual needs.

STEP 1	Conduct a game analysis
STEP 2	Establish the amount of time available for training implementation
STEP 3	Identify specific training objectives to be achieved
STEP 4	Develop the training program
STEP 5	Implement the training program and make adjustments where required

SOURCE 1 The steps required to devise a personal training strategy

STUDY TIP

Detailed information on the format and requirements of the Project – folio is provided on pages 10–15 of Chapter 1.

This information includes:

- a description of the task
- assessment objectives
- a summary of the ISMG.

Be sure to read this information carefully before you work through the information provided in this section.

Game analysis summary GPAI: 'Performance' physical activities					
Name:			**Date:**		
Physical activity:			**Position/event:**		
Phase and cycle information		Macrocycle number:	**Phase of training:**		
		Mesocycle number:	**Microcycle number:**		
Performance (i.e. any match, authentic scenario, event, or performance during the competition phase) Effort/leg (e.g. the bike leg of a triathlon): ______________________ _______________			**Result**	**Current vs. previous game/ event** Key: B = better W = worse S = same H = higher L = lower NA = not applicable	**Reflection and notes**
1	Heart rate data	**Resting heart rate** (i.e. prior to performance)			
		Working heart rate range (i.e. use a HR monitor data to determine this)			
		Heart rate (HR) 1 (i.e. immediately after)			
		Heart rate (HR) 2 (i.e. 30 seconds after work)			
		Heart rate recovery (i.e. subtract HR 1 from HR 2)			
2	**Intensity data** ***Refer to GPAI 9 – Intensity of movement: 'Net and court']***	**Rating of perceived exertion (PRE) at end of effort/leg** (i.e. provide rating from 1–10)			
		Average time spent at high intensity			
		Average time spent at moderate intensity			
		Average time spent at low intensity			
3	**Movement data** ***[Refer to GPAI 10– Frequency, direction and duration]***	**Main types of movement** (e.g. running, sidestepping, jumping, etc.) **Main directions of movement** (e.g. forward, backwards, etc.)			
4	**Skills data** ***[Refer to GPAI 11 – Specialised movement sequence analysis]***	**Specialised movement sequence 1**	% ineffective		
			% effective		
		Specialised movement sequence 2	% ineffective		
			% effective		

SOURCE 2 A game analysis should collect information that includes the athlete's physiological responses to a particular performance. A GPAI designed for 'Invasion' and 'Net and court' physical activities sports is provided on your obook assess.

Example

George is a Year 12 PE student who has selected long jump as his phyiscal activity in Unit 4. George is already quite proficient at long jump, representing his school each year at the secondary schools' sport athletics carnival.

He conducts a game analysis to gather a range of quantitative and qualitative primary data on his performance. Among other things, he collects information on his heart rate, rating of perceived exertion, total time at work, speed of approach, accuracy (distance short of, or over, the board on each attempt) and consistency (maintaining speed over each jump and maintaining accuracy).

A comparison of this data to a model of effective technique leads George to believe that his approach is optimal. Video footage taken from behind, side on and in front of George shows that his preparatory step for take-off is perfectly flat-footed and his angle during the take-off phase is ideal. However, an error is spotted during his rise and fall in the flight phase; his body is rotating too far forward. He now has a clearly identified problem that he can devise a strategy to improve, using energy, fitness and training concepts. George conducts some independent research and synthesises his primary data with secondary data to gain valuable insight. He learns that forward rotation is a common problem for long jumpers and that a range of mid-air techniques exist to combat this unwanted rotation. Specifically, the hitch kick technique is recommended, but only when the athlete's take-off has been mastered.

Step 2 – Establish the amount of time available for implementation of your training strategy

The time available to implement your training strategy will depend on the task that has been set by your teacher. For example, you could be asked to devise a training strategy for a microcycle, consisting of three training sessions or to devise a training strategy for a 4 week mesocycle. In the event that a timeframe has not been specified, it is recommended that you negotiate a plan with your teacher, taking into account the amount of class time you will be given for implementation. The duration of your strategy is an important detail as it will determine how much you can realistically achieve.

Example

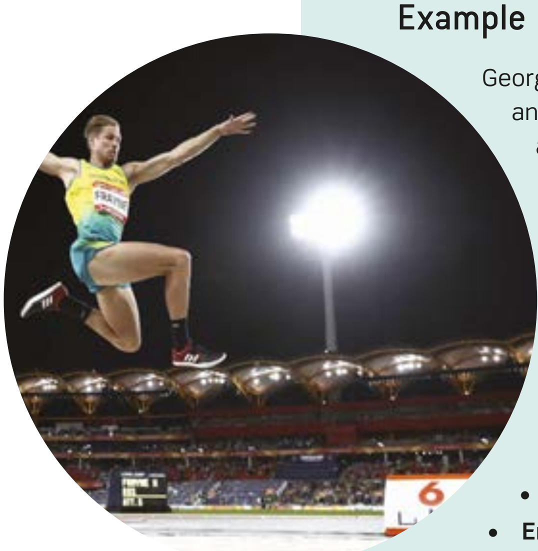
George's task sheet does not stipulate the duration of his training strategy so he queries this with his teacher. She explains that she will allocate three weeks of class time for students to devise and implement their training strategies. Students can choose to either implement three microcycles (i.e. take up the whole time), or they may implement a shorter training strategy and use the remaining lessons to work on participating in their selected event to optimise their technique and gather more video footage for their Project – folio.

Step 3 – Identify specific training objectives to be achieved

You must now determine what improvements you can realistically aim to achieve. The personal training strategy you devise has to clearly show an intent to optimise performance of the specialised movement sequences for one movement strategy, through the application of energy, fitness and training concepts. Therefore, it is suggested that you break your major objective down into the following four categories:

- **the movement strategy** you will be aiming to develop
- **the specialised movement sequences** you will be focusing on, for that movement strategy
- **the energy systems** you will be developing
- **the fitness components** you will be targeting.

Example



SOURCE 3 The hitch kick technique (shown here) is used to combat forward rotation during the flight phase. A relatively proficient long jumper like George might set this skill as an objective for his training strategy.

George sets himself the major objective of learning and optimising the one-and-a-half stride hitch kick technique, which requires significant power and control. In working on this specialised movement sequence, he is developing the movement strategy of 'building effort and distance or height throughout the competition'. In his journal, George clearly communicates this information and turns this major training objective into more specific objectives:

- **Movement strategy:** to vary intensities of jumps depending on the order of the jump within the competition. The first and third jumps are to be executed at maximal effort and the second jump at a conservative effort, with the aim to build effort and distance or height throughout the competition
- **Specialised movement sequence:** transition, flight and landing
- **Energy system/s:** ATP–PC
- **Fitness component/s:** speed, power

Step 4 – Develop the training program

This step requires you to clearly communicate your strategy in writing. In other words, you will need to construct the training program and/or individual training sessions that you plan to implement. It is advisable to use the templates that are available on the obook assess as they will prompt you to include all of the relevant information. It is recommended that you follow the guidelines on training program and training session design in Sections 4.12 and 4.13.

Example

George decides to devise a training strategy for three individual training sessions (i.e. one microcycle). He begins by mapping where these three sessions fit in terms of the mesocycle and training phase that they sit in. Taking this top-down approach to his planning will allow him to fully understand and justify the objectives for his three sessions, showing how he is applying periodisation.

Step 5 – Implement the training program and make adjustments where required

You can now participate in the training sessions and pay careful attention to how your body responds and continually analyse your primary data. As you will have learnt in this chapter, physiological adaptations only occur when the conditions are right. Training that is too easy or too hard will not elicit positive change. As outlined in Section 4.13, it is advisable that you evaluate every training session using two tools:

- rating of session effectiveness (RSE)
- the preparedness flowchart (Source 4 on page 269)

These tools will allow you to make decisions about whether the training session was effective or not, and whether participating in the next scheduled training session is advisable.

Example

Once George has written the training sessions in minute-by-minute detail, he is ready for implementation. As he performs each session, he will collect primary data using a GPAI. In the 24 hours following each session, he will complete a journal entry and use the rating of session effectiveness and preparedness flowchart (Source 4) as tools to determine if his session worked and if the timing of his next scheduled session is appropriate. If not, he will reduce the work volume and intensity of the planned session, modify it completely or postpone the planned session until his body is ready.

Evaluate your personal training strategy

Once you have devised your training strategy, you need to evaluate whether it has been effective or not. This requires you to use the principles of training to appraise the outcomes, implications and limitations of the selected training methods, energy systems and fitness components.

To break this down, it is helpful to understand the terms 'appraising outcomes', 'appraising implications' and 'appraising limitations' in relation to training. We can consider these terms by answering the following questions.

Appraising outcomes

Using the principles of training, what conclusions can be drawn about the effectiveness of your training strategy?

Example considerations for specificity include:

- Did the training strategy effectively target the energy, fitness and skill needs of the specialised movement sequences for an identified movement strategy?

STUDY TIP

Remember that your training strategy for the Project – folio needs to be coherent. Whatever the combination of modes of presentation you choose (e.g. a mix of written paragraphs, photographs, videos and drawings), your Project – folio must have a clear purpose and direction. In other words, it needs to tell a logical story from beginning to end.

- Is there evidence that the training strategy has optimised your performance of specialised movement sequences for one movement strategy?

Example considerations for frequency and duration (work volume) and intensity include:

- Was the relationship between work volume (frequency and duration) and intensity appropriate for the competition phase?

Example considerations for individuality include:

- Did the training strategy effectively address the problems identified by your game analysis?

Example

George writes: 'To develop explosive power for take-off height, which provides sufficient time for refining an effective one-and-a-half stride hitch kick, I used the training method of plyometrics. Plyometrics training is consistent with the ATP–PC energy system requirements (95–100% intensity), with a short duration (in these sessions, 1–5 seconds) and the training principle of specificity.'

Appraising implications

Using the principles of training, what conclusions can be drawn about your training strategy's potential to optimise performance if continued?

Example considerations for specificity and variety include:

- Would you have the motivation necessary to continue to adopt the training strategy over time?

Example considerations for progressive overload include:

- Does the training strategy propose the appropriate progressive overload? If not, how would progressive overload need to be better applied?

Example

George writes: 'The benefit of using plyometric activities is the variety of exercises that can be used to continue to develop power and speed. Within each session, I used single leg box jumps, squat jumps and scissor jumps. To maintain motivation, these three exercises could be changed to single leg hops over 30 metres, bounding and multiple box jumps of different heights. Based on my fitness testing results, I kept the number of foot contacts between 60 and 80 in each session. This makes it easy to apply the principle of progressive overload by increasing the number of contacts to 80–100 in the next mesocycle.'

Appraising limitations

Using the principles of training, what conclusions can be drawn about the aspects of the training strategy that were not effective?

Example considerations for specificity include:

- Did the selected training methods fail to target the appropriate fitness components (for the specialised movement sequences for one movement strategy)?

Example considerations for frequency and duration (work volume) and intensity include:

- Was your implementation period not long enough to optimise performance?
- Was the work volume and intensity too difficult or not difficult enough?
- Did you train too often/not often enough?

Example considerations for progressive overload include:

- Was there a lack of progression in session difficulty? (Or, indeed, a lack of appropriate recovery?)

Example considerations for individuality include:

- Was the training strategy too generic? That is, was it not written to suit your needs?

Example considerations for variety include:

- Did the training strategy only target one aspect of your needs?
- Was the training strategy too boring?

Example

George writes: 'The two essential fitness components for developing an effective long jump technique are speed for the approach and power for the take-off. The training method of plyometrics can be used to replicate the jumping technique so it was an ideal method to cater for the energy system requirements and the training principle of specificity. One drawback of using this training method is that the intensity levels are high and it requires 2 to 3 days recovery between sessions. Performing three plyometric sessions was very taxing and I found that the proposed number of contacts (jumps) became harder to implement in session 3. Upon reflection, I should have decreased the number of contacts and increased the recovery time between sets and reps in session 1, and conducted only two plyometric sessions in the mesocycle.'

Justify your personal training strategy

Once you have evaluated the outcomes, implications and limitations of your personal training strategy, you will need to justify whether your strategy, on balance, should be maintained or not. To do this you should consider which specific aspects of your training strategy should be maintained (i.e. are working and do not need refinement), which should be further developed (i.e. have potential but need refinement) and which should be completely modified (i.e. are not helping to optimise performance).

Example

George writes: 'My primary data proves that my personal training strategy has optimised some aspects of my long jump performance. However, as outlined in this folio, there are a few elements of the strategy that need to be improved. For this reason, I propose that my personal training strategy be further modified.'

Evaluate and justify the effectiveness of your personal performance using body and movement concepts

Next, you are required to evaluate your overall personal performance of your selected physical activity, with a focus on the specialised movement sequences for two movement strategies from two principles of play. To do this you will need to appraise the outcomes, implications and limitations of your personal performance. You may choose two principles of play from the list below:

- setting up attack
- defending against an attack
- creating, defending and exploiting space
- attacking opposition space and scoring.

Your evaluation is required to consider two body and movement concepts in the evaluation of your performance – 'quality of movement' and one other. See Source 4 for a breakdown of each body and movement concept. To maximise your chance of success, your evaluation should reference all relevant criteria from each body and movement concept. In addition to your overall judgment of the effectiveness of your personal performance, you will need to justify which specific aspects of your performance should be maintained, which should be further developed and which should be completely modified. Ensure you use primary and secondary date to support your justifications. It is important to note that this evaluation is separate to the evaluation you made of your personal tactical strategy. You can use information gathered from the same GPAIs, but you do not need to include your personal training strategy in this evaluation.

Quality of movement	Body awareness
Criteria: → speed (e.g. fast, slow) → timing (e.g. in time, out of time) → accuracy (e.g. on target, off target) → effort (e.g. level of motivation) → force (e.g. strong, light) → fluency and flow (e.g. free, bound)	Criteria: → body parts (e.g. arms, legs, elbows, knees, head) → body shape (e.g. stretched, curled, wide, narrow, twisted, symmetrical, asymmetrical) → body action (e.g. flexion, extension, rotation, swing, push, pull, transfer of weight, stability)
Space awareness	**Relationships**
Criteria: → space (e.g. personal and general space) → pathways of movement (e.g. curved, straight, zigzag) → planes of movement (e.g. sagittal, frontal, horizontal) → direction (e.g. forwards, backwards, sideways, up, down) → levels (e.g. high, middle, low)	Criteria: → people (e.g. alone, with partner, with group) → equipment (e.g. bats, balls and other pieces of equipment; uniforms and supplies)

SOURCE 4 The four body and movement concepts

Source 5 provides an example of how a student studying Australian football has demonstrated specialised movement sequences for two movement strategies from two principles of play. It also shows how the student has applied the body and movement concepts to evaluate their performance.

<table>
<tr><td colspan="4">SUMMATIVE INTERNAL ASSESSMENT 3: Project – folio
PLANNING GUIDE</td></tr>
<tr><td colspan="2" rowspan="3">Category of physical activity:
☑ 'Invasion'
☐ 'Net and court'

Selected physical activity:
Australian football</td><td>Specialised movement sequences:
Leading, marking, handballing and kicking</td><td>Specialised movement sequences:
Marking, handballing and kicking</td></tr>
<tr><td>Movement strategy 1:
Break through the defence by knocking the ball forward, handballing, kicking and running to space</td><td>Movement strategy 2:
Move the football into opponent's defensive area to score</td></tr>
<tr><td>Principle of play 1:
Setting up attack</td><td>Principle of play 2:
Attacking opposition goal and scoring</td></tr>
<tr><td>Body and movement concept 1:

Quality of movement</td><td>Criteria:
▶ Speed (e.g. fast, slow)
▶ Timing (e.g. in time, out of time)
▶ Accuracy (e.g. on target, off target)
▶ Effort (e.g. level of motivation)
▶ Force (e.g. strong, light)
▶ Fluency and flow (e.g. free, bound)</td><td>My personal rating:
☑ Accomplished and proficient
☐ Effective
☐ Competent
☐ Variable or inaccurate
Evident criteria:
Accuracy, effort, fluency and flow, timing and speed
Supporting visual evidence:
Clips that show how I break through the defence by leading into space with an outcome that is beneficial to the team (e.g. knocking a lost ball off the ground to a teammate, breaking away from defence to receive a handball or mark, moving into free space to kick a ball to a teammate).</td><td>My personal rating:
☐ Accomplished and proficient
☑ Effective
☐ Competent
☐ Variable or inaccurate
Evident criteria:
Accuracy, force, development, continuity and outcome of movement, efficiency
Supporting visual evidence:
Clips that show that I have a high percentage of marks in front of the uprights and a high degree of goal accuracy (e.g. kicking effectively to a teammate for them to take a mark in reach of the uprights, optimising horizontal and vertical space and using force development by jumping to catch a mark in the scoring zone, fluently handballing on to a teammate who is free to kick for goal).</td></tr>
<tr><td>Body and movement concept 2:

Relationships</td><td>Criteria:
▶ People (e.g. alone, with partner, with group)
▶ Equipment (e.g. bats, balls and other pieces of equipment; uniforms and supplies)</td><td>My personal rating:
☐ Accomplished and proficient
☑ Effective
☐ Competent
☐ Variable or inaccurate
Evident criteria:
People (i.e. interaction with teammates and opponents)
Supporting visual evidence:
Clips that show how I read the opponent's movement to perceive and act on affordances (e.g. choosing to kick the ball to an open teammate further up the field rather than handballing to a closer one who would be easily challenged, winning a physical contest – i.e. outmanoeuvring opponent – to take a mark).</td><td>My personal rating:
☐ Accomplished and proficient
☑ Effective
☐ Competent
☐ Variable or inaccurate
Evident criteria:
People (i.e. interaction with teammates and opponents), equipment
Supporting visual evidence:
Clips that show that I use the opponent and the movement of the ball up the field to position myself effectively, creating affordances for my teammates so that I can mark their kick (e.g. moving to the left of the uprights and making myself seen, when the ball is travelling up the left hand side, successfully reading the irregular bounce of the ball to take possession).</td></tr>
</table>

SOURCE 5 This example shows how a student studying Australian football has demonstrated specialised movement sequences and two movement strategies from two principles of play. It also shows how the student has applied the body and movement concepts to evaluate their performance.

STUDY TIP

Revisit and revise the body and movement concepts that were covered in Unit 1 of the QCE Physical Education syllabus by referring to Section 2.7 (pages 69–75) of *Physical Education for Queensland Units 1 & 2*.

If you no longer have access to the printed Student book, you can still access a complete digital version online via your obook assess.

You will be expected to provide the same level of evaluation for your selected physical activity for your Project – folio. A template for this DCI is provided on your obook assess.

Section 2 – Supporting evidence

The second component of this task requires you to provide 2 to 3 minutes of supporting evidence (i.e. video footage) demonstrating and applying your physical performance in an authentic environment. The visual evidence you supply should demonstrate:

- specialised movement sequences for two different movement strategies from two principles of play
- your application of quality of movement and one other body and movement concept to reflect on your typical performance of specialised movement sequences for two movement strategies from two different principles of play.

If you completed the Evaluating and justifying your personal performance part of the assessment, you will need to identify the two different movement strategies from two different principles of play you wish to use. For example:

Principle of play 1: Setting up attack	**Principle of play 2:** Attacking opposition goal and scoring
Movement strategy 1: Break through the defence by knocking the ball forward, handballing, kicking and running to space	**Movement strategy 2:** Move the football into opponent's defensive area to score

To demonstrate accomplished (highly skilled) and proficient (well advanced or expert) specialised movement sequences, you will need to have sufficient, sustained visual proof that shows relevant specialised movement sequences and variations of these skills. For example:

Principle of play 1: Setting up attack	**Principle of play 2:** Attacking opposition goal and scoring
Specialised movement sequences: Leading (e.g. moving into space) Marking (e.g. from handballs and kicks) Handballing (e.g. various distances, bounce pass, using left- and right-hand passes) Kicking (e.g. drop punts of different heights and distance, torpedo, grubber)	**Specialised movement sequences:** Marking (e.g. from handballs and kicks) Handballing (e.g. various distances, bounce pass, using left- and right-hand passes) Kicking for goal (e.g. snap shot, banana kick, set shot)

As your supporting evidence can only be 2 to 3 minutes long, you will need to choose the footage you include carefully. If applicable, you are permitted to use some of the footage you included in the folio; however, it is recommended to only do this if it reflects your typical, sustained performance.

If you need more visual evidence to meet the time requirements of your supporting evidence, select clips that show variations of specialised movement sequences with successful outcomes.

4.14 Check your learning

Engage and understand

1 Access an up-to-date version of the instrument-specific marking guide (ISMG) for summative internal assessment 3: Project – folio. Read the assessment objectives and marks allocated for each. **Identify** the areas of the task you think will be most challenging. **Identify** some techniques that you can use to help you perform well in these areas.

2 **Explain** the terms 'outcomes', 'implications' and 'limitations' in relation to the evaluation of a training strategy.

Analyse and apply

3 Refer to the second example on page 282. **Reflect on** the process that George followed in order to develop his training objectives and **create** your own checklist for setting your objectives. In other words, write down the steps you need to take to ensure you set the most effective training objectives.

4 **Differentiate** between maintenance, further development and modification in relation to the justification of a training strategy.

Evaluate and justify

5 **Predict** the principles of training that are going to have the most impact on the outcomes, implications and limitations of your training strategy. **Justify** your response.

Check your obook assess for the following additional resources and more:

» **Student book questions**
4.14 Check your learning

» **Video**
Assessment support for Summative internal assessment 3: Project – folio

» **Weblink**
A link to the ISMG for Summative internal assessment 3: Project – folio (© QCAA)

SOURCE 6 Summative internal assessment 3: Project – folio requires you to evaluate and justify a personal training strategy.

CHAPTER 4 REVIEW

Sum it up!

4.1 **Energy** is a term used to describe the power derived from fuels (i.e. food) by a range of systems and chemical reactions that take place in the body in order to produce movement.

Fitness is a term used to describe the body's ability to function efficiently and effectively.

Training is a term used to describe the specific tasks and activities an athlete completes to enhance or improve their energy and fitness in their chosen physical activity.

The study of energy, fitness and training in sport is known as **exercise physiology**.

4.2 There are three main types of nutrients found in all foods. They are **carbohydrates**, **protein** and **fats**.

The energy content of different nutrients is measured in **kilojoules** (kJ). Kilojoules are the unit used to measure the amount of **chemical energy** provided by various types of foods. This chemical energy is converted into **mechanical energy** for movement.

Carbohydrates can be categorised as **simple carbohydrates** or **complex carbohydrates**. When carbohydrates are digested, a chemical reaction takes place and they are broken down into **glucose**.

When proteins are digested, a chemical reaction takes place and they are broken down into **amino acids.** Amino acids can be categorised as **essential amino acids** and **non-essential amino acids**.

When fats are digested, a chemical reaction takes place and they are broken down into **fatty acids.** Fats can be categorised as **essential fatty acids** and **non-essential fatty acids**.

Adenosine triphosphate (ATP) is a complex molecule found in the cells of every living thing. ATP captures chemical energy from the breakdown of food molecules and releases it when needed in order to fuel a range of tasks, including moving the muscles.

4.3 There are **three main energy systems** in the body that power the ATP resynthesis and ensure that our body has the energy it needs to take part in physical activity: the **ATP–PC system**, the **lactic acid system** and the **aerobic system**.

The ATP–PC system and the lactic acid system are **anaerobic**, meaning they don't use oxygen to resynthesise ATP, while the aerobic system does.

The **ATP–PC energy system** is used by the body for short, maximum-intensity activities that last between 10 and 15 seconds. The ATP–PC system resynthesises ATP quickly and efficiently due to the readily available stores of **phosphocreatine (PC)** in the muscles.

Once PC stores in the muscles have been depleted after about 10 to 15 seconds, the **lactic acid system** becomes the predominant energy system and is typically used for high-intensity activities lasting approximately 60 to 90 seconds. The lactic acid system provides energy by using supplies of sugar circulating in the blood (i.e. as **glucose**) and stored in the muscles and liver (i.e. as **glycogen**).

The **aerobic system** is typically used by the body for low- to moderate-intensity activities lasting longer than 90 seconds. The aerobic system produces the energy required to resynthesise ATP using the same chemical process used in the lactic acid system (i.e. glycolysis), but with the presence of **oxygen**.

4.4 The term **fitness** refers to the condition of being physically fit and healthy, and a person's ability to participate effectively in a particular sport or physical activity.

There are seven components of fitness: **aerobic capacity**, **power**, **strength**, **speed**, **agility**, **muscular endurance** and **flexibility**.

Athletes use **fitness tests**, which measure and test the components of fitness, in order to develop and implement personalised training strategies.

4.5 The body systems involved in **oxygen uptake** and delivery during physical activity are the **respiratory system**, the **circulatory system** and the **muscular system**.

The stress put on the body during training causes a number of changes to occur in the body. These changes can be immediate, known as **acute physiological adaptations** (e.g. increased heart rate [HR], increased respiratory rate [RR] and increased muscular temperature) or take place over a longer period of time, known as **chronic physiological adaptations** (e.g. increased number of lung capillaries, increased size and strength of heart, increased muscle mass).

An athlete's maximal oxygen uptake is commonly referred to as **VO_2 max**.

The intensity at which lactate begins to accumulate in the blood is known as the **lactate threshold**. The lactate threshold for an average athlete is reached at around 80 to 85 per cent of their **maximum heart rate (MHR)**. If the intensity of physical activity is not reduced at this point, a more pronounced accumulation in blood lactate occurs, known as the **lactate turn point (LTP)**. When the LTP is reached, muscle fibres can be prevented from contracting properly, causing fatigue.

4.6 Athletes use **training programs** to plan, implement and evaluate training.

Before designing a training program, athletes should perform a **game analysis** and identify **training objectives**.

A training program is written on many levels over different time periods with increased detail. The time periods are **annual plan**, **macrocycles**, **training phases**, **mesocycles**, **microcycles** and **training sessions**.

Training programs should consider **game analysis, training objectives, work volume**, **training load**, **tapering** and **recovery**.

4.7 A **training zone** is a range that indicates the upper and lower limits of intensity for training.

There are four major training zones: the **recovery training zone**, the **aerobic training zone**, the **lactate threshold training zone** and the **anaerobic training zone**.

4.8 The **principles of training** are guidelines that help to ensure that athletes get the most value and benefit out of their training and are able to achieve their training objectives.

The seven principles of training are: **specificity**, **frequency**, **intensity**, **duration**, **progressive overload**, **individuality** and **variety**.

4.9 **Training methods** are forms of exercise that athletes can use to target different components of fitness and optimise particular aspects of their performance.

4.9A **Continuous training** is a form of exercise performed at the same intensity for an extended period of time without rest.

4.9B **Fartlek training** is a form of continuous training that enhances the aerobic capacity by having athletes vary the intensity of their exercise through increasing their speed and/or increasing their resistance.

4.9C **Resistance training** is a form of exercise that requires an athlete to work against something (e.g. weights) that resists the movement of their body or specific parts of their body (e.g. arms, legs, particular muscles).

There are four types of resistance training: **isotonic (dynamic)** resistance training, **isometric (static)** resistance training, **isokinetic** resistance training and **plyometric** training.

4.9D **Interval training** is a form of exercise that uses alternating periods of work with periods of rest to enhance specific components of fitness and target particular energy systems.

There are three main types of interval training: **high-intensity interval training (HIIT)**, **sprint interval training (SIT)** and **aerobic interval training (AIT)**.

4.9E **Flexibility training** is a form of exercise that involves stretching the muscles, tendons and ligaments in and around joints.

There are four main types of flexibility training: **dynamic** flexibility training, **static** flexibility training, **passive** flexibility training and **proprioceptive neuromuscular facilitation (PNF)** flexibility training.

4.9F **Circuit training** involves a series of exercises that are performed in a consecutive rotation, with minimal rest periods in between.

4.10 **Fatigue** is defined as the reduction in the efficiency of a muscle or organ that occurs when the body is placed under physical stress.

Recovery is defined as the process of an individual returning to their normal physiological state after a period of physical activity. There are two types of recovery: **intra-session recovery** and **inter-session recovery**. Recovery can also be **active** or **passive**.

General Adaptation Syndrome (GAS) explains that the human body adapts when the right amount of stress is applied and then removed.

The **fitness–fatigue model** explains that there is an optimal window for training after a previous session when the body has recovered from fatigue and made physiological adaptations and before they begin losing these gains through too much rest.

4.11 The process of breaking down a training program into smaller and smaller blocks so that energy, fitness and skill can be built over time is called **periodisation**.

The **annual plan** is a term used to describe an athlete's planning over a 12-month period.

An annual plan can consist of one or more **macrocycles**. Macrocycle is a term used to describe the time from when an athlete starts to train for a season or event, to the completion of their post-season or post-event recovery.

Each macrocycle is divided into four **training phases**, each with its own goals for energy and fitness development.

The **preparatory phase** is when the athlete focuses on increasing their general level of fitness.

The **pre-competition phase** is when the athlete focuses on optimising their energy, fitness and skill levels for their specific sport, position and/or event.

The **competition phase** is when the athlete focuses on maintaining their energy, fitness and skill levels for their specific sport, position and/or event and maximising their performance in authentic game or performance environments.

The **transition phase** is when the athlete focuses on rest and recovery from the physical and mental stress of training and competition.

Each training phase is divided into a series of 4 to 6 week blocks known as **mesocycles**.

Mesocycles can be divided into shorter blocks, usually 7 to 10 days in length, called **microcycles**.

Each microcycle consists of around three **training sessions**.

A training session has three phases: the **warm up phase** (which should apply the RAMP warm up), the **conditioning phase** and the **cool down phase**.

4.12 A **game analysis** allows an athlete to study the demands on movement patterns, energy, fitness and skills, as well as strategy and tactics, and to recognise areas where they should focus their attention in order to improve their overall performance.

Training objectives are the specific energy, fitness and skill goals that athletes aim to achieve through the implementation of their training program.

4.13 When drawing up a training session plan, athletes should include: general information such as date, time and phase of training; training session objectives such as energy, fitness and skill objectives; warm up, cool down and conditioning activities; and data collection and reflection.

4.14 As part of your assessment for Unit 4 of the QCE Physical Education syllabus, you will be required to complete a **Project – folio**.

Dig deeper!

Exam-style revision questions and tasks

SECTION 1

→ Ten multiple-choice questions

QUESTION 1

The ATP–PC energy system

(A) peaks at 30 seconds when athletes work maximally from the outset.

(B) uses fat to resynthesise ATP.

(C) is the predominant supplier of energy in high jump.

(D) is the best energy source because it is in abundant supply.

QUESTION 2

The lactic acid system

(A) produces a fatiguing by-product.

(B) is the main source of energy for a triathlete.

(C) should be avoided by athletes.

(D) uses protein as a fuel source.

QUESTION 3

Lactate threshold is best described as the level of intensity where

(A) oxygen consumption meets oxygen demand and onset of blood lactate occurs.

(B) oxygen consumptions does not meet oxygen demand and onset of blood lactate occurs.

(C) lactic acid is oxidised and prevented from accumulating.

(D) respiration decreases to reduce the lactate build up in the muscles.

QUESTION 4

Work volume is:

(A) a combination of frequency and duration.

(B) a combination of frequency and intensity.

(C) a combination of overload and duration.

(D) a combination of repetitions and sets.

QUESTION 5

The principle of individuality considers

(A) the energy and fitness requirements of the physical activity.

(B) the inclusion of a range of movement options in training.

(C) the need for an increase in training load.

(D) the fitness levels of the athlete.

QUESTION 6

A netball goal shooter mostly requires

(A) speed, agility and power and predominantly uses their ATP–PC and aerobic systems.

(B) speed, agility and power and predominantly uses their lactic acid and aerobic systems.

(C) speed and muscular endurance and predominantly uses their aerobic system.

(D) aerobic capacity, strength and power and predominantly uses their ATP–PC system.

QUESTION 7

In resistance training, 3 x 15 x 20RM with a 3 second repetition duration would most likely target which of the following fitness components?

(A) Strength

(B) Muscular endurance

(C) Speed

(D) Power

QUESTION 8

Progressive overload in a circuit training session can be achieved by

(A) decreasing the intake of carbohydrates.

(B) increasing the variety of stations.

(C) increasing the time or repetitions at each station.

(D) decreasing the number of repetitions and sets.

QUESTION 9

The best example of SIT listed below is

(A) $2 \times 2 \times 1000$ m runs with a W:R ratio of 1:1 and RPE 6–7.

(B) $2 \times 4 \times 600$ m runs with W:R ratio of 1:2 and RPE 4–5.

(C) $2 \times 6 \times 100$ m runs with W:R ratio of 1:4 and RPE 8–9.

(D) $2 \times 8 \times 20$ m runs with W:R ratio of 1:1 and RPE 4–5.

QUESTION 10

According to the theory of periodisation, if an athlete wanted to create a training program starting with the longest period of time and get progressively more detailed, in which order should she attack the various cycles and phases in her training program?

(A) Annual plan, training phases, macrocycles, microcycles, mesocylces, training sessions

(B) Annual plan, macrocycles, mesocycles, microcycles, training phases, training sessions

(C) Annual plan, mesocycles, macrocycles, training phases, training sessions, microcycles

(D) Annual plan, macrocycles, training phases, mesocycles, microcycles, training sessions

SECTION 2

→ Three short-response questions

STIMULUS 1

An athlete shown during a training session.

QUESTION 11 (150 words)

Use Stimulus 1 to **infer** the types of acute physiological adaptations that the athlete has experienced in response to his training and **explain** the reasons for these adaptations.

Stimulus 2

An incomplete training session plan is shown below.

Warm up	
Conditioning phase	1 10 × 30m (20 m forwards, 10 m backwards) sprints 90% intensity (1:4) (5 mins) 2 3 v 1 Rucking drill (defender runs backwards continuously at a steady pace; ruck must make 3 touches before defender reaches 30 m mark) high intensity (1:4) (15 mins) 3 3 v 2 touch game (20 × 20 m grids) team of 3 has 3 touches to score. Rotate attackers and defenders and continue (20 mins) 4 4 v 4 touch game (50 m × 50 m grids) – continuous game (normal touch rules) (20 mins)
Cool down	1 Jog to collect up all markers then run them around the touch field. 2 Stretches (dynamic and pnf stretches)

QUESTION 12 (150 words)

Analyse Stimulus 2 and **apply** the RAMP approach to **devise** a warm up that would adequately prepare the athlete for the training activities proposed in this session. **Justify** the design of your warm up.

STIMULUS 3

Volleyball is a fast-paced physical activity that requires players to develop specific components of fitness in order to be successful. An image taken during a game of volleyball is shown here.

QUESTION 13 (150 words)

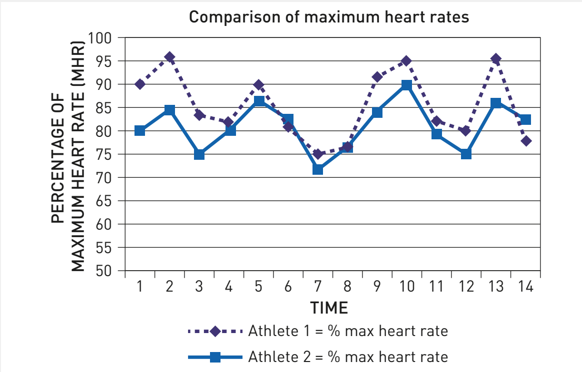
Analyse Stimulus 3 and identify the components of fitness this athlete needs to complete this movement successfully and optimise her chances of scoring a point. Justify your selection, referring to the features of the movement and your understanding of the components of fitness.

SECTION 3

→ One extended response question

Stimulus 4

The data shown below was collected during a 14-minute game analysis of an 'Invasion' physical activity played in the pre-competition phase. It shows the percentage of MHR for two athletes marking each other over time.



QUESTION 14 (400 words)

Use the data provided in Stimulus 4 to **design** a training strategy for Player A in an 'Invasion' physical activity of your choice. The training strategy must aim to develop Player A's energy and fitness needs as they approach their competition phase.

Describe your training strategy design, the specialised movement sequences and movement strategies included to target your selected sport.

Practice assessment task

This practice assessment task was prepared according to the specifications in the *Physical Education 2019 v1.1 General Senior Syllabus*. It has not been endorsed by the QCAA.

Subject	Physical Education	**Instrument number**	IA3 (i.e. Summative internal assessment 3)
Technique	Project – folio		
Unit	4 Energy, fitness and training and physical activity		
Topic	1 Energy, fitness and training integrated with selected physical activity		
Conditions			
Duration	5 hours		
Mode	Multimodal (visual and written or spoken)	**Length**	Section 1 – Folio 9–11 minutes Section 2 – Supporting evidence 2–3 minutes
Individual /group	Individual		
Resources available	Refer to Section 6 – Physical activities of the *Physical Education 2019 v1.1 General Senior Syllabus*		

Context:

Throughout this unit, you engaged in integrated learning experiences about energy, fitness and training and applied body and movement concepts to optimise your selected physical activity. You have also participated in authentic game play and used the body and movement concepts to critique your personal performance of the specialised movement sequences for various movement strategies.

Task:

Devise a personal tactical strategy for specialised movement sequence/s to optimise your performance of one movement strategy in the selected physical activity. **Evaluate** and **justify** the effectiveness of your personal tactical strategy. Evaluate and justify your personal performance of specialised movement sequences and two movement strategies from two different principles of play by applying two body and movement concepts (i.e. quality of movement and one other).

Supply visual evidence of specialised movement sequences and two movement strategies from two different principles of play in an authentic environment.

Detailed instructions for this task (including a copy of the ISMG) are available on your obook assess.

Check your obook assess for these additional resources and more:

» **assess quiz**
Test your skills with this auto-correcting multiple choice quiz for Chapter 4

» **Revision notes**
[Make your own revision notes with this handy template designed to help you prepare for assessment tasks]

» **Data analysis worksheet**
This worksheet helps you to practise analysing secondary data and writing extended responses

» **Practice assessment task**
A printable and editable version of the practice assessment task in for Chapter 4 (including ISMG)

‘If you fail to prepare, you’re prepared to fail.’

Mark Spitz (1950–present)

Former American competitive swimmer, nine-time Olympic champion and former world record-holder in seven events

CHAPTER

5 REVISION AND EXAM PREPARATION

INTRODUCTION

This chapter contains a range of information and practical tips to help you thoroughly revise the subject matter in Unit 4 – Topic 1: Energy, fitness and training, and prepare you for the external Examination – Combination response. The exam will contribute 25 per cent of your total marks for QCE Physical Education Units 3 & 4, so it is important to prepare well and ensure you have all the information you need to perform at your best under exam conditions.

This chapter is divided into seven sections. Each section is designed to target specific areas from the subject matter dot points included in the syllabus. Each section includes the following features:

- **Key concepts –** a brief summary of one or more key concepts (or subject matter dot points) covered in Unit 4 – Topic 1: Energy, fitness and training
- **Test your understanding! –** a graded activity designed to test your knowledge and understanding of particular concepts (or subject matter dot points)
- **Revisit and revise –** a handy reference table with a self-assessment checklist to help you identify and locate the information you need to revisit and revise in Unit 4 – Topic 1: Energy, fitness and training
- **Exam tip –** helpful tips designed to help you prepare, study and perform at your best under exam conditions
- **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 4 – Topic 1: Energy, fitness and training
- **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 chapter 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 4. You may like to cover one section per week over the course of seven weeks or move through the sections more quickly.

Best of luck with the exam!

5.1 Energy requirements for physical activity and energy systems

That's a goal!

By the end of Section 5.1, you should be able to:

→ **understand** and **explain** the role of food in energy production
→ **understand** and **explain** the role of ATP in energy production
→ **identify** the three energy systems involved in ATP resynthesis
→ **understand** how factors such as intensity and duration impact the energy systems used in physical activity
→ **determine** the best ways to train each energy system for optimal performance
→ **understand** the phrase 'interplay of energy systems'
→ **understand** how energy system contributions fluctuate throughout physical activity.

PAGE 296

SOURCE 1
In many sports and physical activities, such as touch football, there is interplay between the three energy systems: the ATP–PC system, the lactic acid system and the aerobic system.

Key concepts

Let's start by reviewing the following key concepts from the syllabus.

Energy requirements for physical activity

The human body requires energy to engage in physical activity. This energy comes from the foods we eat in the form of nutrients. There are three main types of nutrients found in all foods. They are:

- **carbohydrates** – stored in limited supply as glycogen and an ideal source of energy due to how easily they break down. The body can store enough glycogen to last 60 minutes of vigorous exercise or 90–120 minutes of moderate intensity activity. Carbohydrate food sources include grains (e.g. breakfast cereals), starchy vegetables (e.g. potatoes and peas), sugars, fruits and dairy products.
- **protein** – stored as amino acids and generally used for muscle growth and repair rather than as an energy source (except in extreme circumstances) due to the length of time it takes to metabolise them for energy. Protein food sources include meat, eggs and dairy products, as well as grains, legumes, nuts and seeds.
- **fats** – stored as fatty acids in abundant supply, fats are an ideal source of energy for low- to moderate-intensity activity. They take longer to metabolise for energy than carbohydrates but have the benefit of lasting for longer periods of time. Fat food sources include oils, nuts, dairy products (e.g. milk, cheese), avocados, some cuts of meat and oily fish.

Nutrients from the food we eat are not directly responsible for providing the energy that facilitates movement in working muscles. For this, a chemical compound called adenosine triphosphate (ATP) is required. ATP is not found abundantly in our bodies and must be repeatedly resynthesised to continue to supply the body's energy needs. This resynthesis occurs through the body's energy systems and is fuelled by carbohydrates, protein and fats.

Energy systems

There are three energy systems that work to facilitate ATP resynthesis:

- the **ATP–PC system** – used in high-intensity physical activities lasting a maximum of 10–15 seconds (e.g. a 100 m sprint)
- the **lactic acid system** – used in moderately high-intensity physical activities lasting a maximum of 60–90 seconds (e.g. a 200 m freestyle swim)
- the **aerobic system** – used in moderately low-intensity physical activities lasting for an indefinite amount of time (e.g. a marathon).

The intensity and duration of the physical activity, as well as an individual's fitness, determine which energy system or combination of systems is used at any given time. In many activities, there is interplay between the three energy systems. Each energy system contributes to a share of the energy production over the course of the physical activity, but at different times. The system used at any given time is dependent on the needs of the individual and the specific circumstances of their performance.

Key terms

Source 2 contains is a list of key terms relevant to the topic of energy requirements for physical activity, including energy systems. You will need to familiarise yourself with these terms in preparation for your external exam.

→ Fats	→ Amino acids	→ ATP cycle	→ Energy systems interplay
→ Kilojoules (kJ)	→ Fatty acids	→ Energy systems	→ Aerobic glycolysis
→ Chemical energy	→ Triglycerides	→ ATP–PC system	→ Anaerobic glycolysis
→ Mechanical energy	→ Adenosine triphosphate (ATP)	→ Lactic acid system	→ Lactic acid
→ Glucose		→ Aerobic system	→ Lactate
→ Cells		→ Phosphocreatine (PC)	→ Resynthesise

SOURCE 2 Key terms you need to know

Test your understanding!

Now it's time to test how well you understand the key concepts in this section. To perform well under exam conditions, you need to provide clear, concise and accurate responses to all questions on this part of the course. Your ability to do this will depend on:

- how quickly and accurately you can recognise, recall and explain concepts relating to energy requirements for physical activity and energy systems
- how well you can analyse and synthesise data and apply energy requirements for physical activity, including energy systems in unfamiliar contexts
- how well you can use your understanding of energy requirements for physical activity, including energy systems to devise, evaluate and/or justify training strategies
- how effectively you can communicate your understanding of energy requirements for physical activity, including energy systems.

SOURCE 3 Three energy systems work together to facilitate ATP resynthesis: the ATP–PC system, the lactic acid system and the aerobic system.

To test your understanding of these key concepts, complete the following tasks. Answers for these tasks are provided on your obook assess.

Level of difficulty	Task	Key terms and concepts
★	1 **Define** each of the following key terms.	→ Carbohydrates → Protein → Fats
★★	2 **Analyse** the following concepts (providing examples as required to demonstrate your understanding).	→ The role of adenosine triphosphate (ATP) in energy production → The interplay of energy systems during individual physical activities
★★★	3 In a written response of 150 words, **discuss** how you would use your knowledge of the following concept to develop a training strategy (e.g. training program, training session).	→ The role of the different energy systems in ATP resynthesis during physical activity: – ATP–PC system – Lactic acid system – Aerobic system

SOURCE 4 Complete the tasks in this table to test how well you understand the key concepts in this section.

Revisit and revise

Once you have completed the tasks in Test your understanding!, use the answers (provided on your obook assess) to score your responses. Then use the table below to rate your level of understanding and confidence for each key concept. If you need to revisit and revise any of these concepts, use the section and page references provided to quickly find what you are looking for and target your revision.

STUDY TIP

Remember to revisit Chapter 1 when you begin revising for the Examination – combination response. Section 1.2C (pages 20–24) contains some helpful information about the structure of the exam, as well as tips on:

- the types of questions you will be expected to answer
- how to answer different types of questions
- the importance of cognitive verbs.

Key terms and concepts	My level of understanding and confidence	Section	Page/s
The role of food in energy production: → Carbohydrates → Protein → Fats	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.2	169–172
The role of adenosine triphosphate (ATP) in energy production	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.2	173–175
The role of the different energy systems for ATP resynthesis during physical activity: → ATP–PC system → Lactic acid system → Aerobic system	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.3	176–181
The interplay of energy systems during individual physical activities	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.3	181–185

SOURCE 5 Use this table to rate your level of understanding and confidence for each key concept, and to identify which areas you need to revisit and revise.

EXAM TIP

Preparing for an exam can be a challenging and stressful time. However, the exam tips provided throughout this chapter are designed to help you plan and prepare for success. Some tips relate specifically to QCE Physical Education, while others are more general and apply to all QCE subjects.

Tip 1: Access key documents and read them carefully

One of the quickest and simplest things you can do to set yourself up for success in the QCE Physical Education examination is to get your hands on a couple of key documents and read them carefully. The most important document is the QCAA Physical Education General Senior Syllabus. It sets out all of the information you are expected to learn and provides important details about the Examination – combination response (including a description of the types of questions you will be expected to answer, how long the exam will run for and advice on what subject matter will be assessed).

- At the time this book went to print, the current syllabus was ***Physical Education 2019 v1.1 General Senior Syllabus***. Much of the exam advice in this chapter is based on the information contained in that version of the syllabus; however, the QCAA may have released an updated version of the syllabus since this book was published. To ensure you are well prepared and working to the current exam specifications, you should visit the QCAA website and download a copy of the most recent syllabus. A link is also provided on your obook assess. Alternatively, ask your teacher.
- The QCAA website also has a number of other useful documents that are worth checking out, including past examination papers, examination reports and other support materials.

PRACTICE EXAM

Now that you have tested your understanding of the key concepts relating to energy production and energy systems – and revised any concepts you were uncertain about – it's time to put your learning to the test by completing **Practice exam 5.1**. This is available on your obook assess.

Practice exam 5.1 only includes questions relating to energy requirements for physical activity and energy systems. It is structured and formatted in a similar way to the official QCAA Examination – combination response. It contains:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response to stimulus.

You can use the practice exam in any way you like. If you feel confident with the subject matter, you might only complete a few questions from each section. If you feel that you need extra practice, you may choose to complete all the questions under exam conditions.

Answers for Practice exam 5.1 are available on the Teacher obook assess. Your teacher can provide you with the answers if you wish to check your responses.

PERFORMANCE | SKILL DRILL **5.1**

Evaluate how effective a training session is at developing a specific energy system

>> Refer to your obook assess to complete this integrated research activity..

Check your obook assess for the following additional resources and more:

- **Test your understanding!** Answers to the Test your understanding! tasks in this section
- **Video** Prepare for the external exam using Chapter 5
- **Practice exam** Ask your teacher for a copy of a practice exam for this section (answers are also provided)
- **Skill drill worksheet** 5.1 Evaluate how effective a training session is at developing a specific energy system

5.2 Fitness requirements for physical activity

That's a goal!

By the end of Section 5.2, you should be able to:

→ **understand** the importance of building a fitness profile

→ **define** each of the seven components of fitness

→ **determine** personal performance capacities based on position- or event-specific fitness testing.

Key concepts

Let's start by reviewing the following key concepts from the syllabus.

Components of fitness

Fitness is the ability of an athlete to perform a range of specialised movement sequences for movement strategies:

- at an appropriate intensity
- for an appropriate length of time.

It is important to consider the broad spectrum of fitness requirements relevant to a specific sport, position or event in order to build a fitness profile. A fitness profile involves the consideration of the seven components of fitness:

- **aerobic capacity** – the ability of the heart, lungs and circulatory system to supply oxygen and other nutrients to working muscles so that an athlete can exercise continuously for extended periods without tiring
- **power** – the ability to exert maximum force in the shortest amount of time
- **strength** – the ability of a muscle (or muscles) to exert force by contracting against a resistance
- **speed** – the ability to move the entire body (or specific parts of the body) quickly
- **agility** – the ability to move the entire body (or specific parts of the body) from one position to another, or from one direction to another, quickly and precisely
- **muscular endurance** – the ability to sustain or repeat a series of muscle contractions without fatigue
- **flexibility** – the ability of a joint to move through its full range of motion.

For an athlete to build a fitness profile, they must complete a series of traditional and/or specialised fitness tests for each fitness component. Recorded results can then be compared to norms or to previous test results to determine where strengths and weaknesses lie or to monitor improvement over time. An athlete's fitness objectives can have an impact on the type of training they will need to undertake.

SOURCE 1 Like most athletes, basketball players need to use all seven components of fitness at different times of a training session or match.

Key terms

Source 2 contains is a list of key terms relevant to the topic of fitness requirements for physical activity. You will need to familiarise yourself with these terms in preparation for your external exam.

→ Components of fitness
→ Fitness profile
→ Aerobic capacity
→ Power
→ Strength
→ Speed
→ Agility
→ Muscular endurance
→ Flexibility
→ Fitness testing

SOURCE 2 Key terms you need to know.

Test your understanding!

Now it's time to test how well you understand the key concepts in this section. To perform well under exam conditions, you need to provide clear, concise and accurate responses to all questions on this part of the course. Your ability to do this will depend on:

- how quickly and accurately you can recognise, recall and explain concepts relating to fitness requirements and fitness components
- how well you can analyse and synthesise data and apply fitness requirements for physical activity in unfamiliar contexts
- how well you can use your understanding of fitness requirements for physical activity to devise, evaluate and/or justify training strategies
- how effectively you can communicate your understanding of fitness requirements for physical activity.

To test your understanding of these key concepts, complete the tasks below. Answers for these tasks are provided on your obook assess.

Level of difficulty	Task	Key terms and concepts
★	1 **Define** each of the following key terms.	→ Power → Strength → Speed → Agility → Flexibility
★★	2 **Analyse** the following concepts (providing examples as required to demonstrate your understanding).	→ The role of the following components of fitness in developing a fitness profile: – Aerobic capacity – Muscular endurance
★★★	3 In a written response of 150 words, **discuss** how you would use your knowledge of the following concept to develop a training strategy (e.g. training program, training session).	→ The importance of fitness testing for individual sports, events or positions

SOURCE 3 Complete the tasks in this table to test how well you understand the key concepts in this section.

SOURCE 4 Fitness tests are a great indicator of an athlete's fitness profile.

Revisit and revise

Once you have completed the tasks in Test your understanding!, use the answers (provided on your obook assess) to score your responses. Then use the table on the next page to rate your level of understanding and confidence for each key concept. If you need to revisit and revise any of these concepts, use the section and page references provided to quickly find what you are looking for and target your revision.

Key terms and concepts	My level of understanding and confidence	Section	Page/s
The role of the following components of fitness in developing a fitness profile:	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	186–95
Aerobic capacity	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	189–190
Power	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	190–191
Strength	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	191–192
Speed	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	192
Agility	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	193
Muscular endurance	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	194
Flexibility	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	194–195
The importance of fitness testing for individual sports, events or positions	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.4	186–195

SOURCE 5 Use this table to rate your level of understanding and confidence for each key concept, and to identify which areas you need to revisit and revise.

☑ EXAM TIP

Tip 2: Use different strategies to review and revise

At the end of each week, it's a great idea to summarise your notes so that you can review and revise what you've learnt ahead of any assessment tasks, tests or exams. Regular revision will help you to grasp concepts more fully and recall key information when you need to. Try one or more of the following revision strategies.

Revision strategy	Details
Create detailed revision notes	→ Creating your own revision notes can be time-consuming, but it's time well spent! → Taking the time to create your own revision notes reinforces what you've learnt and frames the information in language that makes sense to you.
Write dot-point summaries on index cards	→ Detailed revision notes are great, but you may also benefit from creating brief study notes in the form of dot-point summaries. → Copy these summaries onto index cards so you can carry them with you and revise on your way to school or at home on the couch.
Make audio recordings of your notes	→ Record yourself as you read your revision notes or dot-point summaries aloud. → Listen to your recordings while you're out and about.
Quiz yourself	→ Quizzes are quick, fun and a good way to test what you do and don't know. → Use your textbook, revision notes or quiz cards to quiz yourself. → Ask friends or family members to quiz you on key terms and concepts.
Complete practice questions, essays and exams	→ Practice makes perfect, so the more you test your knowledge and develop your skills by completing practice questions, written responses and exams, the better. → Ask your teacher to provide feedback on your practice responses to help you improve.

SOURCE 6 Use revision strategies to help you grasp concepts more fully and recall key information when you need to.

PRACTICE EXAM

Now that you have tested your understanding of the key concepts relating to fitness requirements for physical activity – and revised any concepts you were uncertain about – it's time to put your learning to the test by completing **Practice exam 5.2**. This is available on your obook assess.

Practice exam 5.2 only includes questions relating to fitness requirements for physical activity. It is structured and formatted in a similar way to the official QCAA Examinations – combination response. It contains:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response to stimulus.

You can use the practice exam in any way you like. If you feel confident with the subject matter, you might only complete a few questions from each section. If you feel that you need extra practice, you may choose to complete all the questions under exam conditions.

Answers for Practice exam 5.2 are available on the Teacher obook assess. Your teacher can provide you with the answers if you wish to check your responses.

PERFORMANCE | SKILL DRILL **5.2**

Determine personal performance capacities for physical activity

>>Refer to your obook assess to complete this integrated research activity.

Check your obook assess for the following additional resources and more:

» **Test your understanding!**
Answers to the Test your understanding! tasks in this section

» **Practice exam**
Ask your teacher for a copy of a practice exam for this section (answers are also provided)

» **Skill drill worksheet**
5.2 Determine personal performance capacities for physical activity

5.3 Oxygen in performance and training zones

That's a goal!

By the end of Section 5.3, you should be able to:

→ **define** what is meant by VO_2 max, lactate threshold and onset of blood lactate
→ **explain** how oxygen uptake and delivery to working muscles impacts VO_2 max
→ **understand** acute and chronic physiological adaptations
→ **define** and **explain** the term 'training zone'
  – **understand** the importance of manipulating training intensity to work in specific training zones
  – **understand** maximum heart rate (MHR) and target heart rate (THR).

Key concepts

Let's start by reviewing the following key concepts from the syllabus.

Oxygen in performance

Oxygen plays a crucial role in the performance of an athlete. When oxygen delivery to working muscles is optimal, it allows an athlete to work harder for longer and to recover more quickly from bouts of exercise. The uptake and delivery of oxygen is impacted by physiological structures such as the lungs, heart, blood vessels and muscles. The maximum oxygen an athlete can deliver to the working muscles per minute is known as their VO_2 max. Training can enhance the structure and function of the body's respiratory, cardiovascular and muscular systems to improve an athlete's VO_2 max.

In situations where athletes do not have enough oxygen to supply the working muscles (e.g. during high-intensity exercise), the muscles have to operate anaerobically (i.e. without oxygen). After approximately 30 to 60 seconds, this prolonged oxygen deficit causes an onset of blood lactate. Blood lactate is a by-product of anaerobic glycolysis and can cause debilitating fatigue in athletes. The point at which blood lactate starts to rapidly accumulate is known as onset of blood lactate accumulation. The intensity of training at which this occurs is referred to as an athlete's lactate threshold.

Training zones

To ensure that appropriate physiological adaptation can occur (i.e. that the athlete's body changes in the desired way as a result of training), athletes use training zones. Training zones use heart rates to determine the range of intensities, in percentage, within which a target heart rate (THR) can lie for the relevant adaptation to take place. THR is determined as a percentage of maximum heart rate (MHR).

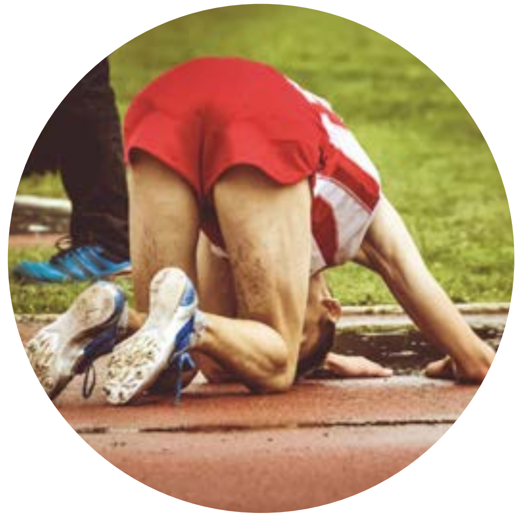
Four training zones include:

- **the recovery training zone –** a low-intensity training zone that allows for the recovery and adaptation of the body's structures after a bout of high-intensity work. The THR in the recovery training zone is less than 65 per cent of MHR.

- **the aerobic training zone –** a moderate-intensity training zone that facilitates development of the body's circulatory system and encourages the body to use fats as the primary fuel source. The THR in the aerobic training zone is usually 60 to 80 per cent of MHR
- **the lactate threshold training zone –** a specific zone in which the athlete trains at or just under their lactate threshold with the aim to increase the efficiency of the body at clearing blood lactate. The THR in the lactate threshold training zone is usually around 80 to 85 per cent of MHR
- **the anaerobic training zone –** a high-intensity training zone in which an athlete works above their lactate threshold in intervals. In this training zone, an athlete engages their ATP–PC and/or lactic acid energy systems. While the THR for this zone is greater than 85 per cent of MHR, heart rate is not the only indicator of training in this zone.

In addition to using heart rate to determine an athlete's training zone, the speed at which an athlete's heart rate drops after exercise can provide a measurement of their fitness. A fast heart rate recovery (i.e. return to resting heart rate) is said to be a good indicator of fitness.

Source 2 contains a list of key terms relevant to the topic of the role of oxygen in performance and training zones. You will need to familiarise yourself with these terms in preparation for your external exam.



SOURCE 1 When athletes do not have enough oxygen to supply the working muscles (e.g. during high-intensity exercise), muscles are forced to operate anaerobically (i.e. without oxygen). The accumulation of blood lactate that can result from prolonged anaerobic energy supply can cause extreme muscular fatigue.

→ Respiratory system	→ Chronic physiological adaptation	→ Lactate turn point (LTP)	→ Recovery training zone
→ Circulatory system	→ Heart rate recovery	→ Maximum heart rate (MHR)	→ Aerobic training zone
→ Muscular system	→ VO_2 max	→ Target heart rate (THR)	→ Lactate threshold training zone
→ Haemoglobin	→ Lactate threshold	→ Training zones	→ Anaerobic training zone
→ Acute physiological adaptation	→ Onset of blood lactate		

SOURCE 2 Key terms you need to know.

Test your understanding!

Now it's time to test how well you understand the key concepts in this section. To perform well under exam conditions, you need to provide clear, concise and accurate responses to all questions on this part of the course. Your ability to do this will depend on:

- how quickly and accurately you can recognise, recall and explain concepts relating to the role of oxygen in performance and training zones
- how well you can analyse and synthesise data and apply the role of oxygen in performance and training zones in unfamiliar contexts
- how well you can use your understanding of the role of oxygen in performance and training zones to devise, evaluate and/or justify training strategies
- how effectively you can communicate your understanding of energy requirements for the role of oxygen in performance and training zones.

To test your understanding of these key concepts, complete the tasks on the following page. Answers for these tasks are provided on your obook assess.

Level of difficulty	Task	Key terms and concepts
★	1 **Define** each of the following key terms.	→ Target heart rate (THR) → VO_2 max → Lactate threshold
★★	2 **Analyse** the following concepts (providing examples as required to demonstrate your understanding).	→ Heart rate recovery as a measure of fitness → Onset of blood lactate as a measure of lactate threshold
★★★	3 In a written response of 150 words, **discuss** how you would use your knowledge of the following concept to develop a training strategy (e.g. training program, training session).	→ The role of training zones for determining training intensity

SOURCE 3 Complete the tasks in this table to test how well you understand the key concepts in this section.

Revisit and revise

Once you have completed the tasks in Test your understanding!, use the answers (provided on your obook assess) to score your responses. Then use the table below to rate your level of understanding and confidence for each key concept. If you need to revisit and revise any of these concepts, use the section and page references provided to quickly find what you are looking for and target your revision.

Key terms and concepts	My level of understanding and confidence	Section	Page/s
VO_2 max as an indicator of fitness and training intensity	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.5	196–198
Lactate threshold as an indicator of training intensity	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.5	199–200
Onset of blood lactate as a measure of lactate threshold	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.5	199–200
Heart rate recovery as a measure of fitness	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.5	201
Determining target heart rate (THR)	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.7	209
The role of training zones for determining training intensity	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.7	209–211

SOURCE 4 Use this table to rate your level of understanding and confidence for each key concept, and to identify which areas you need to revisit and revise.

☑ EXAM TIP

Tip 3: Set yourself up for success

Success in QCE Physical Education doesn't begin and end in the classroom. To perform at your best, you will need to make time for regular periods of study and revision outside school hours. You don't need to study for hours every day, but you should incorporate short periods of revision into your daily routine. Here are some suggestions:

Choose the best place to study

- Whether it's your bedroom, your local library or your favourite café, find a regular study space that works for you. Ideally, your study space should be quiet, comfortable, bright and airy, and free from distractions.
- If you like to listen to music while you study, make sure you can do this without disturbing others.

Choose the best times to study

- Some people find it easier to concentrate early in the morning, while others find it easier at night. Decide what works best for you and plan for regular study sessions at this time of day.

Remember that studying can take many different forms

- Finding time for study can be difficult sometimes, so keep in mind that effective studying can take different forms and happen almost anywhere. For example, you might:
  - read over your notes for 10 minutes on the bus on your way to school
  - chat to your friends at lunch about a concept that you found difficult in class or organise regular group study sessions with them
  - make an audio recording of your notes and listen to them while you're exercising.

PRACTICE EXAM

Now that you have tested your understanding of the key concepts relating to the role of oxygen in performance and training zones – and revised any concepts you were uncertain about – it's time to put your learning to the test by completing **Practice exam 5.3**. This is available on your obook assess.

Practice exam 5.3 only includes questions relating to the role of oxygen in performance and training zones. It is structured and formatted in a similar way to the official QCAA Examinations – combination response. It contains:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response to stimulus.

You can use the practice exam in any way you like. If you feel confident with the subject matter, you might only complete a few questions from each section. If you feel that you need extra practice, you may choose to complete all the questions under exam conditions.

Answers for Practice exam 5.3 are available on the Teacher obook assess. Your teacher can provide you with the answers if you wish to check your responses.

PERFORMANCE | SKILL DRILL **5.3**

Analyse heart rate data to target the correct training zone

>> Refer to your obook assess to complete this integrated research activity.

Check your obook assess for the following additional resources and more:

» **Test your understanding!**
Answers to the Test your understanding! tasks in this section

» **Practice exam**
Ask your teacher for a copy of a practice exam for this section (answers are also provided)]

» **Skill drill worksheet**
5.3 Analyse heart rate data to identify the target the correct training zone

5.4 Principles of training

That's a goal!

By the end of Section 5.4, you should be able to:

→ **explain** the seven principles of training: specificity, frequency, duration, intensity, progressive overload, individuality and variety
→ **apply** the principles of training to optimise training
→ **use** the principles of training to evaluate the effectiveness of a training program or training session.

Key concepts

Let's start by reviewing the following key concepts from the syllabus.

Principles of training

When an athlete is training to optimise their performance, they must take the principles of training into consideration. These principles are:

- **specificity** – ensuring training is relevant to the athlete's targeted energy systems, position-specific movements and the fitness requirements of a specific sport or performance
- **frequency** – consideration for how often the athlete should train to meet training objectives
- **duration** – consideration for how long the athlete should train to meet training objectives
- **intensity** – consideration for how hard the athlete should train to meet training objectives
- **progressive overload** – the process of increasing training load to encourage physiological adaption in the athlete
- **individuality** – the consideration of an athlete's individual circumstances that could impact on meeting training requirements
- **variety** – ensuring training activities, movement options and training contexts are varied in order for athletes to stay interested and motivated.

SOURCE 1 The training principle of variety states that training should be varied where possible to maintain an athlete's motivation. Australian football players often train at the beach to build fitness and team cohesion at the same time.

Principles of training can be used as a guide when evaluating the effectiveness of a training program or a training session. For example, the principle of frequency can be used to determine whether an athlete is training often enough for improvement. Generally, it is necessary to consider multiple principles of training in an insightful evaluation because, for example, intensity (how hard) and duration (how long) of training can play a role in determining the appropriate frequency (how often) of training.

Source 2 contains a list of key terms relevant to the topic of principles of training. You will need to familiarise yourself with these terms in preparation for your external exam.

→ Principles of training	→ Intensity	→ Progressive overload	→ Variety
→ Specificity	→ Duration	→ Individuality	→ Loading
→ Frequency	→ Physiological adaptation		

SOURCE 2 Key terms you need to know.

Test your understanding!

Now it's time to test how well you understand the key concepts in this section. To perform well under exam conditions, you need to provide clear, concise and accurate responses to all questions on this part of the course. Your ability to do this will depend on:

- how quickly and accurately you can recognise, recall and explain concepts relating to principles of training
- how well you can analyse and synthesise data and apply principles of training in unfamiliar contexts
- how well you can use your understanding of the principles of training to devise, evaluate and/or justify training strategies
- how effectively you can communicate your understanding of energy requirements for principles of training.

To test your understanding of these key concepts, complete the tasks below. Answers for these tasks are provided on your obook assess.

Level of difficulty	Task	Key terms and concepts
★	1 **Define** each of the following key terms.	→ Specificity → Frequency → Intensity → Duration
★★	2 **Analyse** the following concepts (providing examples as required to demonstrate your understanding).	→ Progressive overload as a principle of training
★★★	3 In a written response of 150 words, **discuss** how you would use your knowledge of the following concept to develop a training strategy (e.g. training program, training session).	→ The role of variety and individuality of training as tools to develop, design and evaluate training

SOURCE 3 Complete the tasks in this table to test how well you understand the key concepts in this section.

Revisit and revise

Once you have completed the tasks in Test your understanding!, use the answers (provided on your obook assess) to score your responses. Then use the table on the following page to rate your level of understanding and confidence for each key concept. If you need to revisit and revise any of these concepts, use the section and page references provided to quickly find what you are looking for and target your revision.

Key terms and concepts	My level of understanding and confidence	Section	Page/s
The role of the following principles of training as tools to develop, design and evaluate training:	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.8	212 –217
Specificity	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.8	212–213
Frequency	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.8	213–214
Intensity	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.8	214
Duration	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.8	214–215
Progressive overload as a principle of training	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.8	215
Individuality	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.8	216
Variety	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.8	216

SOURCE 4 Use this table to rate your level of understanding and confidence for each key concept, and to identify which areas you need to revisit and revise.

EXAM TIP

Tip 4: Manage your study time effectively

Use one or more of the following time management strategies to stay on track.

Time management strategy	Details
Create a study timetable	→ A study timetable that helps you schedule periods of regular study and revision for all your subjects is key to your success. A template to help you create your own study timetable is provided on your obook assess. → Once you create your study timetable, be sure to stick to it. If it isn't working, revisit it and make a new one.
Use a diary, wall planner or calendar to record key dates	→ A record of key dates is essential to your success. Recording due dates for assessment tasks and assignments will help you manage your time effectively and meet your deadlines (especially in weeks when you have multiple assessment tasks due). → Recording the dates of tests and exams will also help keep your preparation on track.

Time management strategy	Details
Make lists	→ A simple 'to do' list can be a great tool to help you manage time and achieve your goals. → A separate list of weekly or monthly goals can help you keep the bigger picture in mind. → Lists are a great way to break big tasks down into smaller, more manageable tasks, so that you gain a sense of achievement.
Set reminders	→ A regular alarm or reminder to tell you it's time to study can keep you on track.
Take breaks	→ Regardless of where or when you study, make sure you incorporate regular study breaks. Aim to work in 50 minute blocks and then take a 10 minute break. → When you do take a break, get up from your desk and leave your study space. Take the dog for a quick walk, make yourself a snack or chat to your family or friends. → Everyone has bad days, so if you're feeling tired, upset or frustrated, you might need to take a break from study. Just make sure you don't do this too often!

SOURCE 5 Time management strategies can help you manage your study time effectively.

PRACTICE EXAM

Now that you have tested your understanding of the key concepts relating to the principles of training – and revised any concepts you were uncertain about – it's time to put your learning to the test by completing **Practice exam 5.4**. This is available on your obook assess.

Practice exam 5.4 only includes questions relating to the principles of training. It is structured and formatted in a similar way to the official QCAA Examinations – combination response. It contains:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response to stimulus.

You can use the practice exam in any way you like. If you feel confident with the subject matter, you might only complete a few questions from each section. If you feel that you need extra practice, you may choose to complete all the questions under exam conditions.

Answers for Practice exam 5.4 are available on the Teacher obook assess. Your teacher can provide you with the answers if you wish to check your responses.

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PERFORMANCE

SKILL DRILL **5.4**

Determine the importance of principles of training when developing a training program

>> Refer to your obook assess to complete this integrated research activity.

Check your obook assess for the following additional resources and more:

» **Test your understanding!**
Answers to the Test your understanding! tasks in this section

» **Practice exam**
Ask your teacher for a copy of a practice exam for this section (answers are also provided)

» **Skill drill worksheet**
5.4 Determine the importance of principles of training when developing a training program

5.5 Training methods, fatigue and recovery in training

That's a goal!

By the end of Section 5.5, you should be able to:

→ **understand** six training methods: continuous training, fartlek training, resistance training, interval training, flexibility training, circuit training

→ **apply** training methods to achieve training objectives

→ **apply** fatigue and recovery principles to optimise physiological adaptation.

Key concepts

Let's start by reviewing the following key concepts from the syllabus.

Training methods

Training methods are the forms of exercise an athlete uses to help meet their training objectives. Training methods include:

- **continuous training** – a type of training performed at the same intensity for an extended period of time without periods of rest. Types of continuous training include long slow distance (LSD) training and tempo training.
- **fartlek training** – a variation of continuous training whereby athletes vary the intensity of their exercise by increasing their speed or increasing the resistance of their work (e.g. adding incline, running on sand, running upstairs).
- **resistance training** – a type of training that requires an athlete to work against something that resists the movement of the body (or particular body parts). Types of resistance training include isotonic resistance training, isometric resistance training, isokinetic resistance training and plyometric resistance training.
- **interval training** – a type of training that manipulates periods of work and rest to enhance a specific fitness component and target a particular energy system. Types of interval training include high-intensity interval training (HIIT), sprint interval training (SIT) and aerobic interval training (AIT).
- **flexibility training** – a type of training that involves stretching the muscles, tendons and ligaments in and around joints. Types of flexibility training include dynamic flexibility training, static flexibility training, passive flexibility training and proprioceptive neuromuscular facilitation (PNF) training.
- **circuit training** – a specific training method in which a variety of different activities are performed consecutively in a cycle.

Fatigue and recovery principles in training

According to the theory of the General Adaptation Syndrome (GAS), it is important for athletes to ensure that training cycles their body through appropriate periods of fatigue and recovery in order for physiological adaptation to occur. Athletes who train when their body is at the optimal level of preparedness increase their potential of achieving fitness gains. This fitness–fatigue model proposes that after any training session, the fatigue effect wears off faster than the fitness effect (adaptation). The window of time between the fatigue effect wearing off and the fitness effect remaining is when an athlete's preparedness to benefit from training again is at its highest.

Recovery between one session and the next is known as inter-session recovery. Recovery during a training session is called intra-session recovery. Intra-session recovery can be either active or passive depending on a range of factors including the training load and training method.

Source 1 contains a list of key terms relevant to the topic of training methods, fatigue and recovery. You will need to familiarise yourself with these terms in preparation for your external exam.

- → Training methods
- → Continuous training
- → Fartlek training
- → Resistance training
- → Interval training
- → Flexibility training
- → Circuit training
- → Long slow distance (LSD) training
- → Tempo training
- → Point of failure
- → Isotonic (dynamic) resistance training
- → Isometric (static) resistance training
- → Isokinetic resistance training
- → Plyometric training
- → Cadence
- → Repetition maximum (RM)
- → Repetition duration
- → Isolated exercise
- → Compound exercise
- → High-intensity interval training (HIIT)
- → Sprint interval training (SIT)
- → Aerobic interval training (AIT)
- → Dynamic flexibility training
- → Static flexibility training
- → Passive flexibility training
- → Proprioceptive neuromuscular facilitation (PNF) flexibility training
- → Circuit training
- → Unloading
- → Loading
- → General Adaptation Syndrome (GAS)
- → Eustress
- → Distress
- → Fitness–fatigue model
- → Preparedness
- → Intra-session recovery
- → Inter-session recovery
- → Active recovery
- → Passive recovery

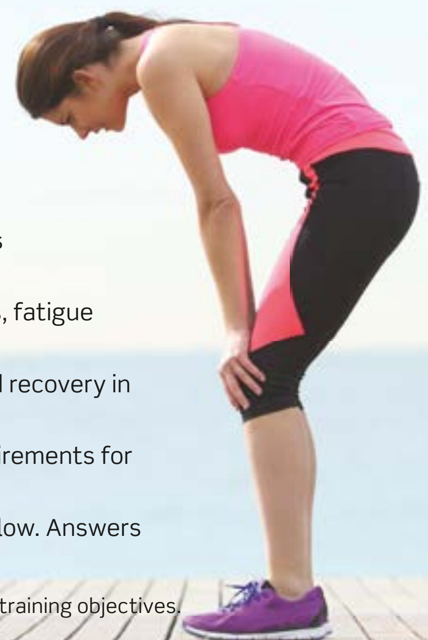
SOURCE 1 Key terms you need to know.

Test your understanding!

Now it's time to test how well you understand the key concepts in this section. To perform well under exam conditions, you need to provide clear, concise and accurate responses to all questions on this part of the course. Your ability to do this will depend on:

- how quickly and accurately you can recognise, recall and explain concepts relating to training methods, fatigue and recovery in training
- how well you can analyse and synthesise data and apply training methods, fatigue and recovery in training in unfamiliar contexts
- how well you can use your understanding of training methods, fatigue and recovery in training to devise, evaluate and/or justify training strategies
- how effectively you can communicate your understanding of energy requirements for training methods, fatigue and recovery in training.

To test your understanding of these key concepts, complete the tasks below. Answers for these tasks are provided on your obook assess.



SOURCE 2 Training methods are the forms of exercise an athlete uses to help meet their training objectives.

Level of difficulty	Task	Key terms and concepts
★	1 **Define** each of the following key terms.	→ Continuous training → Fartlek training → Resistance training → Flexibility training → Circuit training
★★	2 **Analyse** the following concepts (providing examples as required to demonstrate your understanding).	→ Training methods used to achieve training objectives
★★★	3 In a written response of 150 words, **discuss** how you would use your knowledge of the following concept to develop a training strategy (e.g. training program, training session).	→ The role of fatigue and recovery in training – Unloading – Preparedness – Active recovery – Passive recovery

SOURCE 3 Complete the tasks in this table to test how well you understand the key concepts in this section.

Revisit and revise

Once you have completed the tasks in Test your understanding!, use the answers (provided on your obook assess) to score your responses. Then use the table below to rate your level of understanding and confidence for each key concept. If you need to revisit and revise any of these concepts, use the section and page references provided to quickly find what you are looking for and target your revision.

Key terms and concepts	My level of understanding and confidence	Section	Page/s
Training methods used to achieve training objectives	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.9	218–241
Continuous training	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.9A	220–221
Fartlek training	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.9B	222–223
Resistance training	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.9C	224–231
Interval training	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.9D	232–235
Flexibility training	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.9E	236–238
Circuit training	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.9F	239–241

Key terms and concepts	My level of understanding and confidence	Section	Page/s
The role of fatigue and recovery in training: → General Adaptation Syndrome (GAS) → Fitness–fatigue model → Active recovery → Passive recovery	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.10	243–246

SOURCE 4 Use this table to rate your level of understanding and confidence for each key concept, and to identify which areas you need to revisit and revise.

☑ EXAM TIP

Tip 5: Stay motivated

- You're close to the finish line, staying motivated and keeping a positive attitude is more important than ever.
- Avoid comparing yourself to others. Instead, set goals that are right for you.
- Many parts of the QCE Physical Education course require repetition, practice and resilience to master. A lot of the concepts are complex, and you may not understand them the first time you come across them, but don't give up!

PRACTICE EXAM

Now that you have tested your understanding of the key concepts relating to training methods and fatigue and recovery in training – and revised any concepts you were uncertain about – it's time to put your learning to the test by completing **Practice exam 5.5**. This is available on your obook assess.

Practice exam 5.5 only includes questions relating to training methods and fatigue and recovery in training. It is structured and formatted in a similar way to the official QCAA Examinations – combination response. It contains:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response to stimulus.

You can use the practice exam in any way you like. If you feel confident with the subject matter, you might only complete a few questions from each section. If you feel that you need extra practice, you may choose to complete all the questions under exam conditions.

Answers for Practice exam 5.5 are available on the Teacher obook assess. Your teacher can provide you with the answers if you wish to check your responses.

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PERFORMANCE SKILL DRILL 5.5

Determine the impact of volume, intensity and skill work on the development of a specialised movement sequence

>> Refer to your obook assess to complete this integrated research activity.

Check your obook assess for the following additional resources and more:

» **Test your understanding!**
Answers to the Test your understanding! tasks in this section

» **Practice exam**
Ask your teacher for a copy of a practice exam for this section (answers are also provided)

» **Skill drill worksheet**
5.5 Determine the impact of volume, intensity and skill work on the development of a specialised movement sequence

5.6 The theory of periodisation

That's a goal!

By the end of Section 5.6, you should be able to:

→ **define** periodisation
→ **understand** that an annual plan can be divided into one or more macrocycles and that each macrocycle consists of four training phases
→ **identify** the four training phases and differentiate between each
→ **understand** that training phases can be divided into smaller parts, with each part targeting a specific energy and/or fitness needs. These parts are mesocycles, microcycles and training sessions
→ **explain** the purpose of each part of an annual plan.

Key concepts

Start by reviewing the following key concepts from the syllabus.

Periodisation

Before athletes can begin the process of devising a training strategy (e.g. a training program or a training session), they must have a good understanding of the theory of periodisation.

The process begins with an athlete developing an annual plan (i.e. their plan for all of the physical activities that they aim to participate in over a 12 month period). Afterwards, they identify **macrocycles** – one macrocycle per physical activity (e.g. a 5 month macrocycle for their summer sport and a 5 month macrocycle for their winter sport). Every macrocycle is then broken down into four training phases:

- **preparatory phase** – a set period of time during which an athlete focuses on increasing their general level of fitness
- **pre-competition phase** – a set period of time during which an athlete focuses on optimising their energy, fitness and skill levels for their specific sport, position and/or event
- **competition phase** – a set period of time during which an athlete focuses on maintaining their energy, fitness and skill levels for their specific sport, position and/or event and maximising their performance in authentic game or performance environments
- **transition phase** – a set period of time during which an athlete focuses on rest and recovery from physical and mental stress of training and competition.

Each training phase can be further broken down into several **mesocycles** of 4 to 6 weeks in length, each with different energy and fitness training objectives.

Each mesocycle can then be broken down into even smaller cycles called **microcycles**, which are typically a week long (but can be as long as 10 days, depending on the timeframe between matches or events).

Finally, each microcycle can be broken down into several **training sessions**, each of which typically last for about an hour. Training sessions are designed to consider all the planning that has been done at the training phase and mesocycle level, and ensure that athletes are in the best physical condition to perform in their physical activity when it matters the most.

Periodisation must consider how to cycle the athlete through fatigue (i.e. navigate loading and unloading the athlete through increasing or decreasing work volume and/or intensity) and recovery to maximise physiological adaptation.

Source 1 contains a list of key terms relevant to the topic of periodisation. You will need to familiarise yourself with these terms in preparation for your external exam.

→ Annual plan	→ Competition phase	→ Peaking	→ Overtraining
→ Macrocycle	→ Transition phase	→ Tapering	→ RAMP warm up
→ Training phases	→ Mesocycle	→ Recovery	→ Conditioning phase
→ Preparatory phase	→ Microcycle	→ Specialising	→ Cool down
→ Pre-competition phase	→ Training session		

SOURCE 1 Key terms you need to know.

Test your understanding!

Now it's time to test how well you understand the key concepts in this section. To perform well under exam conditions, you need to provide clear, concise and accurate responses to all questions on this part of the course. Your ability to do this will depend on:

- how quickly and accurately you can recognise, recall and explain concepts relating to the theory of periodisation
- how well you can analyse and synthesise data and apply the theory of periodisation in unfamiliar contexts
- how well you can use your understanding of the theory of periodisation to devise, evaluate and/or justify training strategies
- how effectively you can communicate your understanding of energy requirements for the theory of periodisation.

To test your understanding of these key concepts, complete the tasks below. Answers for these tasks are provided on your obook assess.

SOURCE 2 The preparatory phase is the first of the four training phases. Among other things, the preparatory phase is designed to build an athlete's general strength.

Level of difficulty	Task	Key terms and concepts
★	1 **Define** each of the following key terms.	→ Annual plans → Macrocycles → Training program
★★	2 **Analyse** the following concepts (providing examples as required to demonstrate your understanding).	→ The role of the following phases in performance optimisation – preparatory phase – pre-competition training phase in performance optimisation – transition training phase
★★★	3 In a written response of 150 words, **discuss** how you would use your knowledge of the following concept to develop a training strategy (e.g. training program, training session).	→ The role of the competition training phase in performance optimisation (divided into mesocycles, microcycles and training sessions) with a focus on: – peaking – tapering

SOURCE 3 Complete the tasks in this table to test how well you understand the key concepts in this section.

Revisit and revise

Once you have completed the tasks in Test your understanding!, use the answers (provided on your obook assess) to score your responses. Then use the table below to rate your level of understanding and confidence for each key concept. If you need to revisit and revise any of these concepts, use the section and page references provided to quickly find what you are looking for and target your revision.

Key terms and concepts	My level of understanding and confidence	Section	Page/s
Developing annual plans and macrocycles as the broadest levels of a training program	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.11	247
The role of the preparatory phase in performance optimisation (divided into mesocycles, microcycles and training sessions)	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.11	249–250
The role of the pre-competition training phase in performance optimisation (divided into mesocycles, microcycles and training sessions)	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.11	250
The role of the competition training phase in performance optimisation (divided into mesocycles, microcycles and training sessions) with a focus on: → peaking → tapering	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.11	250–252
The role of the transition training phase (divided into mesocycles, microcycles and training sessions)	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.11	252–254

SOURCE 4 Use this table to rate your level of understanding and confidence for each key concept, and to identify which areas you need to revisit and revise.

☑ EXAM TIP

Tip 6: Ask for help

- Completing your QCE can be a challenge sometimes, especially if you have other commitments such as work, sport or music outside school hours. If you're feeling stressed or overwhelmed, make sure you talk to the people around you and get support if you need it. Remember that your teachers, friends and family are there to help you. Many schools also have services and programs set up to help you, so take advantage of them!
- If you're having difficulty understanding a particular concept or completing a certain task, make sure that you turn to your teacher or classmates for help.

SOURCE 5 When necessary, reach out to your support network for help.

PRACTICE EXAM

Now that you have tested your understanding of the key concepts relating to the theory of periodisation – and revised any concepts you were uncertain about – it's time to put your learning to the test by completing **Practice exam 5.6**. This is available on your obook assess.

Practice exam 5.6 only includes questions relating to the theory of periodisation. It is structured and formatted in a similar way to the official QCAA Examinations – combination response. It contains two:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response to stimulus.

You can use the practice exam in any way you like. If you feel confident with the subject matter, you might only complete a few questions from each section. If you feel that you need extra practice, you may choose to complete all the questions under exam conditions.

Answers for Practice exam 5.6 are available on the Teacher obook assess. Your teacher can provide you with the answers if you wish to check your responses.

PERFORMANCE | SKILL DRILL **5.6**

Assess the importance of periodisation

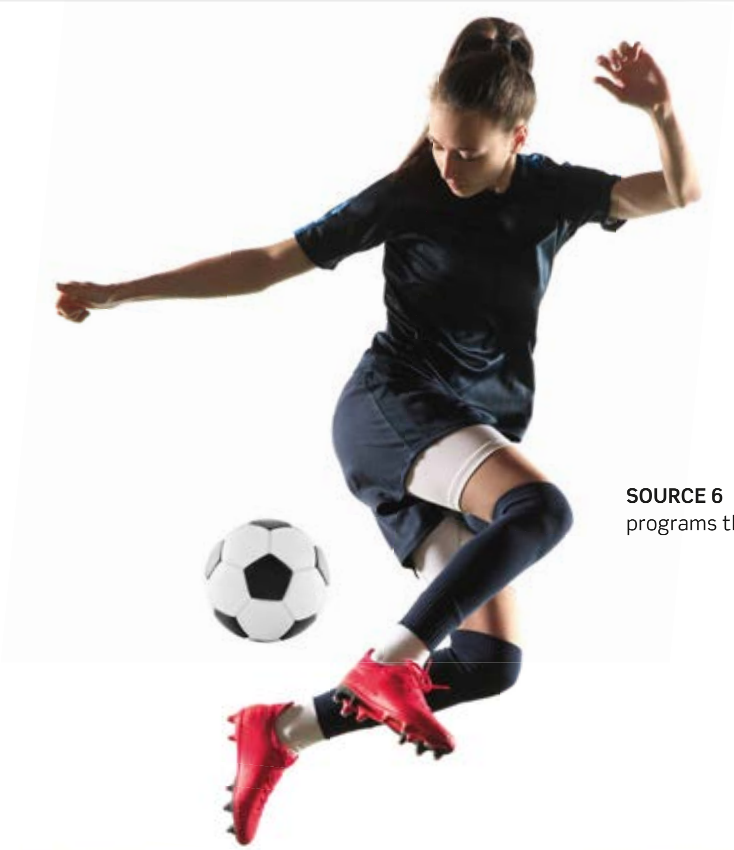
>> Refer to your obook assess to complete this integrated research activity.

Check your obook assess for the following additional resources and more:

» **Test your understanding!**
Answers to the Test your understanding! tasks in this section

» **Practice exam**
Ask your teacher for a copy of a practice exam for this section (answers are also provided)

» **Skill drill worksheet**
5.6 Assess the importance of periodisation



SOURCE 6 Periodisation allows athletes to develop training programs that consider their fitness, energy and training needs.

5.7 Developing training programs and training sessions

That's a goal!

By the end of Section 5.7, you should be able to:
→ **identify** the features of a training program and a training session
→ **understand** how to develop a training program and a training session.

Key concepts

Start by reviewing the following key concepts from the syllabus.

Developing training programs

As we've learnt, creating a training program is a way to plan training events/activities over a specific period of time (e.g. one week, two months, one year) to help an individual or team achieve a range of energy, fitness and skill goals. Training programs need to feature:

- **a game analysis** – data collected about an athlete to identify personal training needs
- **training objectives** – the aims or outcomes for each component of a training program
- **work volume (frequency and intensity) and duration of activity** – indications of the training load an athlete will be expected to complete
- **tapering and recovery** – intentions to reduce training load in the lead up to competition and manage fatigue to optimise performance gains.

Training programs are use periodisation and are usually presented as a detailed table. Athletes must determine the length of their macrocycle and training phases. Within each phase, they must then determine the length of their mesocycles and set a loading–recovery pattern. Within each mesocycle, they must determine how many microcycles they will run and indicate which days they will train on within each microcycle.

Developing training sessions

Training sessions are generally presented in tabular form and commonly include:

- general information such as date, time and phase of training
- training session objectives including energy, fitness and skill objectives
- warm up activities applying the RAMP principle
- a conditioning phase that outlines the activities performed and training load, while following the relevant principles of training
- cool down activities
- room for data collection and reflection.

Source 1 contains a list of key terms relevant to the topic of designing training programs and training sessions. You will need to familiarise yourself with these terms in preparation for your external exam.

→ Game analysis	→ Training objectives	→ Loading–recovery pattern	→ Initial training values

SOURCE 1 Key terms you need to know.

Test your understanding!

Now it's time to test how well you understand the key concepts in this section. To perform well under exam conditions, you need to provide clear, concise and accurate responses to all questions on this part of the course. Your ability to do this will depend on:

- how quickly and accurately you can recognise, recall and explain concepts relating to developing training programs and training sessions
- how well you can analyse and synthesise data and apply training programs and training sessions in unfamiliar contexts
- how well you can use your understanding of training programs and training sesssions to devise, evaluate and/or justify training strategies
- how effectively you can communicate your understanding of energy requirements for training programs and training sessions.

To test your understanding of these key concepts, complete the tasks below. Answers for these tasks are provided on your obook assess.

Level of difficulty	Task	Key terms and concepts
★	1 **Define** each of the following key terms.	→ Training session
★★	2 **Analyse** the following concepts (providing examples as required to demonstrate your understanding).	→ Setting training objectives to achieve a determined outcome → Compiling a training program (creating a planning document)
★★★	3 In a written response of 150 words, **discuss** how you would use your knowledge of the following concept to develop a training strategy (e.g. training program, training session).	→ Conducting a game analysis

SOURCE 2 Complete the tasks in this table to test how well you understand the key concepts in this section.

Revisit and revise

Once you have completed the tasks in Test your understanding!, use the answers (provided on your obook assess) to score your responses. Then use the table below to rate your level of understanding and confidence for each key concept. If you need to revisit and revise any of these concepts, use the section and page references provided.

Key terms and concepts	My level of understanding and confidence	Section	Page/s
Conducting a game analysis	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.12	258–265
Identifying training objectives to achieve a determined outcome	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.12	260–261
Compiling a training program (creating a planning document)	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.12	262–264
Developing a training session	☐ High – I've got this! ☐ Medium – I need a little more revision. ☐ Low – I have some serious work to do!	4.13	266–275

SOURCE 3 Use this table to rate your level of understanding and confidence for each key concept, and to identify which areas you need to revisit and revise.

EXAM TIP

Tip 7: Understand the structure of the exam and the types of questions you will be expected to answer

To give yourself the best chance of success, it's important to become familiar with the types of questions that typically appear on the exam. Chapter 1 – Physical Education toolkit (pages 2–37) contains some helpful information about the structure of the exam, but some additional tips and tricks are provided below.

During the exam, you will be required to respond to a combination of different types of questions. These questions are developed by the QCAA and you will not have access to them until you sit the exam. The exam is a single assessment instrument with multiple parts, which may include the following elements:

Multiple-choice questions

- You must select one option only. Your task is to select the most correct answer to each question.
- If you are unable to eliminate three incorrect responses, take an educated guess between those you are still unsure of. Marks are not deducted for incorrect responses, so it is better to choose a response.
- Take your time! Before locking in your final choice, read through all of the options again.
- Once you have completed the multiple-choice section, use a ruler (or the edge of your question paper) to check your response sheet to make sure you have provided only one answer per question. If you accidentally provide two responses, that question will be marked zero – even if one of the answers is correct.

Short-response questions

- Short-response questions assess your knowledge and understanding of concepts. You may need to **analyse** and **evaluate** information and **justify** your decisions. Depending on the type of question, the length of the response required could be up to 250 words.
- There are three types of short-response questions that you may be expected to answer in the examination:

Question type	Types of response required
Simple	Simple, familiar procedures; labelling diagrams; sentences; short paragraphs; response to stimulus – single word or sentence responses; simple, familiar calculations
Practical	Drawing maps, graphs or diagrams; calculations using algorithms; modelling; illustrations; data responses; complex, familiar operations in an unfamiliar context
Interpretive	Interpreting graphs, tables and diagrams; analysing stimulus and information; evaluating stimulus and information; paragraph responses to stimulus; artistic statements; complex, unfamiliar operations

SOURCE 4 Types of short-response questions

- Short-response questions will generally include a cognitive verb. When formulating your response, make sure you are doing what the cognitive verb is asking you to do.
- Stick to the word limit. It is an important skill to be able to answer the question accurately and concisely.
- If the question asks you to refer to a stimulus, be sure to refer specifically to this in your response.

Extended response to stimulus

- The extended response to stimulus question requires you to analyse a stimulus (e.g. a graph, quote, data table, diagram or photograph) and write an extended written response of approximately 400 words or more.
- Regardless of the type of stimulus provided, you will need to apply your knowledge and understanding of the concepts you have learnt in Unit 4 to draw conclusions about the data provided and justify these conclusions.
- Take your time when reading the question and analysing the stimulus. Map out how you plan to respond in draft form on a spare piece of paper. Don't fall into the trap of jumping straight into your response for fear of running out of time. Planning and drafting your response is time well spent! The final result will be a more coherent and accurate response.

- Once you have mapped out what you intend to say, think carefully about structuring each paragraph to make your point clear and support it with what you know. A handy tool to help you achieve this is known as the PEEL method.

Point	Clearly state your point.
Explain	Explain the importance/relevance of your point.
Evidence	Provide evidence to support your point (directly from the stimulus or from what you have learnt throughout Unit 4).
Link	Link this evidence back to your point to provide clear support for it.

SOURCE 5 The PEEL method provides a structure to make your response clear, concise and compelling.

PRACTICE EXAM

Now that you have tested your understanding of the key terms and concepts relating to developing training programs and training sessions – and revised any concepts you were uncertain about – it's time to put your learning to the test by completing **Practice exam 5.7**. This is available on your obook assess.

Practice exam 5.7 only includes questions relating to developing training programs and training sessions. It is structured and formatted in a similar way to the official QCAA Examinations – combination response. It contains:

- Section 1 – multiple-choice questions
- Section 2 – short-response questions
- Section 3 – extended response to stimulus.

You can use the practice exam in any way you like. If you feel confident with the subject matter, you might only complete a few questions from each section. If you feel that you need extra practice, you may choose to complete all the questions under exam conditions.

Answers for Practice exam 5.7 are available on the Teacher obook assess. Your teacher can provide you with the answers if you wish to check your responses.

PERFORMANCE | SKILL DRILL **5.7**

Evaluate the importance of a correctly structured warm up

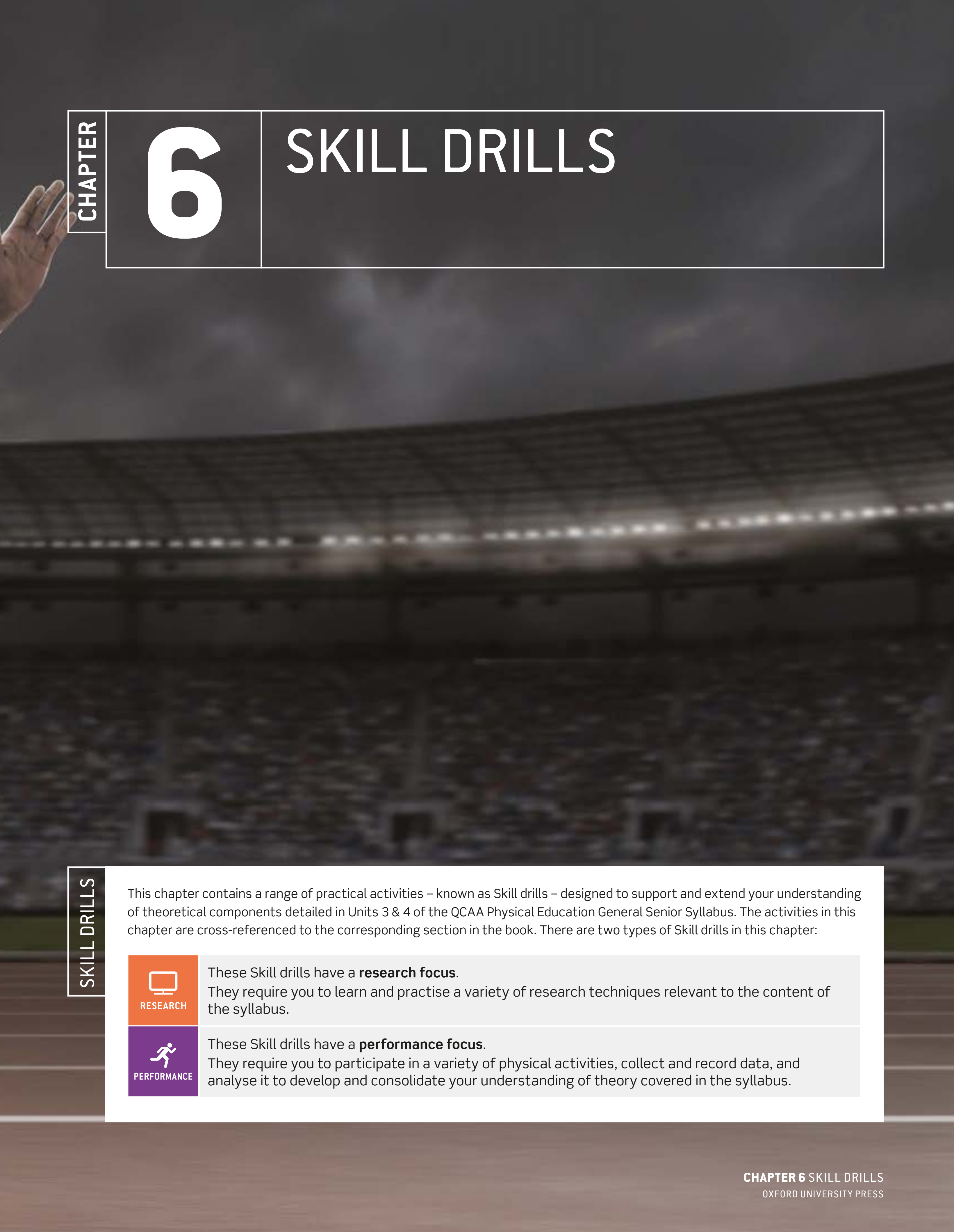
>> Refer to your obook assess to complete this integrated research activity.

Check your obook assess for the following additional resources and more:

» **Test your understanding!**
Answers to the Test your understanding! tasks in this section

» **Practice exam**
Ask your teacher for a copy of a practice exam for this section (answers are also provided)

» **Skill drill worksheet**
5.7 Evaluate the importance of a correctly structured warm up



CHAPTER

6 SKILL DRILLS

SKILL DRILLS

This chapter contains a range of practical activities – known as Skill drills – designed to support and extend your understanding of theoretical components detailed in Units 3 & 4 of the QCAA Physical Education General Senior Syllabus. The activities in this chapter are cross-referenced to the corresponding section in the book. There are two types of Skill drills in this chapter:

RESEARCH	These Skill drills have a **research focus**. They require you to learn and practise a variety of research techniques relevant to the content of the syllabus.
PERFORMANCE	These Skill drills have a **performance focus**. They require you to participate in a variety of physical activities, collect and record data, and analyse it to develop and consolidate your understanding of theory covered in the syllabus.

>> from page 15

RESEARCH

SKILL DRILL **1.2A**

Plan, create and present a Project – folio

By the end of this Skill drill, you should be able to:

- record personal observations and reflections of a physical performance
- deliver an audio visual presentation
- communicate your findings to an audience.

Refer to your obook assess to complete this integrated research activity.

>> from page 19

RESEARCH

SKILL DRILL **1.2B**

Create and present an Investigation – report

By the end of this Skill drill, you should be able to:

- use the internet to find relevant, credible and reliable sources
- compare, select and use information from a range of sources
- collect, record and analyse relevant data
- structure and present a written point of view
- reference and credit sources.

Refer to your obook assess to complete this integrated research activity.

>> from page 24

RESEARCH

SKILL DRILL **1.2C**

Develop skills to improve your results on the Examination – combination response

By the end of this Skill drill, you should be able to:

- apply a range of skill strategies to improve your results under examination conditions
- respond to multiple-choice questions
- conduct appropriate responses to short-response questions
- conduct appropriate responses to extended written response questions.

Refer to your obook assess to complete this integrated research activity.

>> from page 31

RESEARCH

SKILL DRILL **1.3A**

Capture and analyse video footage of physical performances

By the end of this Skill drill, you should be able to:

- capture and analyse video footage of specialised movement sequences and/or physical performances
- record observations and use a range of tools to analyse a specialised movement sequence and/or physical performance.

Refer to your obook assess to complete this integrated research activity.

>> from page 33

RESEARCH

SKILL DRILL

1.3B Conduct a survey and present the results

By the end of this Skill drill, you should be able to:

- design and structure a print or online survey that is reliable and valid
- use a range of tools (e.g. graphs and infographics) to present the results of the survey.

Refer to your obook assess to complete this integrated research activity.

>> from page 34

RESEARCH

SKILL DRILL

1.3C Use the internet to find relevant, credible and reliable sources

By the end of this Skill drill, you should be able to:

- use the internet to find relevant and credible sources
- evaluate the reliability of a range of different sources found online.

Refer to your obook assess to complete this integrated research activity.

>> from page 63

PERFORMANCE

SKILL DRILL **2.3**

Devise a personal tactical strategy

Aim

To observe, record and analyse the emergence of a personal tactical strategy

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **identify** and **explain** how different constraints affect the development and emergence of a personal tactical strategy
- **use** primary and secondary data to **analyse** the emergence of a personal tactical strategy.

Equipment

- Indoor or outdoor playing surface
- Bibs
- Markers
- Whistle
- Goals
- Soft foam ball
- Game Performance Assessment Instrument 1 (GPAI 1), also available on your obook assess
- Clipboard
- Pen

Method

STEP 1

Form two teams of equal sizes and participate in a teacher-led warm up.

STEP 2

Take part in a 10-minute game of futsal with the following task constraints:

a The ball must be made of soft foam.

b Each player's bottom must remain lower than their knees at all times.

STEP 3

During the 10 minutes of play, your teacher will blow the whistle to pause the game every 2 minutes.

Each time the game is paused, take 2–3 minutes to complete the relevant section of GPAI 1.

For each of the three specialised movement sequences listed (i.e. passing, shooting, marking an opponent), make brief notes about the quality of:

- timing
- technique
- movement patterns (e.g. direction, frequency, intensity of movement)
- decision-making.

Time	Quality of:	Specialised movement sequences		
		Passing	Shooting	Marking an opponent
2 minutes	Timing			
	Technique			
	Movement patterns			
	Decision-making			
4 minutes	Timing			
	Technique			
	Movement patterns			
	Decision-making			
6 minutes	Timing			
	Technique			
	Movement patterns			
	Decision-making			
8 minutes	Timing			
	Technique			
	Movement patterns			
	Decision-making			
10 minutes	Timing			
	Technique			
	Movement patterns			
	Decision-making			

GPAI 1

Analysis and discussion tasks

1 Use the data you have gathered in GPAI 1 to complete the following tasks:
   - a **Describe** the changes that took place to your specialised movement sequences of passing, shooting and marking over the 10 minute period of play. Try to **identify** trends for each of these.
   - b **Identify** the specialised movement sequence that was first affected by the task constraints.
   - c **Describe** the specialised movement sequence that had the greatest change over the 10 minutes.
   - d **Identify** any movement solutions that emerged throughout the 10 minutes of play.
   - e **Identify** and **describe** the movement solution that had the greatest impact on your performance. Note that this movement solution is a personal tactical strategy for this activity.

2 The data you have gathered using GPAI 1 will allow you to identify and describe any personal tactical strategies that emerged for you. **Analyse** the data in order to complete the following tasks:
   - a **Explain** how the task constraints (i.e. playing with a foam ball; keeping your bottom lower than your knees during play) may have influenced the personal tactical strategy that emerged for you.
   - b **Explain** how the environmental constraints (e.g. the playing surface; the weather) may have influenced the personal tactical strategy that emerged for you.
   - c **Explain** how learner constraints (e.g. your physical capacity; level of fitness; any pre-existing injuries) may have influenced the personal tactical strategy that emerged for you.

3 **Use** the primary data you have gathered in GPAI 1, to **evaluate** the effectiveness of your personal tactical strategy. Gather some secondary data online to support your position.

>> from page 71

PERFORMANCE

SKILL DRILL 2.4

Evaluate the effectiveness of decision-making in authentic game settings

Aim

To evaluate the effectiveness of decision-making in authentic game settings

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **assess** the strengths, weaknesses and implications of your decision-making abilities in authentic game settings
- **use** primary and secondary data to **analyse** the effectiveness of your decision-making abilities.

Equipment

- Equipment relevant to your selected physical activity
- Game Performance Assessment Instrument 2 (GPAI 2), also available on your obook assess
- Clipboard
- Pen

Method

STEP 1

Form four teams of equal size (i.e. Team A, Team B, Team C, Team D) and prepare to take part in a 10 minute game of your selected physical activity.

STEP 2

Take a few minutes to read over GPAI 2 and familiarise yourself with the types of movements you will be required to assess.

STEP 3

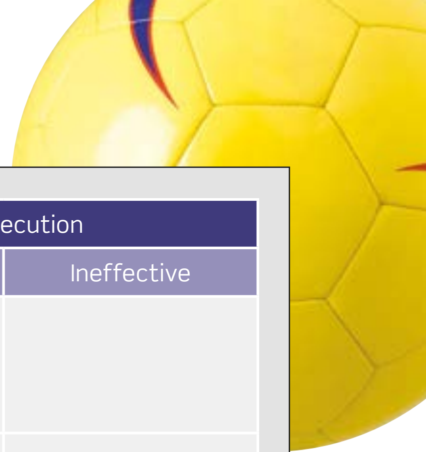
Participate in a teacher-led warm up.

STEP 4

Each player on Team A should now select a partner from Team C and each player on Team B should select a partner from Team D. Players on Team A and Team B take part in a 10 minute game while players on Team C and Team D observe their partner's 'on the ball' and 'off the ball' movements and use GPAI 2 to record all instances of appropriate and inappropriate decision-making and effective and ineffective skill execution (in relation to these movements).

STEP 5

Players on Teams C and D now take part in a 10 minute game while their partner on Team A or Team B observes and records their movements using GPAI 2.



Movements	Decision-making		Skill execution	
	Appropriate	Inappropriate	Effective	Ineffective
'On the ball' movements (e.g. passing, shooting, dribbling, hitting)				
'Off the ball' movements to support attack (e.g. leading and driving into space).				
'Off the ball' movements to support defence (e.g. positioning, marking, zone defence, one-on-one defence).				

GPAI 2

Analysis and discussion tasks

1 The data collected in your GPAI can allow you to objectively identify trends, patterns and relationships in your performance. **Use** the data your partner collected on your performance to complete the following tasks.

   a **Analyse** your decision-making over the course of the game. **Compare** the quality of your decision-making for 'on the ball' and 'off the ball' movements.

   b **Consider** the relationship between your decision-making and your skill execution (e.g. Was there a direct correlation between appropriate decision-making and effective skill execution or inappropriate decision-making and ineffective skill execution?).

   c **Evaluate** the quality of the data collected by your partner and decide if it is an accurate and reliable reflection of what actually happened during the game. Provide examples to support your point of view and make suggestions as to how the accuracy and reliability of the data could be improved next time (e.g. 'My data suggests that I made lots of inappropriate decisions and had poor skill execution, but I often felt that my decision-making was good even though I wasn't able to pull off the skill').

2 Secondary data can be used to help you further understand the primary data you have collected.

   a **Conduct** additional research on the features of the ecological model (i.e. a dynamic model of learning) and summarise your findings in a 50–100 word paragraph.

   b **Describe** one instance in your game play where you used perception-action coupling.

   c **Identify** one moment during the game when you were required to make a decision. **List** the affordances that were present. You might find it useful to **reflect on** this with your partner as they may be able to offer additional perspectives on what they could see happening at the time.

   d **Apply** the principles of decision-making (i.e. the 4 R model) to the example you identified in Question 2c. Use this model to break down the process you went through when deciding which affordance to act on.

3 **Synthesising** your primary data with secondary data will helps you to make justified evaluations of your performance.

   a **Evaluate** the overall effectiveness of your decision-making during the 10 minutes of game play. **Justify** your response using the secondary data you collected for Question 2a.

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PERFORMANCE

SKILL DRILL **2.6**

Evaluate the effectiveness of a personal tactical strategy

Aim

To evaluate the effectiveness of a personal tactical strategy

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **identify** a personal tactical strategy
- **assess** the strengths, weaknesses and implications of your personal tactical strategy in authentic game settings
- **examine** a range of factors that influenced your personal tactical strategy (e.g. affordances; constraints; the effectiveness of the execution; the outcome; the implications; the limitations; the quality of your decision-making skills)
- **use** primary and secondary data to **assess** the effectiveness of your personal tactical strategy.

Equipment

- Equipment relevant to your selected physical activity
- Video camera or personal recording device (including tripod)
- Game Performance Assessment Instrument 3 (GPAI 3), also available on your obook assess
- Clipboard
- Pen

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Method

STEP 1

Form two teams of equal size and prepare to take part in a 20 minute game of your selected physical activity.

STEP 2

Before you begin playing, spend a few minutes completing Part A of GPAI 3. At this stage, you should:

- select a particular principle of play you wish to collect data for
- identify a specific movement strategy
- identify a personal tactical strategy.

STEP 3

Once this is complete, participate in a teacher-led warm up.

STEP 4

Now set up your video camera to capture footage of the field or court where you will be playing. Take care to ensure the entire playing surface is in view. Begin recording and participate in a 20 minute game of your selected physical activity.

STEP 5

At the completion of play, stop recording and begin to review your video footage. As you watch the footage, you should complete Part B of GPAI 3, identifying:

- 10 instances during the game when you performed your personal tactical strategy (including the time each instance occurred).

For each instance that you performed your personal tactical strategy, you should note:

- the affordance you identified (i.e. opportunities for action)
- any constraint/s present (i.e. aspects that influenced the use of the personal tactical strategy)
- the effectiveness of the execution (i.e. Were you accurate or inaccurate?)

- the outcome (i.e. what happened?)
- the implications (i.e. Were there any unintended opportunities created?)
- the limitations (i.e. Did something limit your performance?)
- the quality of your decision-making skills (i.e. Were the decisions you made appropriate or inappropriate in each situation?).

PART A		
	Principle of play	
	Movement strategy (i.e. specialised movement sequence):	
	Personal tactical strategy:	

PART B		Analysis and evaluation									
	Moments when personal tactical strategy was performed	Affordances	Constraint/s	Execution		Outcomes	Implications	Limitations	Decision-making	
				Accurate	Inaccurate				Appropriate	Inappropriate

GPAI 3

Note: This is an extract of GPAI 3 only. Refer to your obook assess for an electronic copy of the complete GPAI.

Analysis and discussion tasks

1 Use the data you have gathered in GPAI 3 to complete the following tasks:
 a **Identify** the affordance you most commonly responded to during play.
 b **Identify** the affordance that most often resulted in a successful outcome.
 c **Identify** the constraint/s that results in the use of your personal tactical strategy the most.
 d **Evaluate** the success of your personal tactical strategy over the course of the game. Did the execution and outcome improve over time? If so, **explain** why. If not, **explain** why not.
 e **Discuss** the quality of your decision-making over the course of the game. **Summarise** this in a short paragraph, drawing on examples from your video evidence to support your position.

2 **Analyse** your data to see if you can **identify** relationships between:
- the affordances you identified and certain constraints
- the accuracy of your execution and certain constraints
- the affordances you identified and the limitations of your personal tactical strategy
- the affordances you identified and the outcomes
- the accuracy of your execution and the implications of your personal tactical strategy
- certain constraints and the effectiveness of your decision-making.

3 The process of analysing data and identifying trends and relationships between concepts will help you to draw conclusions about your level of tactical awareness.
 a **Reflect on** the affordances that resulted in less successful outcomes. **Identify** what changes need to be made to improve your:
  i execution of the specialised movement sequences
  ii timing.
 b **Reflect on** the 4 R model of decision-making (see page 65) and **identify** a specific area in which you need to develop your decision-making skills (i.e. READ, RECOGNISE and RESPOND, REACT or RECOVER). **Justify** your selection and devise strategies to improve in this area.

4 Based on the data you have collected, **decide** whether you are a tactically-aware performer. **Justify** your response.

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PERFORMANCE

SKILL DRILL **3.4**

Determine your personal values and ethical behaviours in physical activities

Aim

To determine your personal values and analyse how consistently you can implement them in a physical activity setting

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **identify** your personal values and **devise** a personal ethics statement
- **implement** your personal values within a small-sided game
- **assess** the extent to which your personal values influenced your own fair play and integrity, and that of your team
- **explain** how ethics strategies such as statement of values and codes of conduct can influence integrity and engagement.

Equipment

- 4 hula hoops
- 32 balls
- Game Performance Assessment Instrument 4 (GPAI 4), also available on your obook assess
- bibs or sashes in 4 colours
- Clipboard
- Pen

NOTE TO TEACHERS

Detailed rules and instructions for playing a game known as 'Rob the nest' are provided on the Teacher obook assess. Please read these carefully before completing this Skill drill.

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Method

STEP 1

As a group, discuss the importance of fair play in sport (i.e. observing rules; demonstrating appropriate attitudes and behaviours; eliminating form of exploitation; fair competition and equality; respect; team spirit; respect for written and unwritten rules). Now, using Source 1, identify five personal values you wish to demonstrate through your involvement in physical activity. Record these values in the left-hand column of GPAI 4.

SOURCE 1 A selection of personal values

STEP 2

Now form four teams of equal size and participate in a teacher-led warm-up

STEP 3

Your teacher will now explain the rules of the game 'Rob the nest'. Participate in a game of 'Rob the nest' for five minutes (Game 1).

STEP 4

At the end of play, use the four-point scale in the column titled 'Game 1' to score how often you think you displayed each of your values.

NOTE TO TEACHERS

A range of possible rule modifications for 'Rob the nest' are provided on the Teacher obook assess. Please refer to these prior to completing Games 2 and 3.

STEP 5

Your teacher will now make a modification to the rules of the game. Record the rule modification in the column titled 'Game 2'. Participate in a game of 'Rob the nest' for five minutes (Game 2) following the new rule.

STEP 6

At the end of play, use the four-point scale in the column titled 'Game 2' to score how often you think you displayed each of your values.

STEP 7

Your teacher will now make another modification to the rules of the game. Record the rule modification in the column titled 'Game 3'. Participate in a game of 'Rob the nest' for five minutes (Game 3) following the new rule.

STEP 8

At the end of play, use the four-point scale in the column titled 'Game 3' to score how often you think you displayed each of your values.

STEP 9

Discuss your personal values and scores as a class. For example, discuss:

- What were you willing to do (or not do) in order to win/be competitive/have fun?
- To what extent did your personal values influence your decisions in each game?

Personal values	Game 1 No rule modifications:				Game 2 Rule modification:				Game 3 Rule modification:			
	Always (4 points)	**Often** (3 points)	**Sometimes** (2 points)	**Never** (1 points)	**Always** (4 points)	**Often** (3 points)	**Sometimes** (2 points)	**Never** (1 points)	**Always** (4 points)	**Often** (3 points)	**Sometimes** (2 points)	**Never** (1 points)

GPAI 4

Analysis and discussion tasks

1 Collecting and analysing primary data about your performance will provide insights into how often you displayed your personal values under different playing conditions. **Analyse** the data in GPAI 4 to complete the following tasks:

   a **Identify** the personal value that you most often displayed across all three games. Provide reasons why this was the case.

   b **Identify** the personal value that was most affected (either positively or negatively) by the rule modifications in Games 2 and 3. **Discuss** possible reasons for this.

   c **Reflect** on how well you were able to display your values in a competitive game setting. **Consider** whether you would select the same five personal values if you were to repeat this activity – provide reasons and examples to support your response.

   d Based on your experiences, **design** a code of conduct for your class that you think would have a positive influence on fair play and integrity for future games of 'Rob the nest'.

2 **Discuss** how your personal values influence your general understanding of fair play and integrity.

3 **Explain** who has shaped or influenced your personal values. Consider agents of socialisations (i.e. peers, family, coaches, school or community) in your response.

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PERFORMANCE

SKILL DRILL 3.7

Investigate personal responses to an ethical dilemma

Aim

To investigate different ways in which individuals respond to an ethical dilemma

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **identify** an ethical dilemma through involvement in a sporting competition
- **gather, analyse** and **synthesis** primary data and secondary data about an ethical dilemmas in a class context
- **evaluate** your personal responses to an ethical dilemma
- **compare** the personal responses of your classmates to an ethical dilemma
- **devise** an ethics strategy response to an ethical dilemma and **evaluate** its potential outcomes, implications and limitations.

Equipment

- Good-quality badminton or tennis racquets (e.g. regulation racquets that are in good working condition)
- Poor-quality badminton or tennis racquets (e.g. regulation racquets that are damaged or broken, or non-regulation racquets such as plastic toy racquets, table tennis bats, etc.)
- Badminton shuttles or tennis balls
- A round-robin score sheet, available on your obook assess
- Data Collection Instrument 1 (DCI 1), available on your obook assess
- Clipboard
- Pen

Method

STEP 1

Form pairs and participate in a teacher-led warm up.

STEP 2

Prepare to take part in a doubles badminton or tennis round-robin tournament with the following scoring modification: 'first to 7 wins'.

As a class, you have one minute to inspect the equipment available for the tournament and select your racquet. Half the racquets will be good quality and the other half will be poor quality.

STEP 3

Take part in the tournament. The winning team may be awarded a prize at the discretion of the teacher.

STEP 4

Access your obook assess and download a copy of DCI 1 (i.e. survey). Complete the survey. You may like to use Google Forms or SurveyMonkey to create a digital version of the survey.

Analysis and discussion tasks

1 **Synthesise** the primary data that you and all of your classmates have collected using DCI 1. Google Forms or SurveyMonkey will help you automatically gather each student's responses and collate the results.

2 **Present** the class results of Questions 4 and 5 as two separate bar graphs.

   a **Analyse** the two graphs you have prepared. Do you notice any trends or relationships between people's initial feelings about the equipment and the extent to which it affected their performance?

3 **Present** the class results of Questions 10 and 11 as two separate bar graphs.

   a **Analyse** the two graphs you have prepared. Can you identify any discrepancies between people's general perceptions of their integrity and the level of integrity they demonstrated in the tournament? Suggest reasons for any discrepancies which exist.

4 **Describe** the tensions that exist between the ethical dilemma and the personal values of you and your classmates. Discuss the extent to which these tensions impacted on fair play during the tournament.

5 **Devise** an ethics strategy that could be implemented for future tournaments that would increase the chances of achieving fair play and integrity (without changing the equipment available).

   a Evaluate the potential outcomes, implications and limitations of your ethics strategy (using at least one piece of primary data and one piece of secondary data to justify your reasoning).

SOURCE 2 A badminton tournament in which some players have access to good-quality racquets and some players don't, presents a serious ethical dilemma.

>> from page 147

PERFORMANCE

SKILL DRILL 3.8

Use the ethical decision-making framework to devise an ethics strategy and evaluate its effectiveness

Aim

To use the ethical decision-making framework to devise an ethics strategy (in response to an ethical dilemma) that increases integrity and optimises engagement in a physical activity

To evaluate the effectiveness of the ethics strategy using primary and secondary data

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **gather** and **analyse** primary and secondary data relating to an ethical dilemma (in a class context)
- **use** the ethical decision-making framework to help you devise an ethics strategy that responds to an ethical dilemma
- **evaluate** the effectiveness of your ethics strategy to enhance integrity and optimise engagement for all class members.

Equipment

- Netball equipment (e.g. balls, bibs, etc.) and playing facilities (e.g. courts)
- Game Performance Assessment Instrument 5 (GPAI 5), also available on your obook assess
- A copy of the ethical decision-making framework (Source 2 on page 143)
- Clipboard
- Pen

NOTE TO TEACHERS

This activity can be applied to a number of different 'Net and court' or 'Invasion' physical activities. If students are unfamiliar with the rules of netball (or if equipment and playing facilities are unavailable), you can substitute a game of your choice.

Method

STEP 1

Form teams of seven and familiarise yourself with the rules of netball.

STEP 2

Take part in a teacher-led warm up.

STEP 3

Your teacher will now explain the rules of netball (if required). Participate in a game of netball for 10 minutes (Game 1). There should be no umpire for this game.

STEP 4

At the end of play, complete the column titled 'Game 1' (i.e. Parts A and B), taking care to:

- identify an ethical dilemma you faced during the game. Express the ethical dilemma as a 'should' question (e.g. 'Should I abide by the stepping rule if there is no umpire present to enforce it?' or 'Should I ensure I maintain a space of three feet between me and my opponent when in defence to optimise fair play and integrity?').
- describe how you responded response to the dilemma
- use the five-point self-assessment scale to record your thoughts and feelings about other aspects of the game (i.e. 1 = low/negative; 5 = high/positive).

SOURCE 3 Playing a game of netball without an umpire can create a number of ethical dilemmas.

STEP 5

With the other members of your team, discuss the different ethical dilemmas that you each identified in Game 1. As a group, pick one of these ethical dilemmas and use the ethical decision-making framework to devise an ethics strategy that you believe will address this ethical dilemma in order to increase integrity and optimise engagement in Game 2.

STEP 6

Complete the column titled 'Game 2' taking care to:

- record your ethics strategy (in the top row)
- identify an ethical dilemma you are attempting to respond to (in Part A).

STEP 7

Participate in a second game of netball for 10 minutes (Game 2). Again, there should be no umpire for this game. Throughout the game, you and your team should attempt to implement your ethics strategy.

STEP 8

At the end of play, complete Part B of the column titled 'Game 2' (i.e. Parts A and B), taking care to use the five-point self-assessment scale to record your thoughts and feelings about aspects of the game (i.e. 1 = low/negative; 5 = high/positive).

	Ethical-decision making	Game 1 • No umpire • No ethics strategy	Game 2 • No umpire • Ethics strategy: ________
PART A	Ethical dilemma	Should ...	Should ...
PART B	How I responded to the ethical dilemma	I ...	I ...
	Level of personal integrity	1 2 3 4 5	1 2 3 4 5
	Level of personal enjoyment	1 2 3 4 5	1 2 3 4 5
	Level of class engagement	1 2 3 4 5	1 2 3 4 5
	Impact on others	1 2 3 4 5	1 2 3 4 5
	Level of guilt	1 2 3 4 5	1 2 3 4 5

GPAI 5

Analysis and discussion tasks

1 **Analyse** your primary data and determine how your responses to the ethical dilemma changed between Games 1 and Game 2.

2 **Reflect** on how the personal values you identified in Question 2 of Check your learning 3.4 (on page 119) align with your responses in Part B of 'Game 1'. **Discuss** reasons for this.

3 **Compare** the 'Level of personal integrity' rating you gave yourself in Game 1 and Game 2. Using examples, **discuss** reasons for why this rating changed/stayed the same.

4 **Synthesise** the primary data you have collected with secondary data gathered online and **evaluate** the effectiveness of your ethics strategy for enhancing integrity and optimising class engagement. Provide examples to support your response.

5 **Reflect on** the effectiveness of your team's ethics strategy. Using evidence from your primary and secondary data, **justify** whether you think you should maintain your strategy or modify it.

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PERFORMANCE

SKILL DRILL 4.4

Determine your fitness profile

Aim

To determine your level of fitness for your chosen physical activity using a range of traditional fitness tests

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **analyse** and **synthesise** primary data and secondary data about position- or event-specific fitness testing of the relevant components of fitness
- **assess** your results to **identify** personal performance capacities.

Equipment

- Game Performance Assessment Instrument 6 (GPAI 6), also available on your obook assess
- Pens
- Equipment for a fitness test, including:
  - stopwatch
  - cones
  - measuring tape
  - handgrip dynamometer (see Source 3).

NOTE TO TEACHERS

Additional information, instructions and rating norms for the eight fitness tests covered in this Skill drill are provided on the Teacher obook assess.

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Method

STEP 1

Complete a teacher-led RAMP warm up.

STEP 2

Complete as many of the following fitness tests as are deemed relevant to your physical activity by your teacher. Instructions for these fitness tests can be found in your obook assess.

- Beep test
- Sit up test
- Sit and reach test
- Standing long jump test
- Grip strength test
- Push up test
- Illinois agility test
- 40 m sprint test

STEP 3

Record your fitness test results and ratings usings columns 1 and 2 of GPAI 6. You can find rating norms for each fitness test on your obook assess.

SOURCE 4 An example of a handgrip dynamometer used to measure grip strength

Test	1 Result (e.g. sec, reps, kg, cm)	2 Rating (e.g. above average, average, below average)	3 Component of fitness being assessed	4 Component of fitness ranking (e.g. 1 = best; 8 = worst)
Beep test				
Sit up test				
Sit and reach test				
Standing long jump test				
Grip strength test				
Push up test				
Illinois agility test				
40 m sprint test				

GPAI 6

Analysis and discussion tasks

1. It is important that you are able to analyse the primary data you have collected in order to design and implement a training strategy.
   - a. Based on your understanding of components of fitness, use column 3 of GPAI 6 to record the component of fitness being targeted in each of the fitness tests you carried out.
   - b. Using column 4 of GPAI 6, **assess** your fitness test results and rank them from your best (1) component of fitness to your worst (8).
2. Once you have analysed your fitness data, you will need to **determine** the implications and limitations of your fitness profile to make decisions about your suitability in your selected physical activity.
   - a. **Identify** the fitness and energy requirements of a variety of positions (if applicable) within your selected physical activity.
   - b. **Synthesise** the primary data about your fitness and **justify** which position or event you would be most suited to in your selected physical activity.
3. As always, it is necessary to be discerning about the validity and reliability of the tests conducted when using the data in decision-making.
   - a. For each fitness test you completed, **evaluate** how relevant the results are to your selected physical activity. **Consider** factors such as specialised movement sequences, movement strategies and game features, including duration, playing area, body parts used, etc.
   - b. **Identify** one component of fitness and **design** a fitness test that considers the specific requirements of your selected physical activity.

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PERFORMANCE

SKILL DRILL **4.5A**

Determine your VO_2 max

Aim

To determine your VO_2 max and reflect on its importance in your selected physical activity

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **analyse** and **synthesise** primary and secondary data to **identify** your VO_2 max
- **assess** the role VO_2 max plays in performance of specialised movement sequences and movement strategies in your selected physical activity.

Equipment

- Cones
- 400 metre running track
- Stopwatch
- Game Performance Assessment Instrument 7 (GPAI 7), also available on your obook assess
- Clipboard
- Pen

Method

STEP 1

Place cones every 50 metres around a 400-metre track.

STEP 2

Complete a teacher-led RAMP warm up and form pairs.

STEP 3

On a given signal, start running and attempt to keep a steady pace around the track. The aim is to run as far as you can in 15 minutes.

STEP 4

Every time you finish a lap (i.e. cross the 400 metre start/finish line), your partner will run alongside you while you attempt to sing the first verse of a simple song (e.g. 'Twinkle, Twinkle, Little Star'). After each attempt, your partner gives you a rating from 1 to 5 using GPAI 7, as follows:

1 – Can sing the song perfectly
2 – Can sing the song but with long gaps for breaths
3 – Can talk the song
4 – Can talk the song in single syllables
5 – Cannot talk the song with any coherence.

After 15 minutes, the teacher will signal to stop running. Your partner records how far you have run using GPAI 7.

STEP 5

Swap roles with your partner and conduct the test again.

Laps	Talk test rating				
Lap 1	1	2	3	4	5
Lap 2	1	2	3	4	5
Lap 5	1	2	3	4	5
Lap 6	1	2	3	4	5
Lap 7	1	2	3	4	5
Lap 8	1	2	3	4	5
Total distance covered in metres					
Predicted VO_2 max (using the formula in Question 1)					
Rating for VO_2 max (using data in Source 5 (for females) or Source 6 (for males))					

GPAI 7

Analysis and discussion tasks

1 Calculate your VO_2 max using the following formula:
(((Total distance covered in metres ÷ 15) – 133) × 0.172) + 33.3. Record the data in GPAI 7.

2 **Synthesise** your primary data with the secondary data in Sources 5 and 6 and assess your result. Record this information in GPAI 7.

3 The talk test suggests that when you are performing at your VO_2 max, you will find it very difficult to talk or sing coherently. **Analyse** your talk test data. What do the result says about your performance? Does your talk test result indicate that you were getting an indication of your true VO_2 max through this test? **Explain** your answer.

4 Once an initial analysis of data has been conducted, it is important to use this information to develop strategies to optimise your performance.

- **a** **Assess** the importance of having a good VO_2 max for your performance of specialised movement sequences and movement strategies in your selected physical activity.
- **b** **Determine** whether improving your VO_2 max should be a training objective in your training strategy. **Justify** your decision.

Normative data for females (values in ml/kg/min)

Age	Very poor	Poor	Fair	Good	Excellent	Superior
13–19	<25	25–30	31–34	35–38	39–41	>41
20–29	<24	24–28	29–32	33–36	37–41	>41
30–39	<23	23–27	28–31	32–36	37–40	>40
40–49	<21	21–24	25–28	29–32	33–36	>36
50–59	<20	20–22	23–26	27–31	32–35	>35
60+	<17	17–19	20–24	25–29	30–31	>31

SOURCE 5 VO_2 max norms for females

Normative data for males (values in ml/kg/min)

Age	Very poor	Poor	Fair	Good	Excellent	Superior
13–19	<35	35–37	38–44	45–50	51–55	>55
20–29	<33	33–35	36–41	42–45	46–52	>52
30–39	<31	31–34	35–40	41–44	45–49	>49
40–49	<30	30–32	33–38	39–42	43–47	>47
50–59	<26	26–30	31–35	36–40	41–45	>45
60+	<20	20–25	26–31	32–35	36–44	>44

SOURCE 6 VO_2 max norms for males

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PERFORMANCE

SKILL DRILL **4.5B**

Determine your lactate threshold

Aim

To determine your lactate threshold and reflect on tis importance in your selected physical activity

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **analyse** and **synthesise** primary and secondary data about target heart rate and maximum heart rate to identify determine your lactate threshold.

Equipment

- 400 metre running track
- Heart rate monitors
- Stopwatch
- Data Collection Instrument 2 (DCI 2), also available on your obook assess
- Pen
- Clipboard

Method

STEP 1

Conduct a teacher-led RAMP warm up and put on your heart rate monitor.

STEP 2

Determine your maximum heart rate using the formula 206.9 – (0.67 × age in years)

Calculate your target heart rates at 65%, 75%, 85% and 90% intensity by multiplying the percentage (as a decimal) by your maximum heart rate (e.g. 0.65 × 196).

STEP 3

Complete the following set of intervals with 3 minutes rest between each one:

a 400 m run at 65% intensity
b 400 m run at 75% intensity
c 400 m run at 85% intensity
d 400 m run at 90% intensity.

As you are completing each interval, feel for the signs of onset of blood lactate such as sore, heavy (jelly) legs, burning chest, nausea. This should occur at some point between intervals A and D, depending on your fitness levels. When you notice the symptoms, note your HR and at your next rest interval, record it in DCI 2. This HR is your lactate threshold.

At each rest interval, record the following using DCI 2:

- heart rate (HR)
- rate of perceived exertion (RPE)
- qualitative data (e.g. observations and notes about muscle soreness, breathlessness).

SOURCE 7 The exercise intensity at which blood lactate begins to accumulate in the muscles at a faster rate than it can be removed (in the blood) is known as the lactate threshold.

	Heart rate (HR)	Rate of perceived exertion (RPE) (1–10)	Qualitative data (e.g. observations about muscle soreness, breathlessness)
Interval A – 400m @ 65% intensity			
Interval B – 400m @ 75% intensity			
Interval C – 400m @ 85% intensity			
Interval D – 400m @ 90% intensity			
Heart rate when symptoms of onset of blood lactate occur This is an indication you have reached or exceeded your lactate threshold.			
Heart rate at 85% of your maximum heart rate This is a predicted lactate threshold.			

DCI 2

Analysis and discussion tasks

1 Lactate threshold is commonly considered to be approximately 85% of your maximum heart rate, but there can be variations to this figure depending on an athlete's fitness.

   a **Calculate** 85% of your maximum heart rate and record it using DCAI 2.

   b **Calculate** the percentage max heart rate you were at when you first began to feel symptoms of an onset of blood lactate accumulation (OBLA). Was it over or under 85%?

2 Qualitative data can be a useful complement to quantitative data when analysing your findings and determining trends and relationships.

   a **Describe** the relationship between your heart rate, your RPE and your data observations.

   b Plot a line graph with HR on the y-axis and RPE on the x-axis. **Annotate** the graph with the qualitative data you collected at each rest interval.

3 Your lactate threshold can have an impact on your training and performance in your selected physical activity.

   a **Assess** your lactate threshold result and determine the impact it may have on your ability to perform well in your selected physical activity.

   b **Argue** the case for increasing your lactate threshold and determine ways this might be achieved.

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PERFORMANCE

SKILL DRILL **4.5C**

Analyse your heart rate recovery

Aim

To determine your heart rate recovery and reflect on its importance in your selected physical activity

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **analyse** and **synthesise** primary and secondary data to determine your heart rate recovery
- **recognise** and **explain** the importance of heart rate recovery as a measure of fitness.

Equipment

- Running field
- Agility poles
- Heart rate monitors
- Data Collection Instrument 3 (DCI 3), also available on your obook assess
- Stopwatches
- Whistle
- Clipboard
- Pen

Method

STEP 1

Form pairs and begin by measuring your own resting heart rate (HR) and the resting HR of your partner. Record your results in 'Resting HR' column of DCI 3.

STEP 2

Now place two agility poles 40 metres apart. One pole marks Point A and the other marks Point B. The space between the poles is the sprint area. Set up enough agility poles to ensure there are no more than three pairs per sprint area.

STEP 3

Participate in a teacher-led warm up. At the end of the warm up, conduct another HR check. Record this result in the 'HR prior to sprint' column of 'Interval 1'

STEP 4

Commence the first sprint, running at 100 per cent intensity from Point A to Point B and back again (i.e. 80 metres). Try to complete this in under 10 seconds. After 10 seconds, your teacher will blow a whistle to signal you to stop running.

If you were able to cover the 80 metres in 10 seconds, your partner will record this in the 'Distance covered' column. If not, your partner will estimate the total distance you covered in 10 seconds and record it.

Measure your heart rate immediately after the sprint and ask your partner to record it in the 'HR immediately after sprint' column.

Measure your heart rate again after 30 seconds (timed by your partner) and have your record it in the 'HR 30 seconds after sprint' column.

Rest for 40 seconds (timed by your partner) before beginning 'Interval 2'. Note: You should rest for total of 70 seconds between each sprint.

After 70 seconds, measure your heart rate again and record it in the 'HR prior to sprint' column of 'Interval 2'.

Repeat these steps until you have completed all five intervals and have recorded all results using DCI 3.

STEP 5

Switch with your partner and repeat this process.

Resting HR:				
10 second sprints (max 80 m)	HR prior to sprint	HR immediately after sprint	HR 30 seconds after sprint	Distance covered (m)
Interval 1				
Interval 2				
Interval 3				
Interval 4				
Interval 5				

DCI 3

Analysis and discussion tasks

1 **Analyse** the results in the 'Distance covered (m)' column of DCI 3 and comment on your ability to maintain speed across the five intervals. **Explain** how the ability to maintain speed may affect the validity of the test.

2 **Use** Source 8 (also available on your obook assess) to **create** a line graph using the heart rate data you have collected.

  a Plot the results of your HR 'Prior to sprint' for each of the five intervals using a blue pen. Join these points using the same blue pen.

  b Plot the results of your HR 'Immediately after sprint' for each of the five intervals using a red pen. Join these points using the same red pen.

  c Plot the results of your HR '30 seconds after sprint' for each of the five intervals using a green pen. Join these points using the same green pen.

3 Your line graph will now show a blue line representing your HR prior to each sprint, a red line representing your HR immediately after each sprint and a green line representing your HR 30 seconds after each sprint. **Identify** and **analyse** any trends or relationships you observe in the data.

4 Read the following quote taken from an article published by the School of Public Health at University of California, Berkeley (USA):

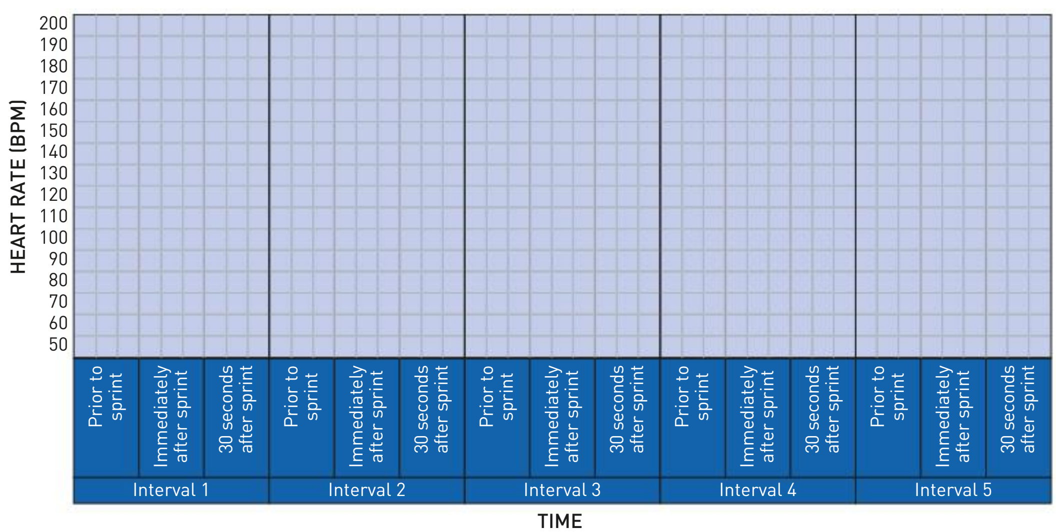
'The length of time it takes for heart rate to return to normal is a good measure of fitness. The more fit you are, the faster the recovery.'

  a **Consider** this quote in the context of the results you gathered using DCI 3. With this secondary data in mind, **appraise** your current level of fitness.

  b **Predict** what the graph of a professional athlete would look like. Think about what the gradient (i.e. angle or steepness) of a graph showing heart rate increase (during exertion) or heart rate decrease (during rest) at each interval might look like compared to yours.

  c **Propose** how you might modify this test to get more position- or event-specific data on heart rate recovery for your selected physical activity.

SOURCE 8 Line graph template



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PERFORMANCE

SKILL DRILL **4.12**

Conduct a game analysis

Aim

To observe, record and analyse performance and skills data from a selected game, sport or physical activity and use this information to design relevant and appropriate training strategies

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **understand** the purpose, stages and features of a game analysis
- **apply** a range of tools and methods to gather data for a game analysis
- **analyse** and **synthesise** primary data and secondary data relating to:
  - position- or event-specific components of fitness (in order to identify personal performance capacities)
  - specialised movement sequences and movement strategies in authentic performance environments (in order to identify the frequency, direction, intensity and duration of movements)
  - work:rest (W:R) ratios.

Equipment

- Equipment specific to your selected physical activity
- Heart rate monitors (enough for half the class)
- Video cameras (enough to capture each game or performance)
- GPS trackers (optional)
- GPAI 8 – Game analysis summary
- GPAI 9 – Intensity of movement, available on your obook assess
- GPAI 10 – Frequency, direction and duration of movement, available on your obook assess
- GPAI 11 – Specialised movement sequence analysis, available on your obook assess
- Clipboard
- Pen

NOTE TO TEACHERS AND STUDENTS

This Skill drill includes an example of a 'Game analysis summary GPAI' for 'Net and court' physical activities (i.e. GPAI 9).

Alternative versions of this 'Game analysis summary GPAI' for 'Invasion' and 'Performance' physical activities are available on your obook assess.

Please note that GPAIs 9, 10 and 11 are provided on your obook assess. These support the 'Game analysis summary GPAI'.

Method

STEP 1

Identify your selected physical activity and make sure you have copies of the four GPAIs listed above (including sport-specific versions of GPAI 8 and GPAI 9 relevant to your selected physical activity.

STEP 2

If you are participating in a 'Net and court' or 'Invasion' physical activity, form pairs and assign a role to each student (i.e. Student A and Student B).

If you are participating in a 'Performance' physical activity, form groups of three and assign a role to each student (i.e. Student A, Student B and Student C).

STEP 3

Next, set up your video equipment to record your performance.

If you are participating in a 'Net and court' or 'Invasion' physical activity, it's likely you'll require one or two cameras per game.

If you are participating in a 'Performance' physical activity, it's likely you'll require only one camera per performer.

As a group, discuss your needs with your teacher and decide on an approach that works for your situation.

STEP 4

Now it's time to complete the shaded portion of GPAI 8 (i.e. name, date, physical activity, position/event and phase/cycle information).

You also need to complete Section 4 of GPAI 8, making note of the two specialised movement sequences you wish to collect data on during your performance.

STEP 5

Now read the information and follow these instructions for each role.

Instructions for Student A – performer:

Your role is to participate in your selected physical activity for a specific period of time while Student B observes you and collects data on your performance. Choose one of the following options:

Physical activity	Duration
'Net and court'	One set (i.e. approximately 10 minutes of activity)
'Invasion'	One play (i.e. approximately 10 minutes activity)
'Performance'	Activity representative of a competitive performance environment (e.g. 3 jumps for long jump, 1 x 400m sprint, etc.).

Before you begin, use the heart rate monitor to record your resting heart rate (HR) in Section 1 of GPAI 8. Then record your (HR) immediately after activity, and 30 seconds after activity.

Immediately after you finish, record and rate of perceived exertion (RPE) in Section 2 of GPAI 8.

The remaining data can be completed later.

Instructions for Student B – statistician:

Your role is to record live statistics of Student A during their performance using GPAI 11. Be sure to take care to record all data relating to the two nominated specialised movement sequences Person A is investigating.

Note: Make sure you are familiar with the type of data you will be collecting ahead of the performance and that you are clear with the format of GPAI 11 before the performance begins.

Instructions for Student C – camera operator ['Performance' physical activities only]:

If you are participating in a 'Performance' physical activity, your group may need a camera operator.

Your role is to record the performance of Student A.

STEP 4

At the end of the first performance, switch roles and complete Step 3 a second time.

[If you are participating in a 'Performance' physical activity, you may need to switch roles and complete Step 3 a third time.]

STEP 5

Once everyone has completed their performances, you will need to gather and review your data (i.e. video footage and GPAI 11) so that you can complete GPAI 8.

Game analysis summary: ‘Net and court’ physical activities					
Name:			**Date:**		
Physical activity:			Position/event:		
Phase and cycle information		Macrocycle number:	Phase of training:		
		Mesocycle number:	Microcycle number:		
Performance (i.e. any match, authentic scenario, event, or performance during the competition phase) Set: ______________________________			**Result**	**Current vs. previous game/ event***	**Reflection and notes**
1	**HEART RATE DATA**	**Resting heart rate** (i.e. prior to performance)			
		Working heart rate range (i.e. use a HR monitor data to determine this)			
		Heart rate (HR) 1 (i.e. immediately after work)			
		Heart rate (HR) 2 (i.e. 30 seconds after work)			
		Heart rate recovery (i.e. subtract HR 1 from HR 2)			
2	**INTENSITY DATA** ***Refer to GPAI 9 – Intensity of movement: ‘Net and court’]***	**Rating of perceived exertion (PRE) at end of 1st set** (i.e. provide rating from 1–10)			
		Average distance covered at high intensity (e.g. fast positional shuffling, lunging during a point, efforts to retrieve or hit a ball, etc.)			
		Average distance covered at moderate intensity (e.g. minor positional shuffling, time between points and games, during timeouts, etc.)			
		Overall distance covered at moderate intensity			
		Overall distance covered at high intensity			
3	**MOVEMENT DATA** ***[Refer to GPAI 10 – Frequency, direction and duration]***	**Main types of movement** (e.g. running, sidestepping, jumping, etc.) **Main directions of movement** (e.g. forward, backwards, etc.)			

4	SKILLS DATA ***[Refer to GPAI 11 – Specialised movement sequence analysis]***	**Specialised movement sequence 1**	% ineffective		
			% effective		
		Specialised movement sequence 2	% ineffective		
			% effective		

***Key:** B = better W = worse S = same H = higher L = lower NA = not applicable

GPAI 8

Analysis and discussion tasks

Before attempting these tasks, you will need to review the video footage of your performance and complete GPAI 8.

1 Refer to Section 2 of GPAI 8 and use the data to **analyse** the intensity of your movement.
   - **a** **Determine** the average distance covered at high intensity.
   - **b** **Compare** this to the average distance covered at moderate intensity.
   - **c** **Synthesise** your responses in Question a and b with your working heart rate range to determine the energy system predominantly used in your event/position/physical activity.
   - **d** **Comment on** how the distances covered at the various intensities could be used to design future training sessions. Refer to specific components of fitness and training methods in your response.
   - **e** **Determine** your approximate work to rest ratio (W:R) for this event/position/physical activity.

2 Refer to Section 3 of GPAI 8 and use the data to **analyse** the frequency, direction and duration of your movements.
   - **a** **Identify** and **comment** on any patterns in the data.
   - **b** Using an example, **explain** how this information might help you to design an effective training strategy.

3 **Analyse** the data collected relating to your performance of the two specialised movement sequences you identified in GPAI 8. **Evaluate** the effectiveness these specialised movement sequences in your performance.

4 **Comment on** the accuracy of the data that was collected about your performance (e.g. were the results typical for you?). **Explain** the reason for any possible discrepancies and suggest how accuracy of the data could be improved next time.

5 **Evaluate** your overall suitability to perform in your selected physical activity. **Justify** your judgements using information about the energy, fitness and skill requirements of your position or event and your own energy, fitness and skill capacities. You may like to refer to the data you collected in the Skill drills for Section 4.5 to support your response.

6 Based on your results, decide on the areas of your performance that need the most attention in your training strategy.

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PERFORMANCE

SKILL DRILL **4.13**

Determine your initial training values

Aim

To determine your initial training values (i.e. your training load for your first training session) in order to design a training session plan

Time

1 lesson (i.e. 70 minutes) with additional time (if required) to complete analysis and discussion tasks

That's a goal!

By the end of this Skill drill, you should be able to:

- **determine** your initial training values in order to design a training session plan
- **evaluate** the effectiveness of a training session to improve performance capacity
- **justify** decisions to maintain or modify a training session using evidence from primary and secondary data.

Equipment

- Heart rate monitor (Note: If your HR monitor does not show you training zones, you will need to determine your heart rate range for the aerobic training zone (i.e. your heart rate between 60–75% maximum)
- Stopwatch
- Game Performance Assessment Instrument 12 (GPAI 12) – Rating of perceived exertion (RPE), also available on your obook assess
- Game Performance Assessment Instrument 13 (GPAI 13) – Rating of fatigue (ROF), also available on your obook assess
- Game Performance Assessment Instrument 14 (GPAI 14) – Rating of session effectiveness (RSE), also available on your obook assess
- Clipboard
- Pen

Method

STEP 1

Before beginning the activity, make sure you have read through the steps below and are familiar with the following GPAIs:

- GPAI 12 – Rating of perceived exertion (RPE)
- GPAI 13 – Rating of fatigue (ROF)
- GPAI 14 – Rating of session effectiveness (RSE)

NOTE TO TEACHERS AND STUDENTS

This Skill drill focuses on the training method of interval training (i.e. aerobic interval training (AIT). If you wish to determine your initial training values for components of fitness in other training methods (i.e. Continuous training, Fartlek training, Resistance training, Flexibility training, and Circuit training), you can use the resources provided on your obook assess.

STEP 2

Form pairs and participate in a teacher-led warm up.

STEP 2

One student (Student A) in each pair should now attach a heart rate monitor and test that it is working. The other student (Student B) will keep time and record data for Student A.

STEP 3

Student A now takes part in the following aerobic interval training (AIT) session:

- 1 interval = a 2-minute run at 60–75% of maximum heart rate (i.e. aerobic training zone) followed immediately by a 1-minute run at 85–90% of maximum heart rate (i.e. anaerobic training zone) followed by a 2-minute rest period.
- Repeat interval five times.

STEP 4

Immediately after the run component of each interval, Student A should:

- communicate their heart rate Student B to record in GPAI 12.

Thirty seconds after the run component of each interval, Student A should:

- communicate their heart rate Student B to record in GPAI 12.

Two minutes after the run component of each interval, Student A should:

- communicate their heart rate Student B to record in GPAI 12.

STEP 5

At the completion of the 5 intervals, Student A should use GPAI 13 to determine and record their rate of fatigue (ROF) for the session.

STEP 6

Student A and Student B should now swap roles and complete the training session again.

Rating of perceived exertion (RPE)

	Rate of perceived exertion (RPE) immediately after run (1–10)	Heart rate (HR) immediately after run	Heart rate (HR) 30 seconds after run	Heart rate (HR) 2 minutes after run
Interval 1				
Interval 2				
Interval 3				
Interval 4				
Interval 5				

GPAI 12

Rating of fatigue (ROF)

ROF scale		Your rating (i.e. tick the relevant box)
0	Not fatigued at all	
1		
2		
3		
4	Moderately fatigued	
5		
6		
7		
8	Very fatigued	
9		
10	Total fatigue	

GPAI 13

Rating of session effectiveness (RSE)

RSE scale		Your rating (i.e. tick the relevant box)
1	It offered no chance for adaptation	
2	It may have caused a slight adaptation	
3	It provided an optimal opportunity for adaptation	
4	It caused a detrimental effect	
5	It caused a catastrophic effect	

GPAI 14

Analysis and discussion tasks

1 An understanding of volume and intensity will help you to design training sessions that are best suited to your needs.

- **a** **Calculate** the volume of training in this session.
- **b** **Describe** the intensity of training in this session.
- **c** **Identify** some ways in which you could manipulate either volume or intensity to change the objective of this training session or to suit the needs of a particular individual or sport.

2 Analysing primary data can enable you to determine trends and relationships which will help you to make decisions about your training strategy and training sessions.

- **a** **Synthesise** the primary data you gathered during this training session with secondary data (e.g. data from this Student book) to **assess** whether the volume and intensity of this training session applied stress effectively to bring about physiological adaptation.
- **b** Based on your rating in GPAI 14, **justify** whether this training session should be maintained or modified in your next training session.
- **c** If necessary, **modify** this training session adjusting volume and intensity levels to suit your individual aerobic capacity. Note: If you decided to maintain your training session in Question 2b, **identify** the training values for your next training session.

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PERFORMANCE

SKILL DRILL 5.1

Evaluate how effective a training session is at developing a specific energy system

By the end of this Skill drill, you should be able to:

- use heart rate data to **determine** the training zone that you are working in
- use identified training zones to **determine** the energy system/s being used.

Refer to your obook assess to complete this integrated research activity.

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PERFORMANCE

SKILL DRILL 5.2

Determine your personal performance capacity for physical activity

By the end of this Skill drill, you should be able to:

- **identify** and **explain** the seven components of fitness
- **understand** the importance of measuring personal performance capacities using traditional and customised fitness tests
- **determine** your personal performance capacities for a selected physical activity based on position- or event-specific testing.

Refer to your obook assess to complete this integrated research activity.

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PERFORMANCE

SKILL DRILL 5.3

Analyse your heart rate to target the correct training zone

By the end of this Skill drill, you should be able to:

- **understand** how to record heart rate (HR) and calculate percentage of maximum heart rate (MHR)
- **determine** what training zone you are working in
- **synthesise** primary data (i.e. HR and % of MHR) and secondary data (information on training zones from your Student book) to identify target heart rate (THR) for specific training zones.

Refer to your obook assess to complete this integrated research activity.

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PERFORMANCE

SKILL DRILL 5.4

Determine the importance of principles of training when developing a training program

By the end of this Skill drill, you should be able to:

- **recognise** and **explain** the seven principles of training
- **understand** the need to consider all principles of training when developing a training program.

Refer to your obook assess to complete this integrated research activity.

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PERFORMANCE

SKILL DRILL **5.5**

Determine the impact of volume, intensity and skill work on the development of a specialised movement sequence

By the end of this Skill drill, you should be able to:

- **understand** the need to adjust volume, intensity and skill work to achieve a determined outcome for a particular training phase
- **evaluate** the relationship between recovery time and intensity of training.

Refer to your obook assess to complete this integrated research activity.

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PERFORMANCE

SKILL DRILL **5.6**

Assess the importance of periodisation

By the end of this Skill drill, you should be able to:

- **recognise** and **explain** the key features of periodisation
- **assess** the role that each training phase plays in a training program.

Refer to your obook assess to complete this integrated research activity.

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PERFORMANCE

SKILL DRILL **5.7**

Evaluate the importance of a correctly structured warm up

By the end of this Skill drill, you should be able to:

- **recognise** and **explain** the features of a training session
- **understand** the importance of a correctly structured warm up.

Refer to your obook assess to complete this integrated research activity.

GLOSSARY

A

ability
the degree to which a person possesses the means to do something (i.e. their physical or mental ability) and/or the degree of proficiency or skill a person possesses (i.e. their talent)

active recovery
recovery through low-intensity movements that helps reduce heart rate

acute physiological adaptation
immediate changes in body structures and organs in response to exercise

adenosine triphosphate (ATP)
an energy-rich molecule found in the cells of every living organism that provides the energy required for most bodily functions (especially the muscle contractions that enable physical activity); ATP is made up of adenosine and three phosphate groups

aerobic
a term used to describe a chemical reaction that takes place with the presence of oxygen

aerobic capacity
the ability of the heart, lungs and circulatory system to supply oxygen and other nutrients to working muscles so that an athlete can exercise continuously for extended periods without tiring; one of the seven components of fitness

aerobic glycolysis
the process of breaking down glycogen in the presence of oxygen via the aerobic system

aerobic interval training (AIT)
a form of interval training that incorporates longer work periods and rest periods than other forms of interval training (i.e. HIIT and SIT)

aerobic system
an energy system that resynthesises ATP aerobically for use in low- to medium-intensity activities lasting longer than 90 seconds

aerobic training zone
a medium intensity training zone that allows for the development of the body's circulatory system

affordances
opportunities for action that present themselves to athletes in a performance environment. Affordances are provided by the environment or the task – but the ability to take advantage of them depends on the ability of the learner

agents of socialisation
the people in our lives from whom we learn the types of behaviours and values that are expected of us in society (e.g. parents and guardians, siblings, friends, teachers and coaches)

agility
the ability to move the entire body (or specific parts of the body) from one position to another, or from one direction to another, quickly and precisely; one of the seven components of fitness

amino acids
the building blocks of protein in our bodies and in the food we eat; they come from the food we eat and are also produced by the body

anaerobic
a term used to describe a chemical reaction that takes place without the presence of oxygen

anaerobic glycolysis
the process of breaking down glycogen without oxygen present via the lactic acid system

anaerobic training zone
a high-intensity training zone in which an athlete works above their lactate threshold in intervals

annual plans
an athlete's overall training plan for the year, which includes an overview of the physical activities that they need to train for and the times at which they must be in peak physical condition for competition. Annual plans can consist of one or more macrocycles

ATP cycle
a process that simultaneously releases the energy captured in ATP (i.e. by carrying out a chemical reaction that produces ADP and phosphate) and uses energy to resynthesise (i.e. remake) ATP (i.e. from ADP and phosphate)

ATP–PC system
an energy system that resynthesises ATP anaerobically for use in maximum-intensity activities lasting 0 to 15 seconds

attunement
the ability to perceive information in a performance environment and use it to identify available affordances

B

bias
prejudice for or against a particular person or group (especially in a way that could be considered unfair)

body and movement concepts
a group of four concepts used to develop specialised movement sequences and 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

C

cadence
the pace, timing or rhythm of an exercise (e.g. performing squats with a 1-down, 1-up or a 3-down, 1-up rhythm)

carbohydrates
a type of nutrient found in food and used as a source of energy; foods high in carbohydrates include grains (e.g. breakfast cereals), starchy vegetables (e.g. potatoes and peas), sugars, fruits and dairy products

cells
the basic building blocks of all living things; membrane-bound units that contain the fundamental molecules of life

chemical energy
a type of energy stored in the bonds of chemical compounds (e.g. atoms and molecules) of certain substances, such as food. Chemical energy is released through chemical reactions and transformed into other types of energy (e.g. mechanical energy)

chronic physiological adaptation
longer-term changes in body structures and organs in response to training

circuit training
a type of training method in which a variety of different activities are performed consecutively in rotation (i.e. a circuit)

circulatory system
a body system responsible for moving blood, oxygen and nutrients around the body (i.e. via the heart, veins, arteries and blood vessels)

code of behaviour
a document that sets out the expected standards of behaviour for members of a particular group, team or organisation (with a focus on stakeholders who publicly represent the team during training, competitions or club-sanctioned activities)

code of conduct
a document that outlines the principles, standards and rules of a particular group, team or organisation

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 instructs the muscles to perform these actions in a linear order (i.e. step-by-step)

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

commercialisation
the process of managing or running something (e.g. a sporting club or sporting code) primarily for financial gain

commodification
the process of turning something with social, cultural or artistic (i.e. non-monetary) value into a commodity (i.e. a product that can be bought and sold)

competition phase
a set period of time within a macrocycle dedicated to maintaining and optimising an athlete's energy, fitness and skill levels to enable them to compete

components of fitness
a series of seven categories used to identify specific aspects of an athlete's overall fitness (i.e. aerobic capacity, power, strength, speed, agility, muscular endurance, flexibility)

compound exercise
an exercise targeting two or more muscle groups over multiple joints

conditioning phase
a section within a training session devoted to targeting specific energy, fitness and skill objectives; the main part of a training session

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

constraints-led approach
an approach to teaching and learning that involves manipulating constraints in authentic game situations so that learners are challenged to find their own movement solutions to the problems they face (or the goals they want to achieve); as opposed to more traditional coaching techniques that favoured coach-directed technical drills performed in isolation outside authentic game situations

continuous training
a type of training performed at the same intensity for an extended period of time without periods of rest

cool down phase
a period of low to moderate physical activity (e.g. walking or jogging) conducted after vigorous exercise in order to reduce the chance of injury

corruption
a term used to describe dishonest or fraudulent conduct carried out by those in power (typically for personal financial gain); in sport, it also includes any unethical or illegal activity that aims to deliberately change or alter the result of a sporting contest

D

data
information collected for reference, analysis and evaluation

distress
a bad form of stress that leads to injury, illness or exhaustion

doping
the use of banned performance-enhancing drugs by athletes and competitors during training or competition

duration
a principle of training that states the length of training time should be appropriate for the selected sport or physical activity

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

dynamic flexibility training
a type of flexibility training that involves stretching body parts and muscles in a controlled way, gradually increasing reach and/or speed of movement

dynamic models of learning
theories that sit within the broader theoretical framework of the dynamic systems approach and explain and predict how certain aspects of motor learning and movement take place

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 systems theory
a dynamic model of learning that focuses on how a learner's motor control system interacts with the environment and produces movements that will maximise the chances of success

E

ecological model
one of two main dynamic models of learning used to explain and predict how certain aspects of motor learning and movement take place; the ecological model focuses on how a learner's motor control system interacts with the environment in order to simultaneously 'perceive and act' and 'act and perceive' to identify opportunities and produce movements that will maximise the chances of success

enabler
a factor that encourages a person to participate in a sport or physical activity

energy
(in the context of sport and physical activity) power derived from fuels (e.g. foods we eat) and used by the body to perform basic bodily functions and produce movement

energy systems
a system used by the body to provide the energy required to resynthesise ATP and ensure that the body has the energy it needs to take part in physical activity. There are three main energy systems used by the body – the ATC–PC system, the lactic acid system, and the aerobic system

environmental constraints
any characteristic of the environment that an athlete needs to overcome or adapt to; they can include physical environmental constraints (e.g. weather, light, noise) and social environmental constraints (e.g. parents, peers, coaches, cultural norms)

equality
a concept that relates to being equal in terms of status, rights or opportunities; it means striving for fairness and justice by treating people the same (regardless of their personal differences)

ethical decision-making framework
a five-stage tool that provides a set of simple, practical tips and recommendations that can be used as a guide when responding to any ethical dilemma

ethical dilemmas
situations in which a difficult choice must be made between two options, when neither option will result in an outcome that is ethically or morally acceptable; in physical education, ethical dilemmas are determined by the interactions between your values and principles, and your purpose for engaging in physical activity

ethical values
a term used to describe a specific group of principles, characteristics or standards of behaviours that most people in a community or society would associate with ethical behaviour

ethics
a system of principles and values (i.e. standards of behaviour) that develop within a social group and by which actions are judged to be 'good' or 'bad'; 'right' or 'wrong'

ethics strategies
any plans of action created with the goal of promoting ethical values, ethical behaviours and fair play

eustress
a good form of stress that leads to physiological adaptation

exercise physiology
a specialised field of physiology that studies the short- and long-term effects of exercise on the human body

exploitation
the act of treating someone or something unfairly in order to gain an advantage or benefit

F

fair competition
observing the rules of a sport and complying with codes of conduct and behaviour; it relies on referees and officials acting fairly and without bias

fair play
following the written and unwritten rules of competition and showing respect, fairness, friendship and tolerance to others (both on and off the field)

fartlek training
a variation of continuous training in which athletes vary the intensity of their exercise by increasing the speed or resistance of their work (e.g. by adding incline, running on sand, running up stairs)

fats
a type of nutrient found in food and used as a source of energy; foods high in fat include oils, nuts, dairy products (e.g. milk, cheese), avocados, some cuts of meat and oily fish

fatty acids
the building blocks of the fat in our bodies and in the food we eat; they come from the food we eat and are also produced by the body

fitness
a term used to describe the condition of being physically fit and healthy, as well as a person's ability to participate effectively in a particular sport or physical activity

fitness–fatigue model
a theory that explains that the body responds to every training session by experiencing a 'fitness effect' and a 'fatigue effect' simultaneously, and it is the relationship between the two that determines when an athlete will benefit from training again

fitness profile
a table of fitness-based values designed to help individual athletes understand their overall fitness level (by providing data on a range of components of fitness) and design an appropriate training strategy

flexibility
the ability of a joint to move through its full range of motion; one of the seven components of fitness

flexibility training
a type of training that involves stretching the muscles, tendons and ligaments in and around joints

frequency
a principle of training that states the number of times training occurs in a given period should be appropriate for the selected sport or physical activity

G

game analysis
the process of observing, recording and analysing performance and skill data from a selected game, sport or physical activity so that this information can be used to design relevant and appropriate training activities

gender exclusion
the action or state of restricting or excluding people from a sporting club, association or code based on their gender or sex

gender inclusion
the action or state of welcoming or including people in a sporting club, association or code, regardless of their gender or sex

General Adaptation Syndrome (GAS)
a theory that explains that the body responds to stress in three phases – alarm, resistance, exhaustion; it states that positive stress (i.e. eustress) results in chronic physiological adaptation and that negative stress (i.e. distress) results in exhaustion

globalisation
a term used to describe the increasing interconnection and interdependence of countries around the world (on a range of economic, cultural, political and environmental issues)

glucose
a simple sugar that is commonly found in many carbohydrates and used as an energy source by the body

glycogen
a substance stored in body tissue that comes from carbohydrates (i.e. a stored form of glucose)

glycolysis
the process of breaking down glycogen in order to resynthesise ATP

gross domestic product (GDP)
a measure of the market value of all the goods and services produced in a period of time

H

haemoglobin
a protein-based molecule in the blood that carries oxygen

heart rate recovery
a measure of the rate at which the heart returns to normal resting levels (in beats per minute) between periods of exercise

high-intensity interval training (HIIT)
a form of interval training that alternates short, intense, unsustainable bursts of anaerobic zone exercise (lasting less than 20 seconds) with short recovery periods

I

individuality
a principle of training that states the personal needs, goals, fitness levels, motivation and skills of individual athletes should be considered when designing a training program

initial training values
the quantitative measurement of training that you can realistically manage at the start of any training program (number of repetitions, work volume, intensity, W:R, duration, sets)

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

integrity
the quality of having strong morals and personal values (e.g. honesty, loyalty, respect for others, trustworthiness, fairness)

intensity
a principle of training that states the magnitude of exertion (i.e. how hard an athlete trains) should be appropriate for the selected sport or physical activity

inter-session recovery
the recovery that takes place in between one training session and another training session

interval training
a type of training that manipulates periods of work and rest to enhance a specific component of fitness and target a particular energy system

intra-session recovery
the recovery takes place within a single a training session (e.g. between sets)

isokinetic resistance training
a type of resistance training in which movement against a resistance maintains a constant speed, no matter how much force is applied

isolated exercise
an exercise targeting a single group of muscles over a single joint

isometric (static) resistance training
a type of resistance training in which the muscle contraction is static (i.e. there is tension in the muscle but no movement across the joint)

isotonic (dynamic) resistance training
a type of resistance training in which the muscle contraction is dynamic (i.e. there is tension in the muscle and movement across the joint) against a constant resistance

K

kilojoules (kJ)
a standard unit of measure used to describe the energy content of different types of foods

L

lactate
a component of lactic acid that remains after hydrogen ions (i.e. the acidic component of lactic acid) are separated

lactate threshold
the point at which lactic acid (i.e. lactate and hydrogen ions) begins to accumulate in the muscles at a faster rate than it can be removed (in the blood)

lactate threshold training zone
a specific zone in which the athlete trains at or just under their lactate threshold

lactate turn point (LTP)
a term used to describe the point at which the accumulation of lactic acid (i.e. lactate and hydrogen ions) results in negative effects (e.g. prevents the muscle fibres from contracting properly) and fatigue

lactic acid system
an energy system that resynthesises ATP anaerobically for use in high-intensity activities lasting 15 to 90 seconds

lactic acid
a by-product of anaerobic glycolysis that is created when glucose is partially broken down to provide energy for ATP resynthesis

learner constraints
any characteristic of the individual (i.e. personal attribute) that an athlete needs to overcome or adapt to; they can include structural learning constraints (e.g. height, weight, physical strength, fitness level) and functional learner constraints (e.g. confidence, motivation, concentration, anxiety)

loading
an increase in work volume and/or intensity of work, placing the athlete's body under stress

loading–recovery pattern
the relationship between loading and recovery, expressed as a ratio

long slow distance (LSD) training
a type of continuous training performed at a steady, low- to moderate-intensity over an extended distance or duration

M

macrocycles
the training period from the beginning of the preparatory training phase to the end of a transition training phase within an annual plan

mass media
a collection of technologies (i.e. print, broadcast, digital) that are used to communicate messages to very large numbers of people

match fixing
the action or practice of dishonestly determining the outcome of a match before it is played (usually for financial gain or with the intention of influencing a betting outcome)

maximum heart rate (MHR)
the highest number of times (i.e. beats) your heart is capable of pumping per minute during exercise

mechanical energy
a type of energy that an object has when it is moving

mesocycles
training periods, generally 4 to 6 weeks in duration, with a specific training focus

microcycles
training periods, generally 7 to 10 days in duration, with a specific training focus

molecule
a group of two or more atoms that are bonded together

morals
ideals or standards of behaviour that a person may try to follow or live up to in order to be considered 'good' and 'right' by other members of a society (e.g. being honest, showing respect for others, being faithful, showing kindness)

motor control system
a term used to describe a range of body systems that work together in order to regulate the production of movements (i.e. nervous system, muscular system, skeletal system, etc.)

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

movement strategies
a variety of approaches that assist a player or team to successfully achieve a movement outcome or goal (e.g. moving into space to receive a pass or hitting a ball away from opponents to make it difficult to retrieve or return)

multimodal presentation
a presentation comprising more than one media or component

multinational
a term used to describe clubs, companies or organisations that operate in many different countries

muscular endurance
the ability to sustain or repeat a series of muscle contractions without fatigue; one of the seven components of fitness

muscular system
a body system responsible for movement (i.e. via the muscles and tendons)

N

norms
a standard or pattern of behaviour that is acceptable or expected within a particular social group (e.g. family, club, society)

nutrients
components of food that are absorbed and used by the body to provide energy for physical activity and support the growth, repair and proper functioning of cells, organs and body systems

O

overtraining
training excessively

P

para-sport
any sport played by people with a disability or impairment (including physical, vision, hearing, intellectual)

passive flexibility training
a type of flexibility training that involves having another person stretch body parts and muscles through a full range of motion and holding them in that position for you

passive recovery
recovery where the body is inactive

peak
an optimal state of athletic readiness aimed at the highest possible performance

perception–action coupling
a process that involves interpreting or giving meaning to information from the environment (i.e. perception) and linking this with a specific movement (i.e. action). This concept suggests that perceiving information and producing an action is a simultaneous two-way relationship (i.e. action influences perception at the same time as perception influences action)

periodisation
the process of dividing an annual training plan into a series of smaller, more manageable periods of time (known as macrocycles, training phases, mesocycles, microcycles and training sessions). Each period of time is designed to target specific training objectives over a specific period of time

personal values
the principles or standards of behaviour that guide how an individual lives their life; a person's judgment on what is important in life (e.g. honesty, fairness, trustworthiness)

phosphocreatine (PC)
a substance found in the body that is broken down via the ATP–PC system in order to resynthesise ATP

physiological adaptation
when normal functioning of the human body adjusts to new energy and fitness conditions

physiology
a field of science that studies the functions and mechanisms at work within living organisms (e.g. humans, animals and plants)

Play by the Rules
a national organisation that provides support and resources to help all Australians embrace the concept of fair play

plyometric training
a type of resistance training that involves rapid concentric (i.e. shortening) movements of muscle groups followed by rapid eccentric movements (i.e. lengthening) of the same muscle groups

point of failure
the moment when no more muscle fibres can be recruited to engage in an activity (e.g. the moment an athlete cannot perform any more bicep curls)

positive engagement
participation in sport and physical activity that sets a good example, both for those who play and watch the sport, and for the wider community

power
the ability to exert maximum force in the shortest amount of time; one of the seven components of fitness

pre-competition phase
a set period of time within a macrocycle dedicated to optimising the athlete's position or event-specific energy, fitness and skill levels

preparatory phase
a set period of time within a macrocycle dedicated to increasing the athlete's general level of fitness

preparedness
an athlete's level of readiness to achieve physiological adaptation from training

principles of decision-making
a set of guidelines (i.e. cognitive processes) that can be used to help individual athletes or teams make the best and most appropriate decisions in performance environments

principles of play
a set of movement strategies that can be used to help individual athletes or teams adapt to any tactical situation in performance environments

principles of training
a set of guidelines that should be considered in the development, design and evaluation of a training program. The principles of training include: specificity, frequency, intensity, duration, progressive overload, individuality, variety

progressive overload
a principle of training that states that training should be planned to ensure gradual increases in training load to ensure that physiological adaptation is appropriate for the selected sport or physical activity

proprioceptive neuromuscular facilitation (PNF) flexibility training
a type of flexibility training that involves stretching body parts and muscles through a full range of motion passively (i.e. with the assistance of another person), followed by the athlete pushing against the resistance, and then another round of passive stretching that pushes the stretch a little beyond the previous range of motion

protein
a type of nutrient found in food and used as a source of energy; foods high in protein include meat, eggs and dairy products, as well as grains, legumes, nuts and seeds

Q

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)

R

RAMP approach
a specific warm up technique aimed at: raising body temperature, heart rate, respiration rate and joint viscosity; activating and mobilising key muscle groups, joints and range of motion; and preparing for exercise by incorporating dynamic stretching

rate limiters
types of constraints that have a negative effect on the development of motor skills in an individual and may restrict performance; rate limiters can be related to the task, the learner or the environment

recovery
the process of an athlete's body returning to its normal state; for example, a fatigued athlete's muscles beginning to feel normal again, and their breathing rate slowing to a normal rate

recovery training zone
a low intensity training zone that allows for the recovery and adaptation of the body's structures following a bout of high-intensity work

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

repetition duration
the amount of time it takes to perform one repetition of an exercise (e.g. the repetition duration of a bicep curl is commonly around three seconds)

repetition maximum (RM)
the most weight an individual can lift for a defined number of repetitions

resistance training
a type of training that requires an athlete to work against something that resists the movement of the body (or particular body parts)

respect
a feeling of admiration towards a person (or thing) based on their abilities, qualities or achievements

respiratory system
a body system responsible for the inhalation and exhalation of air (i.e. via the lungs, trachea, mouth and nasal passage)

resynthesise
to put different elements back together again after being broken apart

risk management
the identification, assessment and implementation of control measures designed to reduce or remove potential safety and wellbeing hazards

S

self-organisation
a process in which many different systems and organs in the body interact dynamically with each other (in response to constraints) to achieve a goal or establish a movement pattern that is stable

sledging
the practice of making taunting or teasing remarks to an opposing player, especially a batsman, in order to disturb their concentration

slippery slope trap
a series of small unethical actions (e.g. 'bending the rules') that can develop into more serious unethical behaviour over time

space awareness
a body and movement concept; space awareness relates to the relationship between the body and its surroundings (i.e. the space around it)

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

specialising
concentrating on, and becoming good at, one physical activity only

specificity
a principle of training that states the type of exercise used in training should be relevant (i.e. specific) to the energy systems, position-specific movements, and the fitness requirements of the selected sport or physical activity

speed
the ability to move the entire body (or specific parts of the body) quickly; one of the seven components of fitness

Sport Australia
a federal government agency in Australia responsible for providing strategic leadership and allocating funding for sporting activities at a national level (formerly known as Australian Sports Commission)

sprint interval training (SIT)
a form of interval training that alternates periods of high-intensity sprints with rest periods

stakeholder
a person (or group of people) who has an interest, connection, concern or investment in something (e.g. stakeholders in a sporting team may include the players, coaching staff, administrative staff, members, spectators, sponsors and investors)

static flexibility training
a type of flexibility training that involves stretching body parts and muscles through a full range of motion and holding them in that position for a period of time with nothing but the use of the agonist muscle (i.e. no assistance)

strength
the ability of a muscle (or muscles) to exert force by contracting against resistance; one of the seven components of fitness

sweatshop
a factory or workshop (especially in the clothing industry), where manual workers are employed at very low wages for long hours and under poor conditions

T

tactical awareness
an athlete's ability to identify and interpret what is happening within a game situation to help them select, adapt and apply the best physical responses and increase their chances of success

tactical strategy
an approach that assists a player or team to successfully optimise performance through the application of specialised movement sequences and movement strategies

tapering
the gradual reduction of work volume and/or intensity of training in the lead up to a major competition in order for the athlete to peak

target heart rate (THR)
the heart rate you aim to train at during exercise

task constraints
any characteristic of a task that an athlete needs to overcome or adapt to (e.g. the rules of a game, the size or shape of the equipment, the size and shape of the playing surface)

team spirit
a term used to describe feelings of pride, loyalty and solidarity shared among the members of a group, enabling them to cooperate and work together as a single unit

tempo training
a type of continuous training performed just under an athlete's lactate threshold

training
(in the context of sport and physical activity) the specific tasks an individual completes to enhance their energy and fitness in preparation for their chosen physical activity

training load
the combination of work volume and intensity; a general measure of the overall difficulty of the training

training methods
forms of exercise that can be selected and used to target particular components of fitness and performance (i.e. continuous training, fartlek training, resistance training, interval training, flexibility training, circuit training)

training objectives
the specific energy, fitness and skill outcomes that athletes aim to achieve through training

training phases
four distinct stages of training that combine to make an annual plan. Each training phase is designed to target a specific training objective over a specific period of time. There are four main training phases: the preparatory phase, the pre-competition phase, the competition phase and the transition phase

training program
a series of training events/activities planned over a specific period of time (e.g. 1 week, 2 months, 1 year), designed to help an individual or team achieve a range of energy, fitness and skill goals. The features of training programs include: specific training objectives; game analysis; work volume (frequency and duration), intensity; tapering and recovery

training session
a specific period of time (e.g. 60 minutes) devoted to energy, fitness and skill training

training strategies
plans developed to improve the performance of an athlete or to help them achieve a goal; training strategies consider the personal requirements of an athlete (e.g. their individual physical and mental characteristics), as well as the requirements of their chosen physical activity (e.g. the physical demands, skills, strategies and techniques needed)

training zones
the range of intensity within which an athlete should train (depending on their training objectives) in order to target their anaerobic or aerobic fitness

transition phase
a set period of time within a macrocycle dedicated to giving the athlete a physical and mental rest from energy and fitness training

triglycerides
the main constituents of natural fats and oils, as well as the chemical form of fat stored by the body; they come from the food we eat and are also produced by the body

U

unloading
a decrease in work volume and/or intensity of work, reducing the stress placed on the athlete's body

unwritten rules
a set of expectations, qualities or values that are known and understood by a group but have not been formally documented

V

variety
a principle of training that states a range of different training activities, movement options and training contexts should be included in a training program

VO_2 max
a measure of an individual's maximum oxygen consumption during intense physical activity

W

warm up phase
a period, or act, of preparation for a match, performance, or exercise session, involving gentle exercise or practice

work volume
a general measure of how much exercise an athlete does; a combination of the frequency and duration of the training activities undertaken

written rules
the formally documented regulations governing a sportIndex

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