

HOW DOES THE ACQUISITION OF SKILL AFFECT PERFORMANCE?

The ability of individuals to experience, learn and refine motor skills greatly affects their ability to perform any physical activity. This chapter explores the processes that individuals undertake when learning a new skill and how these processes can be adapted to help individuals learn these skills more easily and quickly. It also examines the ways in which movement can be assessed.

I - Learning skills

There is a variety of views about how learning actually occurs. Basically, we learn in three main ways:

- cognitive learning—learning by receiving knowledge and information
- affective learning—learning on a social level (for example, by developing ideas of fair play and self-esteem)
- motor learning—learning by acquiring physical motor skills. In a discussion of sports performance, motor learning is of greatest importance, but cognitive learning and affective learning cannot be overlooked. For example, learning complex set plays in the game or cooperating as a team member are extremely important aspects of performance.

A skill can be defined simply as an act or task; for example, driving a car. We can also use the term to indicate the quality of a performance; for example, when we say that Michael Clarke is a skilled cricketer. Driving a car, playing golf or reading this book all require certain skills necessary to perform the specific activity. Learning and performing skills forms a huge part of our lives.

When you watch an elite sportsperson playing sport, think of all the physiological and psychological reactions and changes that are occurring in his or her body. The sportsperson has learnt to play his or her sport very well. How did the person do that? What made the sportsperson such a good player? What does the sportsperson think about during the performance? What pre-game meal did the sportsperson eat? These are precisely the type of questions sports scientists ask about athletes. They analyse every aspect of athletes' performances, using their thorough knowledge of sports science to inform their analysis.

Many of us have been in the situation where we have invited friends along to play our favourite sport—a sport that we have practised for years, but which the visitors have never played—and find that our friends (at their first attempt) are almost as good as we are (after years of practice). This sort of experience makes us consider questions that are similar to those posed by sports scientists:

- Why does it take some people days to learn a mathematical concept, while other people grasp it in a few minutes?
- What makes an 'all-round athlete'—a person who appears to excel at every sport he or she attempts?
- How was Martina Navratilova able to stay at the top of women's tennis for so many years?

The answer to such questions lies in an understanding of the major factors that affect the acquisition of skills. These factors include the:

- stages of skill acquisition
- characteristics of the learner
- environment.

II - The stages of skill acquisition

What is the difference between your tennis serve and that of Serena Williams? And what is the difference between your goal-kicking and that of Matt Giteau? How did they get to be so much better at their sports than the rest of us? Did they once serve or kick like us?

It is generally agreed that learning involves practice and time. Over time, and with practice, someone who is a beginner—in terms of his or her cognitive, affective and motor skills—will progress through various stages to become a skilled performer.

Skill learning is a continuous and dynamic process without distinct and definite stages. For convenience, however, certain 'general' changes can be described in skill learning. For example, over time, improvements in accuracy and rate are observed, as are greater consistency, a reduction in errors and the development of smooth, effortless performances. These changes can be broadly placed into three stages, as developed by Paul Fitts and Michael Posner in 1967. The stages are known as the:

- cognitive (or understanding) stage
- associative (or practice) stage
- autonomous (or automatic) stage.

Most individuals move from stage to stage as they learn skills. However, some might not move on to the last stage, due to the training demands, the complexity of the task or a lack of motivation.

Skill learning is a continuous and dynamic process without distinct and definite stages.

Cognitive stage

The cognitive stage is characterised by thinking—trying to understand the skill. In this stage the learner forms a cognitive picture of the skill and what is required to do it. The movements in this stage are jerky, halting and poorly timed. Performance is variable with a large number of gross errors—the learner knows that something is wrong, but is unsure how to correct it. While learning to play a golf shot, for example, someone in the cognitive stage will often hit the ground or miss the ball completely. An increase in 'self-talk' is evident as this stage progresses. Fortunately, this stage is also quite short and, with regular practice and thought, the learner will make rapid and large gains in proficiency.

The coach should teach simple, fundamental skills in this stage, by demonstrating, modelling and giving clear instructions. Instructions should be brief and should focus on only a few skills at a time. Coaches should observe the following general points:

- Employ a range of motivational techniques.
- Keep instructions and demonstrations short and simple.
- Have athletes follow an example at first and then try the skills themselves with more instruction and feedback.
- Allow for constant blocks of practice.
- Use frequent knowledge of performance (KP) feedback.
- Remember that the aim at this stage is a rough approximation of the required skills.

Feedback at this stage is very important and is supplied predominantly with visual demonstrations and verbal information. The learner needs specific information for corrections, and requires attention to individual skills. It must be remembered that the learner might not understand the task, so the amount and speed of information should be controlled, and the task itself must be clarified, perhaps by visual, auditory or even manual means.

Associative stage

In comparison with the cognitive stage, the associative stage is quite long. In fact, the person might never move beyond the associative stage. In this stage, the fundamentals and mechanics of the skill have been learnt, and performance is less variable and more consistent. There are fewer errors and they are less gross because the athlete has developed the ability to detect and correct errors. Movements become coordinated and refined to the task as the athlete learns to use environmental cues for timing. Anticipation develops, and smoother, unrushed movements result as the individual needs to think less about the skill and there is a shift to memorised movements. There is rapid improvement with a marked decrease in energy expenditure. The golfer, for example, will be able to make regular contact with the ball, though direction and distance will not yet be as consistent as it will become.

In the associative stage it is important for the coach to communicate well and give good feedback. Instruction needs to be more individual, with errors identified and corrections prescribed. There should be a progressive increase in task complexity. Demonstrations, videos of the athlete performing and verbal descriptions of corrections are useful.

Coaches of players in the associative stage should:

- Teach movement patterns first and then add other environmental situations (game-like situations).
- Provide variable practice situations. For example, soccer passing could include 'keep off' and corner passing.
- Use both knowledge of performance (KP) and knowledge of results (KR) feedback, and avoid giving feedback on every attempt.

- Practise skills randomly rather than in blocks.
- Encourage the use of mental imagery.

A coach should teach simple, fundamental skills during the cognitive stages

Autonomous stage

After much practice and experience, the skill becomes habitual or automatic. This is the autonomous stage. In this stage, improvements come slowly, but there is good consistency of performance. Most of the skill is performed without thinking because the athlete requires less attention to basics. Instead, he or she can give more selective attention to higher-order cognitive activities, such as game strategies and external cues; for example, the spin on the ball or the position of the opposition. The athlete has good timing, and can detect and adjust errors and disguise actions. This develops self-confidence and risk-taking in performance situations. The golfer, for example, will be able to change a swing to suit the particular shot required and be able to curve the ball with control after hitting it to allow for external factors, such as slopes and wind.

In the autonomous stage the practice sessions need to be well organised to ensure the best improvements. The athlete must be highly motivated and given a great deal of feedback. Training should attempt to simulate the actual performance conditions. Psychological skills training can be very effective in this stage, especially when dealing with anxiety in competitions.

When a player reaches the autonomous stage, his or her performance is consistently good

Internet support for the stages of skill acquisition can be accessed via

<http://www.oup.com.au/pdhpe12>

Critical inquiry

1 Three stages of skill acquisition are described earlier. Discuss whether these three stages actually exist. Investigate how else we could explain how skills are learned and performed.

2 Propose reasons for the improvements in performances of well-coordinated athletes who seem to progress very quickly or even skip stages.

Practical application : Stages of skill acquisition

1 Individually, or in small groups, practise daily a new skill; for example, juggling or throwing with your non-preferred hand at a target. Keep a record of your daily personal results and comments (regarding feelings, frustrations, problems and insights). Record these data for 20 trials per day over five days.

- Describe, in brief, the skill and scoring procedure.
- Construct a graph of the average scores for each day.
- In terms of the three stages of skill acquisition described earlier, identify which stage you reached.
- Explain how you moved from one stage to the next.
- Identify what would be required for you to progress further.

- f- Identify the attributes that would characterise a performer who has reached the autonomous stage in this skill.
- g- Identify the problems, issues and feelings that you experienced at each stage and why.
- h- Compare your results with the video image which can be accessed via <http://www.oup.com.au/pdhpe12>

Research and Review

- 1- *Distinguish between the important features of the cognitive, associative and autonomous stages of skill acquisition.*
- 2- *Describe how feedback given to a learner changes between the cognitive and autonomous stages of skill acquisition.*
- 3- *Explain the differences you would see in an individual as he or she moves through the three stages of skill acquisition in the sport of golf.*

III - Characteristics of the learner

Each human has unique physical, social and emotional characteristics. The ways in which people learn, perform and think affect every aspect of their lives. These individual differences include inherited, social and emotional factors and they account for the variability in the learning of motor skills.

Inherited factors affecting skill acquisition include gender, age, race, somatotype (body shape), muscle-fibre composition, information-processing capacity and aptitude for the activity. These can be described as the natural ability of the athlete.

After training and practice an athlete's ability to perform activities is usually improved. Prior experience with the task (or with a similar task) will also affect performance.

For example, in taking up basketball, the skills of netball are more easily transferred to the new sport than are the skills of, say, hockey. This transfer of prior experience can also apply to other aspects of various activities, including fitness, strength and flexibility. For instance, if aerobic endurance, speed or strength are required to perform the new skill, someone with previous experience in these will take less time to learn the skill, and will be able to participate at a higher level, than will a total beginner. Even knowledge of the rules of the game, without ever playing it, can increase the ability of the person to perform the activity or skill. A good example of the transfer of skills and attributes from one sport to another is when athletes are able to change relatively easily between rugby union and rugby league, without any obvious decrease in performance.

Skill acquisition depends on levels of keenness, confidence, competitiveness, self-esteem and relations with others and even level of aggression. These personality traits are enhanced as involvement in activity is continued. Roger Federer is a good example of someone who exhibits all these personality traits (see article below).

Skill acquisition can be influenced by the reasons for participation, the level of aspiration, the degree of enjoyment, persistence at the activity, the effort put into the activity and the readiness of the

participant to learn. Those athletes who are confident about their abilities, or their ability to improve and learn, can develop skills faster than those who are not. This self-confidence is sometimes evident in athletes as 'ego'. Ego can also be a good tool for coping with stresses, and for 'throwing others off their games'.

Federer still motivated to be the one World No 1

Roger Federer has dismissed suggestions his career is in decline and said he would use recent defeats as motivation after recovering from a virus.

The Swiss lost in the first round in Dubai last week to Scotland's Andy Murray, his first match since being beaten by eventual champion Novak Djokovic in the Australian Open semi-finals in January.

'In Switzerland there is a little too much speculation my career is over,' Federer, 26, said before yesterday's 6-3 6-7 7-6 win over former world No 1 Pete Sampras in an exhibition at Madison Square Garden. 'People just need to know I'm healthy and happy and not miserable and down and out.' Federer won the final set tiebreaker, 8-6, to ensure victory in the good-natured contest before a crowd of about 19 000, including world No 1 golfer Tiger Woods.

'Honestly, losses like this motivate me more than anything,' Federer said.

'Trying to come back, trying to prove I'm still the one to beat. 'I just want to show I can do it over and over again.'

The successive defeats dented Federer's aura of invincibility and fed the confidence of young rivals who have seen him reign as No 1 for 215 consecutive weeks.

Within two Grand Slam titles of Sampras' record 14, Federer said his affection for tennis was greater than ever. 'I love competing on centre courts all over the world. So many people are happy when I get there. It touches me. I love to practise more and more now,' he said.

'What I enjoy most are the matches, the pressure, the fans, centre court.'

Federer said he was looking forward to competing at the Beijing Olympics in August and future Games.

'The (London) Olympic Games in 2012 is something I'm looking forward to, and go from there. See how I feel with my fitness, my motivation.' Federer may have made his worst start to a season in eight years but Sampras was confident he would soon be winning again.

'In a lot of ways Roger has created this sort of monster of being unbeatable,' Sampras said. 'If you lose a match here, lose a match there, people have the assumption he has lost his edge, lost his dominance.'

The Australian, 12 March 2008

Critical inquiry :

Analyse the article above and determine how this athlete might have come to be described as motivated, confident or naturally talented.

Research and Review

1 Identify pairs of sports (such as hockey and cricket) that show how prior experience can lead to a transfer of skills and improve how quickly the sport is learnt.

2 Explain how natural ability assists somebody to perform an activity well.

3 Outline the role that personality plays in determining athletic ability and learning.

4 Identify the characteristics of a learner that would have the greatest effect on:

a increasing performance

b decreasing performance.

IV - The learning environment

Nature of the skill

The complexity of a skill to be learnt is obviously important in the acquisition of the skill. Movement tasks may be classified according to different criteria:

- the stability of the environment—open or closed
- the precision of the movement—gross or fine
- the distinctiveness of the beginning and end points—continuous, serial or discrete
- timing—externally paced or self-paced.

(See below for an explanation of these terms.) Not all skills fit into one or other category; instead they exist along a continuum. A task can be the whole game or activity, or it may be major individual skills within the game or activity.

Internet support for the nature of skills can be accessed via <http://www.oup.com.au/pdhpe12>

V - Closed and open skills

As noted earlier, in the early stages of learning a skill or activity, the coach tries to make the learning environment as stable and predictable as possible. Skills performed in this sort of environment are said to be closed skills, whereas skills performed in a changing, unpredictable environment are open skills.

A continuum exists whereby closed skills are performed in fixed environmental conditions at one end of the continuum, and open skills are performed within a changing environment at the other. Some examples of closed skills are those involved in golf, archery, weightlifting and synchronised swimming. In these activities the performer can use pre-learned skills or patterns of movement without having to make the major changes that would be needed if the environment were changing. When performing a closed skill it is the athlete who determines at what pace actions should occur. The athlete can execute the movement at a desired speed and method. Such movements are said to be self-paced. For example, a golfer places the tee and ball where the golfer chooses, approaches the ball when ready to do so, takes a predetermined number of practice swings, looks up the fairway, and then swings—all at a pace determined by the golfer.

Open skills include batting in cricket, tackling a player in soccer, executing a set play in rugby union or making a ground stroke in tennis. In contrast to closed skills, open skills are externally paced. This means that they are initiated by actions from an external source or stimulus. The performer then responds to that stimulus. External conditions determine the timing of the performer's response and include the opposition, the weather and the time left in the game. The unpredictability of the environment forces the performer to respond in a variety of ways, some of which might not have been practised in training.

Sports can contain both closed and open skills. For example, a tennis serve is classified as open. All skills and all sports do not fit neatly onto one end of the continuum or the other.

When learning motor skills it is easier to learn closed skills than open ones. When playing softball, batting against a pitcher is an open skill. The batter needs to consider the speed, height and spin of the ball before contact can be made. Learning the actual skill of hitting can be made more closed through the use of a 'batting tee' so that the movement of swinging to hit a ball can be learnt. When the movement is learnt the skill can be made more open by hitting a ball hung on a string; while the ball will be moving, its height is predictable, allowing the batter to practise timing his or her movement before facing the totally open pitcher.

Skills performed in a stable, predictable environment are closed skills. Those performed in a changing, unpredictable environment are open skills.

Weightlifting is a closed skill ; Facing a pitcher makes hitting a ball an open skill

VI - Fine and gross skills

With regard to the precision of the movement, skills can be classed as either fine (using small muscle groups to perform them) or gross (using large muscle groups to perform them).

Examples of fine motor skills include:

- writing
- spinning a ball when bowling
- throwing darts.

Gross motor skills include:

- walking
- running
- throwing.

Again, a continuum exists, and each skill can fall along the line between fine and gross. For example, a softball pitch involves subtle movements of the hand and fingers. It also involves larger gross motor movements from the shoulder, arm and back. The pitching action primarily involves gross motor skills, but the fine motor skills are also important.

VII - Discrete, continuous and serial skills

Skills can also be classified according to where they begin and end. If there is a clearly defined starting and finishing point, the skill is said to be a discrete motor skill. Examples include throwing a ball or performing a dive. If an arbitrary start or end point exists, the skill is described as a continuous motor skill. Swimming and running are examples of continuous motor skills. They are so classified because the beginning and end points are determined by the performer, and not by the task itself.

When a series of discrete motor skills is put together, a serial motor skill exists. Examples of serial motor skills include performing a dance routine, bowling a cricket ball and shooting an arrow in archery. In these situations a specific series of movements must be performed in a specific order for the task to be performed properly.

Pole vaulting requires the use of serial motor skills

Critical inquiry

- Choose a sport and identify all the skills necessary in performing it.
- For each skill determine where it falls along each continuum below.

Closed _____ Open

Fine _____ Gross

Self-paced _____ Externally paced

Discrete _____ Continuous _____ Serial _____

The performance elements

When learning movement skills they are often first experienced in isolation. For example, a soccer ball will be stationary on the ground, and an individual will be asked to run in and kick it at a goal, and then he or she will do it again. This type of learning does not help an individual understand when to kick a ball in a game, which direction it should go or how hard it should be kicked. These questions can only be answered by the individual after having practised the skills in a game-like setting.

Movement skills can be learnt but if you can't apply them to a game situation then they will not be performed effectively. A forehand in tennis might be performed with precision, but be hit straight back to a player at the net. In this case the skill has been performed correctly but a poor choice of shot allows the opponent to win the point. By practising and developing decision-making skills and the tactical aspects of the sport the tennis player may have played a lob shot and won the point instead.

#Movement skills can be learnt but if you can't apply them to a game situation then they will not be performed effectively.

VIII - Decision-making skills

Often in a game setting players need to assess their own strengths and weaknesses, their opponents' strengths and weaknesses and the situation of the game. The ability to assess these factors and then make a decision as to how to react to them affects an individual's ability to develop and perform movement skills, especially while playing games.

Coaches need to ensure the opportunity is available for individuals and teams to practise in gamelike settings so that the individual can hasten the decision-making process when it is time to apply it during a game.

In many game situations, as the pressure to score or prevent the opposition from scoring mounts, poorer decisions about movement are made. In rugby league a player may try to throw a long pass to a winger in the hope that the winger will score a try, but this increases the risk of an intercept. In defence a player may rush up in the hope to tackle a player, leaving a gap in the defensive line for the opposition to run through. Specific training for these game situations will assist players to make better decisions when they need to in a competitive game.

IX - Strategic and tactical development

When coaching less tactical sports (such as weightlifting, archery or gymnastics) coaches can be very specific and technical with the practice activities and feedback they give to the athletes. In tactical games (such as soccer, Australian Rules football and water polo) the learning environment needs to reflect the game environment if players are to understand how they are to apply the skills they have developed effectively in a game.

The tactics associated with game play are similar in many sports. In soccer, Australian Rules football and water polo, for example, movement into space, leading towards the ball, marking a player, moving into a position to shoot, and so on, are common to each. Individuals can learn the tactics of one game and then apply these across a range of similar sports.

The earlier an individual engages in learning the tactical aspects of the game the more effective the learning of this aspect will be. This process requires the coach to introduce skills into game-like situations rather than static skill drills. To teach somebody to pass a ball in soccer you could play a game of 'piggy in the middle', where two players are trying to pass the ball to each other and a third

player is trying to stop the pass being made. For beginners the rules can be set to make it easier for a pass to be made, and as skills develop the rules can be tightened so that the defender has a better chance. By introducing skills in this way, players will become aware quickly that passes need to be made so that the opposition cannot reach them and so that they are directed to their own partners (team) if they are going to keep possession. Compare this approach to that of having two players learning to pass by passing the ball backwards and forwards between hats with no opposition and no tactical knowledge being learnt in the process.

This tactical approach to skill development has the following benefits:

- It allows individuals to understand the complete requirements of the skill.
- It allows practice for decision-making skills.
- It enhances motivation and confidence.
- It improves team coordination.

Each of these benefits is explained below.

Individuals quickly become aware of how much time they have to complete the skill in a game setting. They realise what the results of errors of skill will be (such as loss of possession) and they learn in what context the skill will be used in a game.

As skills and knowledge increase, the game-like practices will develop complexity and, as a result, the decision-making process will be developed and enhanced. They are likely to come across problems that will reflect those they will experience in a real game. Having practised responses to these problems they will be more likely to make decisions that improve performances in the game situation.

As players experience a game-like setting in most training sessions they will develop the confidence to display their skills while playing a game. The approach also motivates individuals as they can work at their own level of skill in most cases and not be held back to simple drills if they have a more advanced skill level than the rest of the team.

By playing in game-like activities with fellow team members there is likely to be an improved understanding of the way they will respond in a given situation.

Once the individual has developed the understanding of the skills and tactics of the game the coach can begin to influence the way the play is conducted on the field. The coach can plan and implement specific tactics during a game. Prior to individuals gaining this understanding they possibly will not understand what the coach wants them to do or why it is important for them to do it.

Practice method

Practising is essential to learning and improving, and can be done in a variety of ways. Types of practice methods include the following:

- speed and accuracy

- massed and distributed
- whole and part.

All these methods are described in more detail in the text that follows. It is essential to understand the applications, uses and limitations of each method. Sporting pursuits vary, and there is therefore no set routine for practice or performance. An astute coach organises training that is appropriate to the task and the athlete, and ensures that the training remains interesting and challenging. How a skill is practised will determine how that skill is acquired and performed. Perfect practice makes perfect performance.

Speed and accuracy practice

Speed is the rate at which a motor task is performed. Accuracy can be described in terms of how a particular response deviated from a specific end point (for example, a tennis serve missed the line by centimetres) or by the end position of an object on a target (for example, a 'bullseye' was scored).

Speed and accuracy are task-specific and should relate to the final expectations of the performance. When speed is predominant for a skill, early emphasis on speed is preferable. When accuracy is needed, early emphasis on accuracy is better. If attention is directed solely to accuracy when learning, speed will gradually improve. If attention is directed solely to speed, however, accuracy tends to diminish. Beginners should concentrate on accuracy, and then increase speed.

Beginners should concentrate on accuracy, and then increase speed.

Massed and distributed practice

The length of time spent practising skills and the time spent at rest are important training considerations. Massed practice is a relatively continuous type of practice in which the rest periods are either very short or non-existent; for example, when a netball goal shooter practises shooting for 20 minutes continuously. Distributed practice occurs when periods of rest, or periods of practising other skills, are equal to (or longer than) periods of practising the primary skill. An example of this is a netball goal shooter practising shots from the right for 10 minutes, having a break for 10 minutes, then practising shooting from the left for a further 10 minutes, followed by rest for a further 15 minutes.

There is no real difference between the two methods in learning basic skills. However, for improving performance, distributed practice is more effective than massed practice because it allows for feedback to be given, and decreases the likelihood of fatigue.

Massed practice is preferable for:

- highly skilled performers
- highly motivated performers.

Distributed practice is preferable for:

- the novice

- in situations where energy demands are high
- when the task is difficult or boring.

Beginners should concentrate on accuracy, and then increase speed.

Whole and part practice

Another way of practising is to use the whole-or-part method. This method refers to whether skills should be practised in parts or as a whole. For example, should a softball hit be taught in its entirety or in its component parts, such as stance, grip, swing and followthrough? One method will be more effective than the other in any given situation, but a decision has to be made on which to use, and when. Figure here under introduces the concepts of task complexity and task organisation to aid in this decision.

Task complexity refers to how many parts or component parts are present, and the intellectual demands of the task. A dance routine has a high level of task complexity, whereas weightlifting has a low level of task complexity.

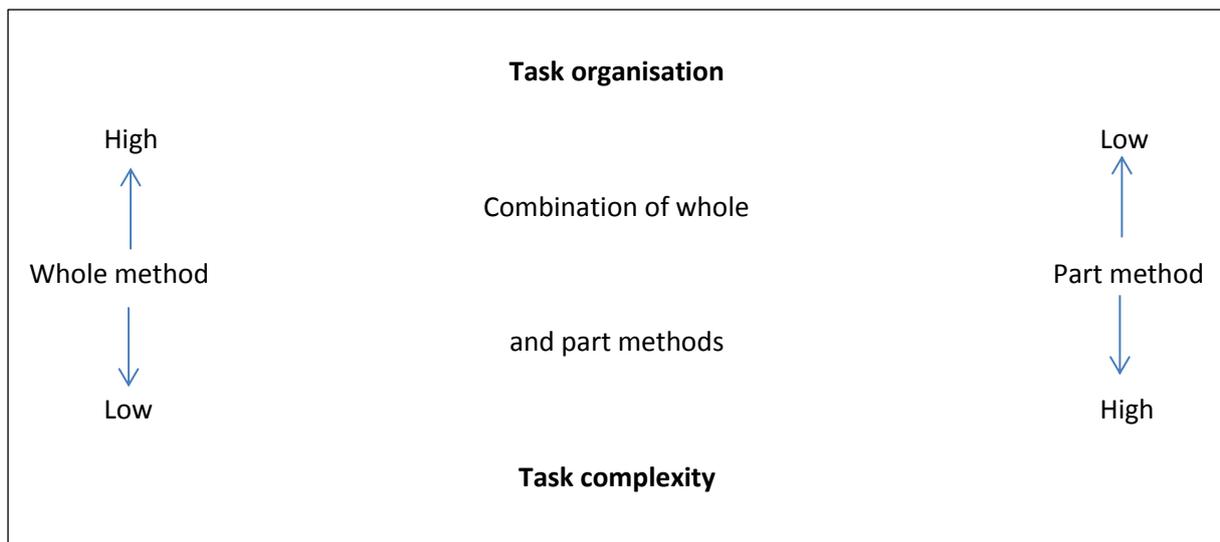
Task organisation refers to how the component parts of the task are interrelated. A jump shot in basketball has a high degree of task organisation because the parts of it are interrelated—with each part being highly dependent upon another to achieve the objective. Dance has a relatively low degree of task organisation because the order of performing the parts is not necessarily related to achieving a definite objective (such as scoring a goal) in the overall performance.

It is difficult to apply the above information because not all skills fit at one end or the other of the continuum of complexity and organisation. It is therefore difficult to predict which method to use. Some skills fall into the middle of the continuum, and might therefore require a combination of methods.

It is not uncommon to use a combination of whole and part practice (learning skills as a whole at times, and in part at other times) or progressive part practice.

Progressive part practice is a term used to describe parts of a complex skill being learnt separately, and then the learnt parts being added together to form larger and larger parts, until the whole skill is practised. For example, a spike in volleyball can be broken down into run up, stepping, jumping and striking. Each skill is practised separately and then each is added to the others, until the whole skill is practised in its entirety. Part practice is useful for novices, or when learning a new skill.

#Part practice is useful for novices, or when learning a new skill. If using progressive part practice, a spike in volleyball could be broken down into run up, stepping, jumping and striking



The relationship of task complexity and task organisation to whole and part practice

XII - Keys to successful practice

Quality practice time is essential for the successful development of sports skills. To be successful in a sport an athlete must be prepared to maximise the type, number and length of practice sessions.

Practice must be specifically related to the activity or game played. Coaches should attempt to make training situations as similar to games as possible; for example, by requiring the athletes to wear playing gear to training. Time spent in the total practice period, time spent at rest and time spent on particular skills should all vary according to the skill level of the learner and according to the importance of the skill in the performance. A tennis player might therefore have a session of practising serving every 5–10 minutes, as the player does in the game.

The practice conditions should also be varied. Athletes will soon lose motivation if the same skills and drills are repeatedly taught in the same way. The skill itself should be analysed according to how it is used in the game, and practised accordingly in a variety of ways.

Critical inquiry

1 Choose a sport and suggest examples of how to structure three training sessions for that sport.

Each training session should emphasise one of the following:

- a- accuracy
- b- whole practice
- c- part practice.

Practical application : Types of practice

1 In your own words, describe Figure 8.8 (page 158). Provide three sporting examples for each method: whole and part practice.

2 Divide the class into three groups.

- a- Design a number of practical activities that examine the effects that the various types of practice may have on performance. Examine:
 - whole and part practice
 - massed and distributed practice
 - speed and accuracy practice.
- b- Conduct the activities in groups involving the rest of the class.
- c- Evaluate the effectiveness of each type of practice according to the skill level of the people involved.

Research and Review

1 *Bowling a cricket ball requires both speed and accuracy. Describe how you would teach a beginner to bowl.*

2 *Name a skill and identify all the segments into which it can be broken for part learning.*

3 *Identify examples of sporting situations in which massed practice is preferable, and those in which distributed practice is preferable.*

4 *Classify the following sports as closed/open, gross/fine and discrete/continuous/serial:*

- a- *surfing*
- b- *playing snooker*
- c- *throwing the javelin*
- d- *high jump*
- e- *taking a penalty stroke in hockey*
- f- *goal-keeping in soccer*
- g- *aerial skiing.*

5 *Choose from hockey, Australian Rules football or netball. Propose three activities that will help beginners to understand the defensive strategies used in the game.*

6 *The way in which skills are learnt, practised and finally, acquired depends on the characteristics of the learner and the nature of the learning environment. Discuss this statement with reference to how a novice Australian Rules football player might be coached through the stages of skill acquisition.*

XIII - Feedback

How many times have you stood on a sideline and heard remarks similar to the following?

- 'Hey, Bill, you're as slow as a wet week.'
- 'You couldn't even catch a cold.'

- 'Hey, ref, it's a good game. Why don't you watch it?'
- 'My grandmother can tackle harder than that!'

All these remarks belittle the player or official, and diminish the respect between the speaker and the person to whom the comment is directed. They are negative in nature. Compare them with the following:

- 'Bad luck, Sarah. Just give it a little more air next time.'
- 'Good goal, Bok. Now hustle back into position.'
- 'Nice pass, Helen. You're getting better every training session.'

These comments are designed to make the participant feel good about his or her performance. They reinforce the desired response and improve the relationship between the speaker and the person to whom the comment is directed. They are positive in nature.

When performers receive any sensory information about an action, this is termed feedback. Feedback comes from a variety of sources and can have the following effects:

- reinforcement of the correct or desired response
- motivation of the performer to improve or maintain the performance
- correction of the action as a result of information received about errors.

The performer can come to rely on feedback and, when feedback is withdrawn, the performance can decline.

Sources of feedback

Feedback can come from sources within the athlete. This is called internal or intrinsic feedback. Alternatively, it can come from external sources, in which case it is termed external or extrinsic feedback.

Internal feedback Internal feedback is information received naturally from the senses as a result of movement. When passing a basketball, the athlete is aware of his or her own legs, shoulders, arms and fingers moving through the air. The athlete is aware of the ball leaving the fingers, and can see and hear it being caught by a partner. The athlete thus perceives information about the performance without the use of equipment, devices or other people. Therefore, internal feedback includes sensations (such as sights, smells, touch and sounds) that are related to the performance.

External feedback External feedback is information that is provided from outside the performer's natural sensory awareness of the immediate action. This external feedback might be the coach's voice, the scoreboard, video analysis or the cheer of the crowd. The external feedback supplements the performer's natural internal feedback. In some cases, there is no external feedback.

Coaches provide external feedback

Types of external feedback

Two important forms of feedback are:

- knowledge of results (KR)
- knowledge of performance (KP).

KR is information that is provided externally after the completion of the action. It is based on the outcome of the performance or on what caused the outcome. It is particularly helpful when learning a new skill. KR allows the learner to correct an action the next time, to be reinforced when the attempt is totally or partially correct, and to remain motivated to try again. A score in gymnastics and the coach's reaction to his or her team's performance are

Examples of KR.

KP is information that is received either internally or externally concerning the movement executed. KP does not inform about the movement success (as KR does). Rather, KP informs about the performance of the movement pattern itself, or how it looked. For example, a gymnastic coach informing the gymnast that she had good body shape and height during a movement or that her feet came apart directly relate to the actual movement and not the score that the gymnast will receive.

#Positive feedback is designed to make the participant feel good about his or her performance.

Timing of feedback

The timing of feedback is very important. There are many opportunities before, during and after a performance when an athlete might receive feedback.

Concurrent feedback is feedback received during the performance. Examples include the feel of a ball as it hits a table tennis bat, or the sight of the goalkeeper moving to the left before a penalty stroke. The athlete can respond to this concurrent feedback at the time.

Delayed feedback (or terminal feedback) is provided after the performance, and is therefore received too late to produce a response at the time. A player jumping to head the ball in soccer cannot change the body's position in the air when the ball is 1 metre from the head. In this case, the correctness of the action is gauged after the ball has been headed. The feedback might be a goal or a comment from the coach. This is an example of delayed feedback.

Concurrent and delayed feedback can therefore be provided both internally and externally. Concurrent feedback, and doing other activities between performances, might hinder learning as it can distract the learner from concentrating on the movement as it is being performed.

The feel of a ball as it hits a table tennis bat is an example of concurrent feedback

Arrows in a target provide knowledge of results

Practical application : Feedback

1 Divide the class into three groups to perform this simple throwing activity. You will need supervisors, recorders and subjects. The task is to throw a ball towards a bullseye target that has

various scoring sections. The ball is to be thrown 10 times, receiving feedback according to the following:

- Group 1 receives KR only. Perform 10 throws blindfolded. Only the score for each throw is given to the performer.
- Group 2 receives KP only. Perform 10 throws blindfolded. No feedback is given.
- Group 3 receives a combination of KR and KP. Perform 10 throws without the blindfold. All scores are given to the performer.

Record all results. Graph the average results for each group. Then complete the following tasks:

- a- Describe the group averages and the trends observed in the activity.
- b- Identify any improvement in performance noted across the 10 trials.
- c- Discuss the influence of KR and KP on performance.
- d- Outline why groups 1 and 2 needed to be blindfolded.

2 Identify a basic tactic associated with a sport of your choice. Design two modified games, as follows, that will assist the learning of the tactic you have identified:

- a- A simple modified game for a beginner
- b- A complex modified game for an advanced player.

3 You have just been appointed the new coach of the Bayside under-7s soccer team. Most players are new but some have played for a season. The team includes boys and girls. Outline your coaching plan for the season, which runs for eight weeks. Include examples of suitable practice methods and how you will use feedback during the stages of skill acquisition. How will you account for the variations in the characteristics of the group, and how will you develop strategies and tactics in the group?

Usefulness of feedback

For extrinsic feedback by observers to be effective, it should:

- contain no sarcasm
- praise and criticise the behaviour, not the person
- be constructive
- be meaningful to the individual
- contain positive non-verbal communication
- be communicated effectively
- be consistent
- use the 'sandwich approach'—give a positive statement, then corrective feedback, then a compliment (for example, 'Good run, Juanita. Next time pass the ball. Keep up the great effort.')

Research and Review

1 Explain why feedback plays a major role in the learning of skills, and in sporting performance.

2 Using examples from sport, explain the difference between KR and KP.

3 Explain why the timing of feedback is critical in the correction of skills.

4 Describe how the type of feedback individuals receive will change as they move through the stages of skill acquisition.

XIV - Assessment of skill and performance

Characteristics of skilled performers

The main aim of the analysis of human performance is to improve performance. A skilled performer has learnt how to achieve a particular performance goal at almost every attempt, and to do so with minimal waste of physical and mental energy, or time. A number of perceptual abilities and physical attributes has been identified by sports scientists to explain differences between skilled and unskilled performers, and to explain individual variations in the acquisition of skills.

#Perceptual abilities are those related to the senses.

Skilled performers are usually stronger and more flexible, have better body coordination and whole body balance, and have better stamina than do unskilled performers. In addition, with respect to perceptual motor abilities, skilled athletes perform better in the following areas compared with unskilled athletes:

- kinaesthetic awareness and proprioception—skilled athletes have an ability to utilise the sensory information gained from within their body concerning body position and limb awareness
- anticipation of what might happen next and appropriate response to it—skilled athletes rely on external environmental information, memory and ‘feel’ during the performance
- timing of responses—skilled athletes have quick and efficient responses (reactions and movements), making them appear to have ‘all the time in the world’
- limb coordination—skilled athletes hold their arms steady and have excellent hand and finger coordination

Skilled performers, such as diver Matthew Mitcham, have learnt how to achieve a certain performance goal at almost every attempt

- consistency of performance—skilled athletes make very few errors during an activity
- technique—skilled athletes maintain correct technique despite fatigue or the game situation
- response to cues—skilled athletes are able to respond to many cues and recognise and respond only to those cues that are relevant

- mental attitude—skilled athletes are more aggressive, competitive, ambitious, self-assured, adventurous, confident, determined and committed; have better concentration; are able to self-regulate anxiety and arousal; and can understand and use complex skills and patterns.

A skilled performer is able to perceive, decide and act in a manner that is efficient in terms of both energy and time. The skilled performer is faster and more accurate and has greater consistency than unskilled performers.

Through experience and practice, skilled performers develop special attributes, such as anticipation and relevant cue recognition. In addition, the skilled performer:

- appears to be smooth and effortless
- has composure
- is able to adjust to changes in plans
- is relatively unaffected by the competitive environment
- is able to regulate personal effort levels
- is able to overcome physical demands and pain
- is able to cope with poor officiating
- can handle the pressure in the final stages of a contest.

There are thus many important observable and measurable characteristics of skilled performance and skilled performers.

Practical application : Characteristics of skilled performers

1 Interview a skilled athlete.

- a- Investigate what motivates the athlete to train and perform in the chosen sport.
- b- Identify the characteristics and skills that the athlete believes to be essential for success in the sport.
- c- Discover how the athlete has developed these skills and characteristics.

Critical inquiry

View a number of videos of skilled and unskilled performances in one skill area. Compare and contrast the performances. For example, you could film your classmates dribbling soccer balls and compare that with the soccer dribbling skills displayed in the [YouTube footage referred to below](#).

Objective and subjective performance measures

Before you decide to do your homework you mentally collect data about the task. The decision you make about the homework you do is based on the time available, the work, the subject and the possible outcomes of doing it—or not doing it! You are measuring and testing data before making the better decision.

In much the same way, a gymnastics judge is able to collect data before making a decision about the quality of a particular gymnast's performance. Similarly, a coach collects data about an athlete's fitness level. Measurement is an important process that allows skills and performances to be evaluated and compared.

Measurement is the act of assessing, usually by the assigning of numbers to whatever is being assessed. A test is an instrument that can be used to make measurements. Appraisal (or evaluation) is a dynamic process in which a decision is made concerning the value, merit or quality of what is being measured. An example of this is using a situp test to measure abdominal strength. Simply giving the athlete a score gives no information about the quality of the performance. By comparing the athlete's results with established norms, however, a value judgement (appraisal) of the performance can be made.

Measurement has many purposes, including:

- placement of athletes into ability groups
- diagnosis of strengths and weaknesses
- prediction of future performance results
- motivation of the performer
- achievement and improvement of levels of skill
- evaluation of instruction methods.

Skills can be appraised by subjective or objective observation.

Subjective appraisal depends on the observer's personal judgment of how well the skill was performed. It is based on personal feelings, and is affected by the mind and temperament of the observer, rather than the attributes of the object. This applies to quality and style of performance, such as in dance or gymnastics routines.

Objective appraisal involves an impartial measurement based on certain indisputable facts about the performance. It occurs without bias or prejudice, and is such that observers will give the same result for the same performances; for example, when a batter is bowled out in cricket, or when the final score for a golfer is six strokes under par.

It is important to establish performance measures upon which to base the appraisal of athletes. It is equally as important to be able to interpret the results of the performance measures. Apart from objective and subjective appraisal, there is a number of other ways in which performances may be judged. There are 'norm-referenced tests' and 'criterion-referenced tests', 'rating scales' and 'percentile rankings'. These measures allow observers to evaluate and rank performance.

The appraisal of skill can involve three types of measurement:

- information-processing capacity (for example, memory and reaction time)
- general motor ability (for example, speed and power)

- specific sports skills (for example, kicking and passing).

A race time is an example of an objective appraisal

Critical inquiry

- a- Identify examples of each of the following:
 - norm-referenced tests and criterion-referenced tests
 - rating scales
 - percentile rankings.
- b- Describe what each is measuring.
- c- Explain how each measures this.
- d- Discuss the advantages and disadvantages of each type.

Skill-related tests

In addition to standard health and fitness tests for endurance, anaerobic capacity, strength, and so on, it is possible to measure motor-skill accomplishment. Skill-related tests can provide objective methods for evaluating the skill attributes that are required for success in particular sports. Skill-related tests can also:

- evaluate learning
- predict future performance
- classify and compare participants
- motivate
- determine achievements
- diagnose injury
- act as a learning tool.

The skill-related tests shown below are considered to be objective, reliable and valid. Most skill tests are accompanied by a set of norms allowing comparison of performances.

Volleyball Rating Scale

5 points— Exceptional ability for the age and gender of the student
4 points— Above-average ability for the age and gender of the student

3 points— Average ability for the age and gender of the student

2 points— Below-average ability for the age and gender of the student

1 point— Inferior ability, far below average ability for the age and gender of the student

Critical elements		Scale (1–5)				
A	Spiking					
	i Approach	5	4	3	2	1
	ii Jump	5	4	3	2	1
	iii Spike placement	5	4	3	2	1
B	Serve					
	i Accuracy	5	4	3	2	1
	ii Difficulty of return	5	4	3	2	1
C	Passing					
	i Proper use of hands	5	4	3	2	1
	ii Accuracy	5	4	3	2	1
D	TeamPlay					
	i Hustle	5	4	3	2	1
	ii Teamwork	5	4	3	2	1

TOTAL SCORE _____

Tennis rating scale

5 = excellent Proper grip, good balance, footwork and near-perfect form. Demonstrates consistent stroke mechanics. Anticipates opponent's shots. Placement appropriate for opponent's weaknesses or position.

4 = good Proper grip, good balance, adequate footwork and acceptable but not perfect form. Demonstrates above-average consistency of stroke mechanics. Anticipates opponent's shots. Consistent placement within court area.

3 = average Proper grip and acceptable balance, but footwork is poor. Form is somewhat erratic and inefficient, resulting in inconsistency in shot placement. Style of play may be defensive. Little anticipation of opponent's shots.

2 = fair Uses improper grip at times, poor footwork and basically incorrect form. Inconsistent stroke mechanics. Defensive style of play, merely trying to get ball over net. Little anticipation of opponent's shots. Unable to sustain a rally.

1 = poor Incorrect grip, off-balance, with poor footwork. Form is very poor and erratic. Inaccurate shot placement. No anticipation of opponent's shots. Experiences difficulty in getting ball over net.

Basketball rating scale

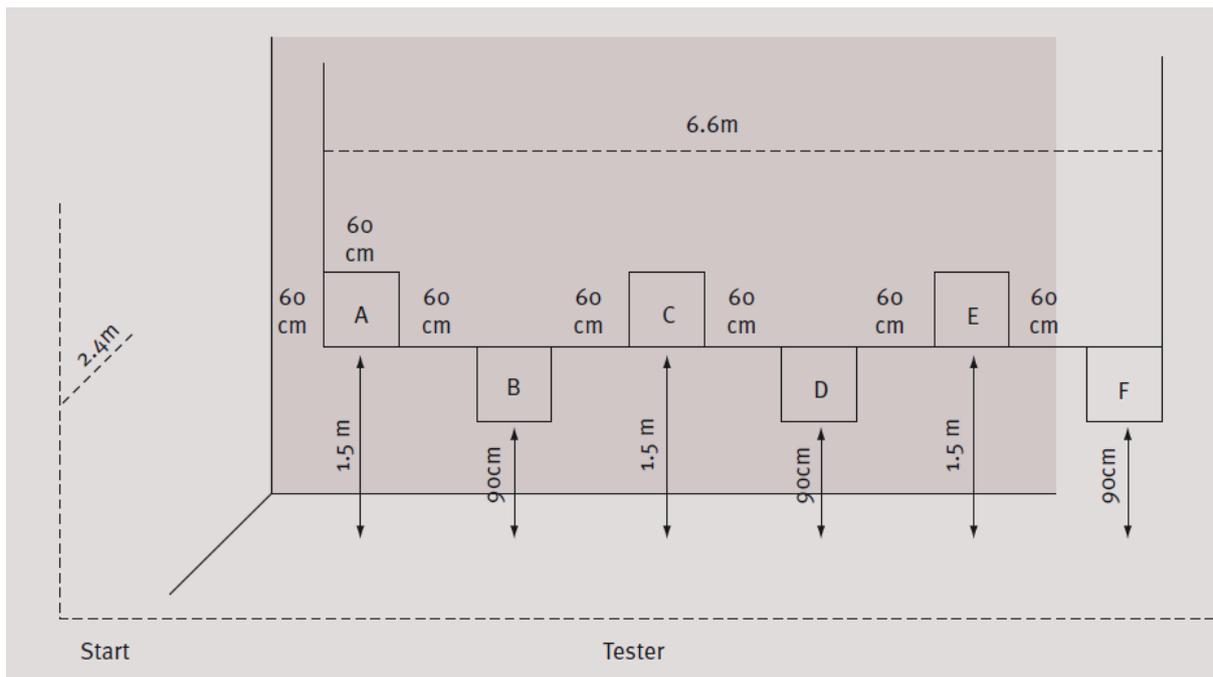
Passing

Objective: To measure skill in passing and recovering the ball while moving

Equipment: Standard inflated basketball, stopwatch, smooth wall surface, marking tape

Procedure: Six squares are marked on the wall and a restraining line is marked on the floor 2.4 metres from the wall. Three 30-second trials are administered, with the first trial considered practice and the last two timed. The player, holding a ball, stands behind the restraining line and faces target A. On the command 'Go', the player chest-passes at target A, recovers the rebound, and moves opposite target B. From behind the restraining line the player chest-passes at target B. This pattern continues until target F, where two chest-passes are executed. Then the player moves to the left, passes at target E, and continues to move left passing at each target in turn.

Scoring: Each pass that hits the desired target counts two points. Each pass hitting the wall but missing the target counts one point. The sum of the last two trial points is the final score.



Practical application

Skill-related tests

- 1
 - a- In pairs, take turns at the passing skill test above. Identify any difficulties in undertaking the test.
 - b- Discuss the strengths and weaknesses of the skills test.
 - c- Propose another test for a different skill in the same sport.
- 2
 - a- Investigate other sports that utilise skill-related tests.
 - b- Describe the test undertaken.
 - c- Evaluate the effectiveness of the test in determining the skill level of a player in the sport.

Validity and reliability of tests

In the pursuit of accuracy, credibility and fairness, new and improved techniques have been devised to provide measurements of performance. The elimination of human error tends to increase the objectivity and reliability of tests in many sports.

Validity is the degree to which a test measures what it is designed to measure. For example, a sprint test does not measure aerobic endurance. Factors that affect validity include the type of measurement tool chosen and the characteristics of the individual, such as age, gender and whether the person is a novice or an expert.

An example of an invalid test is a teacher telling a class that an examination will be on energy systems, when the examination is really on skill acquisition. Validity would be in doubt if the results of a battery of tests indicate that an individual is not suitable for basketball, but that person then wins an award for most valuable player of the season.

Reliability is the ability of the test, and the test results, to be repeated. For example, it is difficult to achieve the same 40-metre sprint results on grass and on sand. The reliability of an instrument or test is dependent on the extent of its measurement error, and its capacity to discriminate between different levels of ability in a group.

An example of an unreliable test is to compare a 'beep' test conducted on grass with one done on the gym floor, and to use different tape decks for each.

A test can be reliable but invalid. That is, a test can give consistent results, but not measure what it claims to measure. A test cannot be valid if it is not reliable. That is, if it cannot provide stable, repeatable results, it is not valid. The reliability of a test should be determined before its validity.

A test can be reliable but invalid, but a test cannot be valid if it is not reliable.

Practical application

Skill-related tests

- 1 Construct a new sports skill-related test for a sport of your choice. Administer the test and decide how to determine its reliability and validity.
- 2 Choose a sport and design an appropriate performance-appraisal technique that is objective, valid and reliable.
- 3 Find three other skill-related tests that are reliable and valid, and participate in them as a class.

Critical inquiry

- 1 Assess whether it is possible for a skilled performance to take place but the athlete not to win.
- 2 Identify who creates the standards of performance for particular events.
- 3 Describe the 'quality of performance' within a sport of your choice.

Research and Review

- 1 Describe the difference between measurement and appraisal.
- 2 Identify how judges and observers can maintain test objectivity.
- 3 Identify the essential characteristics of a skilled performer in your favourite sport or activity.

4 Outline the factors concerning both the environment and the athlete that contribute to a skilled performance.

5 Compare the characteristics of a highly skilled performer with those of an unskilled performer. Use examples to illustrate your answer.

Personal versus prescribed judging criteria

Why is it that one person likes a particular film and another loathes it? How is it determined that Ricky Ponting might be the best batsman in the world? Who decides whether there is such a thing as a 'perfect 10' in gymnastics? The answers to these questions lie in the science of measurement and appraisal. Measurement and appraisal are not mutually exclusive: they can exist separately or together. In fact, adding measurement to appraisal will increase the objectivity of judgment of a performance.

Using measured numerical information, judges are able to compare performers among teams or as individuals. Appraisal relies heavily on the judges' subjective evaluation of the performance. Their objectivity increases as they become experienced at judging. The evaluation might be done either by an established criterion (a prescribed judging criterion) or it might include feelings, emotions, expectations and preconceived ideas about the performance, and thus be a personal judging criterion.

Similar processes are used whether evaluating a movie or choosing a player for next week's game based on performance at training. Two examples of prescribed judging sheets for gymnastics are shown below

Neutral errors include those for stepping out of bounds or violating time requirements, as well as attire or podium violations.

Women's gymnastics scoring sheet				Event _____	Name of judge _____																										
School _____		Judge _____		Competitor _____																											
No. 1		VAULT 1	VAULT 2	<table border="1"> <tr><td>Scratch area</td><td>Difficulty (4.0)</td><td></td></tr> <tr><td></td><td>Originality (1.5)</td><td></td></tr> <tr><td></td><td>Composition (0.3)</td><td></td></tr> <tr><td></td><td>Execution (1.5)</td><td></td></tr> <tr><td></td><td>Amplitude (1.3)</td><td></td></tr> <tr><td></td><td>General impression (1.0)</td><td></td></tr> <tr><td></td><td>SCORE</td><td></td></tr> <tr><td></td><td>Falls, neutral deductions</td><td></td></tr> <tr><td></td><td>FINAL SCORE</td><td></td></tr> </table>	Scratch area	Difficulty (4.0)			Originality (1.5)			Composition (0.3)			Execution (1.5)			Amplitude (1.3)			General impression (1.0)			SCORE			Falls, neutral deductions			FINAL SCORE	
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	FINAL SCORE																														
Vault name	Value	Preflight																													
1 _____	_____	On horse																													
Deduct	_____	Landing																													
2 _____	_____	Neutral																													
Deduct	_____	Total deductions																													
		Final score	_____																												
No. 2		VAULT 1	VAULT 2																												
Vault name	Value	Preflight																													
1 _____	_____	On horse																													
Deduct	_____	Landing																													
2 _____	_____	Neutral																													
Deduct	_____	Total deductions																													
		Final score	_____																												
				Comp _____																											
				Event _____																											
				Score _____																											
				Judge _____																											

Scratch means no handicap or bonus is given

Practical application

Personal versus prescribed judging criteria

Choose a video of a dance or gymnastics performance to watch; for example, the rock eisteddfod. Develop an appraisal instrument (prescribed or personal judging) so that you can evaluate the performance. It may be any type of instrument. View the performance and judge it based on the appraisal instrument. Then complete the following tasks:

- a- What were the limitations of your instrument?
- b- Comment on the objectivity, validity and reliability of your instrument.
- c- Exchange your instrument with that of someone else in the class, and evaluate the performance using another instrument.
- d- Discuss any similarities or differences in the judging results.

Research and Review

1 *'There is no such thing as a totally objective appraisal'. Discuss.*

2 *What is a quality performance? Explain with examples.*

3 *Discuss whether the benefits of skilled performance outweigh the negative outcomes. Provide examples of positive and negative outcomes of actual sporting events.*

4 *Discuss important considerations when using tests or instruments to measure skill and performance.*

CONCLUSION – SUMMARY : HOW DOES THE ACQUISITION OF SKILL AFFECT PERFORMANCE?

Chapter summary

- There are three stages of skill acquisition:
 - 1- cognitive—the beginning stage where the individual is working out what needs to be done to perform the skill
 - 2- associative—where the individual practises the skills and begins to apply them in game settings
 - 3- autonomous—where the individual can focus on the environment in which the skills are occurring and not on the skill itself.
- An individual's characteristics (such as genetic traits, confidence and prior experience) can influence the speed with which that person may acquire a skill.
- Open skills are those that occur in an unpredictable and changing environment and tend to be externally paced. Closed skills are the opposite of this.
- The type of practice undertaken will be determined by the complexity of the skill and the degree of physical effort required to perform it.

- The type of feedback given to an individual will change as the person develops the ability to perform the skill.
- The performance elements are those factors that are required to perform the skill in a game setting, such as decision-making skills.
- The way a performance is assessed can be objective (that is, based on facts, such as a score or time) or subjective (that is, based on the observer's opinion).
- Many sports try to make their judging more objective by establishing specific criteria against which scores are awarded.
- Tests that are valid assess the attribute they state they are testing for. Reliable tests are those that are conducted in exactly the same way each time.

Revision activities

- 1- Describe how making a skill more closed in nature can improve the speed at which it is learnt.
- 2- For a sport of your choice, develop a training session that shows knowledge of the performance elements.
- 3- Outline the key differences between a skilled performance and an unskilled performance.
- 4- Distinguish the characteristics that an individual will display between the cognitive and autonomous stages of skill acquisition. Use specific examples from a sport of your choice.

Extension activities

- 1 Identify technology that can be used to improve the feedback given to an athlete.
- 2 Design valid and reliable skills tests that assess a range of skills in a team sport of your choice.
- 3 Choose an elite performer in any sport and describe the characteristics that athlete displays as a skilled performer.
- 4 Explore the USA Diving website via www.oup.com.au/pdhpe12 and explain the way that attempts have been made to make judging of diving more objective.

Exam-style questions

- 1- Identify how the nature of the skill influences an individual's ability to learn a movement skill. (3 marks)
- 2- Outline the role of feedback in skill acquisition. (4 marks)
- 3- Describe how the characteristics of a learner can influence that individual's progression through the stages of skill acquisition. (5 marks)
- 4- a Outline the nature of skills and performance elements. (4 marks)
b Analyse how these would be applied to the stages of skill acquisition. (6 marks)