



# Practical Skills in Sport and Exercise Science

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Sport and exercise science is a fast-evolving discipline within the sciences. Its foundations began within physical education and evolved through health and physical education and the study of human movement science and kinesiology to become a stand-alone discipline within the sciences. As the discipline has evolved, the number and complexity of the practical skills required of professionals in the field have developed.

While practical work forms the cornerstone of all scientific knowledge, the training required in sport and exercise science is wide, covering the areas of physiology, kinanthropometry, biochemistry, statistics and nutrition, as well as the generic skills of working in teams, critical thinking, information literacy and communication. To be successful in these areas, students must develop a number of specific skills and abilities, ranging from those required to observe, measure, record and calculate accurately, to those associated with operating equipment in both the laboratory and the field. Students must also develop an ability to communicate information effectively in both written and verbal form. This book aims to provide support and guidance that will help students of exercise and sport science to maximise the development of their skills and abilities in all these areas.

The book has been written for students taking undergraduate and postgraduate degree courses in exercise and sport science. However, it will also be relevant to those taking related courses such as clinical dietetics, biomedical science, allied health and medicine. As with the other books in the *Practical Skills* series, we have tried to write in a concise and user-friendly style, giving key points and definitions, real-world illustrations and worked examples, tips and hints, 'how to' boxes and checklists – all designed to assist the student to become a better practitioner.

The book is a labour of love for the authors. The material included in *Practical Skills in Sport and Exercise Science* has been selected on the basis of our extensive teaching background and professional experience in working with both athletes and the general population as sport and exercise scientists. We hope that students will find this book useful in both the laboratory and the field, as well as in clinical and industry placements and during project and research work. The book is not intended to replace conventional laboratory handbooks or study guides, but to

provide information that will help students to maximise their learning. The book covers a wide range of general procedures such as preparing graphs, presenting research projects and tackling statistical analyses. We hope that lecturers will find that the text is an effective way to supplement the information given in practical classes, by acting as a highly comprehensive resource that exercise and sport science students can use across their whole degree programme and beyond as a 'must have' reference guide on their shelves.

*Practical Skills in Sport and Exercise Science* also aims to support the development of a broad range of skills. There are chapters dealing with the evaluation of information, the use of online resources and technologies, revision and examination skills. Given the breadth of material covered, we have tried to focus on the broad principles and key points, rather than providing recipe-like solutions for every potential scenario. However, each chapter is supported by a section giving key sources for further study, including Websites and conventional printed texts or key papers relevant to the topics discussed.

The writing of a comprehensive book such as this is demanding on both time and energy. It is also a team effort for all those involved. We would like to take this opportunity to thank the following colleagues and friends who have provided resources, comments, ideas and constructive feedback at various points during the writing of this book: Aaron Coutts, Greg Rowsell, Aaron Scanlan, Rob Stanton, Bill Aspden, Mitch Duncan, David Kelly and Jonathon Brown. To the Pearson Education team, especially Rufus Curnow and Dawn Phillips, thanks for your guidance and professionalism in working with us from afar. Finally, to our wives, partners and children, especially Claire, Rebecca and Megan Reaburn, Katie Dakin, Polly Reed, Angela Jones and Mary Weyers, a heartfelt thanks. This one's for you.

PETER REABURN

BEN DASCOMBE

ROB REED

ALLAN JONES

JONATHAN WEYERS

Key Points highlight critical features of methodology.

Safety Notes highlight specific hazards and appropriate practical steps to minimise risk.

## 23 Your approach to practical work

Developing practical skills – these will include:

- designing experiments
- observing and measuring
- recording data
- analysing and interpreting data
- reporting/measuring.

Using textbooks in the lab – take this book along to the relevant classes, so that you can make full use of the information during the practical sessions.

**SAFETY NOTE** Mobile phones should never be used in a lab class, as there is a risk of interfering with laboratory equipment. Always switch off your mobile phone before entering a laboratory. Conversely, they are an extremely useful accessory for fieldwork.

Getting to grips with human ethics – in addition to any moral implications of your lab practicals and research projects, you may have the opportunity to address broader issues within your course (see Box 23.1). Sport and exercise scientists should always consider the risks and consequences of their work, and it is therefore important that you develop an appreciation of these issues alongside your academic studies.

**KEY POINT** You will get the most out of practicals if you prepare well in advance. Do not go into a practical session assuming that everything will be provided, without any input on your part.

The main points to remember are:

- Read any handouts in advance: make sure you understand the purpose of the practical and the particular skills involved. Does the practical relate to, or expand upon, a current topic in your lecture? Is there any additional preparatory reading that will help?
- Take along appropriate textbooks, to explain aspects in the practical.
- Consider what safety hazards might be involved, and any precautions you might need to take, before you begin (p. 158).
- Listen carefully to any introductory guidance and note any important points: adjust your schedule/handout as necessary.
- Organise your bench space during the practical session – make sure your lab book is adjacent to, but not within, your working area. You will often find it easiest to keep clean items of glassware etc. on one side of your working space, with used equipment on the other side.
- Write up your work as soon as possible, and submit it on time, or you may lose marks.
- Catch up on any work you have missed as soon as possible – preferably before the next practical session.

**Ethical and legal aspects**

You will need to consider the ethical and legal implications of sports and exercise science at several points during your studies:

- Safe working means following a code of safe practice, supported by legislation, alongside a moral obligation to avoid harm to yourself and other, as discussed in Chapter 24. For sport and exercise science, this can mean only performing methods for which you are competent and are appropriately resourced.
- All exercise science methods should comply with generally accepted moral and scientific standards, and conform to existing procedures and standards.

Fundamental laboratory techniques 153

## 1 The importance of transferable skills

Skills terminology – different phrases may be used to describe transferable skills, depending on place or context. These include:

- UK: core skills, key skills, common skills, transferable skills;
- Australia: generic skills, graduate attributes, key competencies, employability skills;
- New Zealand: essential skills;
- Canada: employability skills;
- US: basic skills, necessary skills, workplace know-how.

Transferable skills are those skills that apply across a variety of jobs and life contexts. They are known by many other names, depending on the country in which you are studying. Transferable skills are taking on increased importance in many countries. Employers across all industries now seek to ensure business success by recruiting and retaining employees who have a variety of skills and personal attributes, as well as the specific technical skills required in exercise and sport science.

Transferable skills are increasingly important because jobs today require flexibility, initiative and the ability to undertake many different tasks. Jobs are not as narrowly prescribed as in the past and are generally more service-oriented, making information and social skills increasingly important. Universities and colleges are also interested in the development of transferable skills as they encourage learners to be more reflective and self-directed.

This chapter outlines the range of transferable skills and their significance to sport and exercise scientists. It also indicates where practical skills fit into this scheme. Having a good understanding of this topic will help you to place your work at university in a wider context. You will also gain an insight into the qualities that employers expect you to have developed by the time you graduate. Awareness of these matters will be useful when carrying out personal development planning (PDP) as part of your studies.

**The range of transferable skills**

Tables 1.1 and 1.2 provide a comprehensive listing of university-level transferable skills under up to eight skills categories. There are many possible classifications – and a different one may be used in your institution or field of study. Note particularly that ‘learning skills’, while important, and rightly emphasised at the start of many courses, constitute only a subset of the skills acquired by most university students.

The phrase ‘Practical Skills’ in the title of this book indicates that there is a special subset of transferable skills related to work in the laboratory or field. However, although this text deals primarily with skills and techniques required for laboratory practicals, fieldwork and associated studies, a broader range of material is included. This is because the skills concerned are important, not only in sport and exercise sciences but also in the wider world. Examples include time management, evaluating information and communicating effectively.

**KEY POINT** Sport and exercise science is essentially a practical area of study, and therefore involves highly developed laboratory and field skills. The importance that your lecturers place on practical skills will probably be evident from the large proportion of curriculum time you will spend on practical work in your course.

The word ‘skill’ implies much more than the robotic learning of, for example, a laboratory procedure. Of course, some of the tasks you will be asked to carry out in practical classes will be repetitive. Certain

Using course materials – study your course handbook and the schedules for each practical session to find out what skills you are expected to develop at each point in the curriculum. Usually the learning objectives/outcomes (p. 24) will describe the skills involved.

Example: The skills involved in teamwork cannot be developed without a deeper understanding of the inter-relationships involved in successful groups. The contact will be different for every group and a flexible approach will always be required, according to the individuals involved and the nature of the task.

Study and examination skills 3

Tips and Hints provide useful hints and practical advice, and are highlighted in the text margin.

## 32 Measuring hydration status and body temperature

**Definitions**

**Euhydration** – normal state of body water content (absence of dehydration or hyperhydration).

**Dehydration** – a state of water loss sufficient to cause intravascular volume deficits leading to orthostatic symptoms.

**Hyperhydration** – a state of excess water content of the body.

**Plasma osmolality** – a measure of the concentration of substances such as sodium, chloride, potassium, urea and glucose in the blood.

**Urine specific gravity** – the density (mass per volume) of a urine sample compared to pure water.

Body water balance is the net difference between fluid intake and fluid loss. Large variations in fluid intake are controlled by the kidneys, which can produce more or less urine depending on changes in body water volumes.

The routes of water intake are gastrointestinal, from food and fluids consumed, and metabolic from biochemical reactions. The routes for water loss are the urinary system via the kidney (urine), the respiratory system via the lungs and respiratory tract (water vapour in breath), the skin (sweat) and the gastrointestinal system (faeces and vomit).

Minor changes in daily water balance are easily restored. However, exercise and environmental stress can dramatically alter the body's water balance, homeostatic mechanisms, sports performance and overall health. Thus, assessment of both hydration status and body temperature is an important skill for the sport and exercise science student to learn.

**KEY POINT** Hydration assessment techniques vary greatly in their applicability because of methodological limitations such as the circumstances for measurement (reliability), ease and cost of application (simplicity), sensitivity for detecting small changes in hydration status (accuracy) and the level of dehydration anticipated.

**Hydration status**

The techniques used by sport and exercise scientists to assess hydration status are summarised in Table 32.1.

**Table 32.1 Summary of hydration assessment techniques**

Technique	Advantages	Disadvantages
<b>Complex markers</b>		
Table/body water (dilution)	Accurate, reliable, 'gold standard'	Complex procedure, expensive, needs baseline
Plasma osmolality	Accurate, reliable, 'gold standard'	Complex procedure, expensive, invasive
<b>Simple markers</b>		
Urine concentration	Easy, rapid, screening tool	Tinting critical, subjective colour, many confounding factors
Body mass	Easy, rapid, screening tool	Confounded over time by changes in body composition
<b>Other markers</b>		
Plasma volume	No advantages over osmolality except plasma sodium as a marker of hypernatremia	Complex procedure, expensive, invasive, many confounding factors
Plasma sodium	Easy, rapid	Requires an initial baseline measure, many confounding factors
Fluid balance (urine)	Easy, rapid	Highly variable, many confounding factors
Saliva (osmolality)	Easy, rapid	Top generalised, subjective
Physiological signs such as: <ul style="list-style-type: none"> <li>oedema and haemorrhage</li> <li>Thirst</li> </ul>	Easy and reliable	Develops poor tests and quenched test soon

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Definitions of key terms and concepts are highlighted in the margin.



## Acknowledgements

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### Tables

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### Text

Box 27.1 from Pre-exercise screening system 2005: Sports Medicine Australia (SMA) – Stage 1 Questionnaire, Sports Medicine Australia.

### Photographs

(Key: b-bottom; c-centre; l-left; r-right; t-top)

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## **Study and examination skills**

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# 1 The importance of transferable skills

**Skills terminology** – different phrases may be used to describe transferable skills, depending on place or context. These include:

- UK: core skills, key skills, common skills, transferable skills;
- Australia: generic skills, graduate attributes, key competencies, employability skills;
- New Zealand: essential skills;
- Canada: employability skills;
- US: basic skills, necessary skills, workplace know-how.

Transferable skills are those skills that apply across a variety of jobs and life contexts. They are known by many other names, depending on the country in which you are studying. Transferable skills are taking on increased importance in many countries. Employers across all industries now seek to ensure business success by recruiting and retaining employees who have a variety of skills and personal attributes, as well as the specific technical skills required in exercise and sport science.

Transferable skills are increasingly important because jobs today require flexibility, initiative and the ability to undertake many different tasks. Jobs are not as narrowly prescribed as in the past and are generally more service-orientated, making information and social skills increasingly important. Universities and colleges are also interested in the development of transferable skills as they encourage learners to be more reflective and self-directed.

This chapter outlines the range of transferable skills and their significance to sport and exercise scientists. It also indicates where practical skills fit into this scheme. Having a good understanding of this topic will help you to place your work at university in a wider context. You will also gain an insight into the qualities that employers expect you to have developed by the time you graduate. Awareness of these matters will be useful when carrying out personal development planning (PDP) as part of your studies.

## The range of transferable skills

Tables 1.1 and 1.2 provide a comprehensive listing of university-level transferable skills under up to eight skills categories. There are many possible classifications – and a different one may be used in your institution or field of study. Note particularly that ‘learning skills’, while important, and rightly emphasised at the start of many courses, constitute only a subset of the skills acquired by most university students.

The phrase ‘*Practical Skills*’ in the title of this book indicates that there is a special subset of transferable skills related to work in the laboratory or field. However, although this text deals primarily with skills and techniques required for laboratory practicals, fieldwork and associated studies, a broader range of material is included. This is because the skills concerned are important, not only in sport and exercise sciences but also in the wider world. Examples include time management, evaluating information and communicating effectively.

**Using course materials** – study your course handbook and the schedules for each practical session to find out what skills you are expected to develop at each point in the curriculum. Usually the learning objectives/outcomes (p. 24) will describe the skills involved.

**Example** The skills involved in team-work cannot be developed without a deeper understanding of the inter-relationships involved in successful groups. The context will be different for every group and a flexible approach will always be required, according to the individuals involved and the nature of the task.

**KEY POINT** Sport and exercise science is essentially a practical area of study, and therefore involves highly developed laboratory and field skills. The importance that your lecturers place on practical skills will probably be evident from the large proportion of curriculum time you will spend on practical work in your course.

The word ‘skill’ implies much more than the robotic learning of, for example, a laboratory procedure. Of course, some of the tasks you will be asked to carry out in practical classes *will* be repetitive. Certain



## The importance of transferable skills

**Table 1.1** Summary of Australian Chamber of Commerce and Industry and Business Council of Australia transferable skills (Australian Chamber of Commerce and Industry and Business Council of Australia, 2002)

Transferable skills	Relevant chapters in this textbook
<i>Communication skills</i> that contribute to productive and harmonious relations between employees and customers	4, 7, 10, 11, 12, 13, 14, 15, 16, 17, 22, 47, 48
<i>Teamwork skills</i> that contribute to productive working relationships and outcomes	3, 16, 17, 21, 22
<i>Problem-solving skills</i> that contribute to productive outcomes	8, 9, 10, 11, 12, 16, 17, 18, 21, 22, 52, 53, 54
<i>Initiative and enterprise skills</i> that contribute to innovative outcomes	3, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 21, 22, 52, 53, 54
<i>Planning and organising skills</i> that contribute to long-term and short-term strategic planning	2, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22, 26, 46, 47, 48, 50, 54
<i>Self-management skills</i> that contribute to employee satisfaction and growth	2, 3, 4, 5, 7, 8, 9, 14, 15, 16, 17, 22, 47, 48
<i>Learning skills</i> that contribute to ongoing improvement and expansion in employee and company operations and outcomes	4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 21, 22
<i>Technology skills</i> that contribute to effective execution of tasks	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 46, 47, 48, 49, 50, 51

**Table 1.2** Example of a university list of transferable skills (taken from CQUniversity's Management Plan for Teaching and Learning, 2006–2011)

Generic skills	Attributes
Monitor the environment, develop strategies and capitalise on change	Enthusiasm for and commitment to their work
Acquire, evaluate and use information effectively	Self-confidence in managing themselves and others
Solve problems and apply scientific reasoning	Critical, creative and strategic thinking
Use information technology	Ethical behaviour towards others
Apply discipline-related theory to practice in both familiar and unfamiliar situations	Capability in and commitment to upholding professional values and ethics
Function effectively as team members and as team leaders	Commitment to learning throughout life
Communicate effectively	Willingness to challenge current knowledge and thinking
	Frequent reflection on and realistic evaluation of their performance and their plans to achieve personal and professional goals
	Readiness to participate in and ambition to lead regional and global societies, in both professional and personal roles

techniques require a high level of skill and attention to detail if accuracy and precision are to be attained, and the necessary competence often requires practice to make perfect. However, a deeper understanding of the context of a technique is important if the skill is to be appreciated fully and then transferred to a new situation. That is why this text is not simply a 'recipe book' of methods and why it includes background information, tips and worked examples.

### Transferability of skills

Transferable skills are those that allow someone with knowledge, understanding or ability gained in one situation to adapt or extend this for application in a different context. In some cases, the transfer of a skill is immediately obvious. Take, for example, the ability to use a