In This Chapter:

CHAPTER 12

MOTOR LEARNING IN PRACTICE

Skill Acquisition

After completing this chapter you should be able to:

- explain the skill acquisition process and describe the stages of learning a skill;
- describe the types of feedback and their roles in skill learning;
- identify the types of transfer and apply transfer principles to learning a skill;
- design a learning environment using effective practice methods.

Distinct changes that occur as a skill is learned and developed are easy to detect because the execution becomes swifter and more fluid and demands much less attention. Your own experiences provide an example of how motor skills change and develop. Your first steps may not have been perfectly executed, but look at you now, walking with the best of them. Certainly, your early attempts at playing the piano, serving a tennis ball, or shooting a basketball were not worthy of acclaim; but with practice and proper guidance, major improvements undoubtedly followed.

Conditions for Skill Acquisition

"Every artist was first an amateur."
RALPH WALDO EMERSON

Before individuals can become skilled in any activity, they must first acquire a basic movement repertoire consisting of certain fundamental movement skills. The important questions to ask here concern the best time and conditions under which movement intelligence (discussed in Chapter 11) may be acquired. Research and practice have identified several factors that affect the development of an individual's movement intelligence: starting at a young age, providing sufficient learning time, being taught by qualified instructors, following the right progression, and using quality equipment. These factors are discussed in more detail in this section.

Starting at a Young Age

The importance of beginning the learning process at a young age was discussed in Chapter 10. Education involving movement skills should begin early, even as early as the preschool years. Developing fundamental skills such as walking, throwing, catching, and climbing early on allows a child to incorporate these skills (which are the basis for numerous other activities) effectively into a repertoire of motor skills. Because movement patterns are still being established in young children, it is important to teach skills correctly the first time to avoid the development of bad habits early.

Getting started early and providing sufficient learning time are vital in developing movement intelligence.

Providing Sufficient Learning Time

A large amount of time during the school day is traditionally dedicated to the acquisition of the more important cognitive skills (e.g., linguistic and mathematical). Similarly, in order to improve an individual's motor skill development, sufficient time must be allotted to participating in physical activities that enhance movement skills. Without physical experience, skills cannot be learned effectively and maintained.

Being Taught by Qualified Instructors

Instructors, physical educators, and coaches must be properly trained and have experience with teaching physical activity in order to teach movement skills. But too commonly, unqualified staff are given the task in schools, community programs, and sports camps. Students deserve the best level of instruction available.

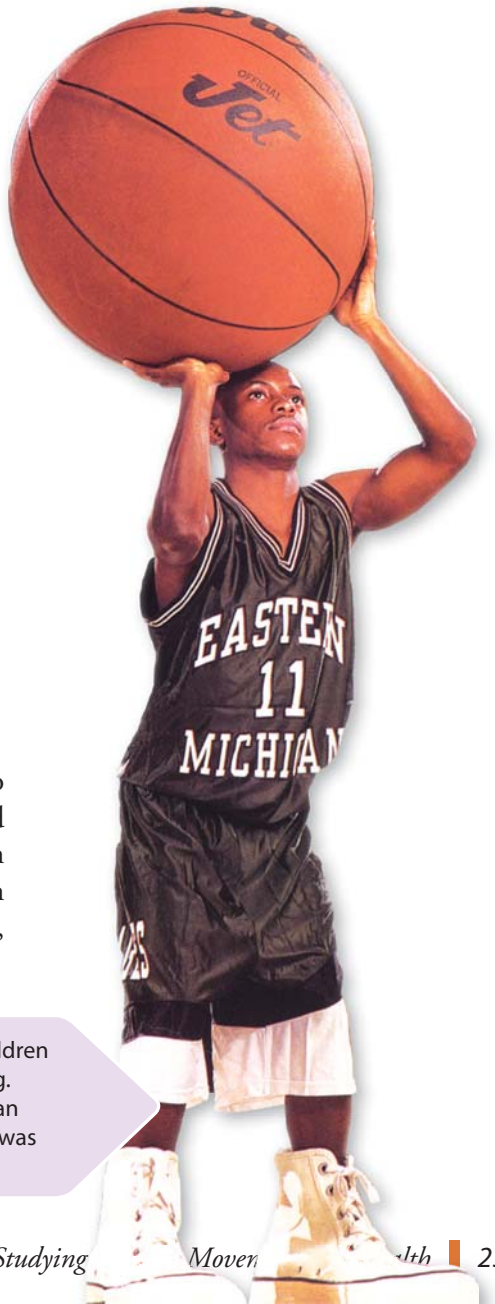
Following the Right Progression

Choosing the right progression to follow has a direct influence on the acquisition of movement skills. In other words, the organized action and the sequence of drills ensure that skills are easier to grasp. For example, you might introduce children to baseball by playing tee-ball (which simplifies the game) and slowly incorporating a live pitcher for batting (slow-pitch first). The skills learned from simpler tasks can then be effectively transferred to more complex tasks.

Using Quality Equipment

The quality of equipment available for teaching movement skills is also important for effective learning. Safe, appropriate, and well-maintained equipment makes learning most effective for students. And since children have different needs from teenagers or adults, equipment that is scaled down to their size (e.g., lower basketball hoops, smaller basketball and soccer balls, smaller soccer nets, lighter baseball bats, and so on) is essential.

Many other factors have an impact on the teaching and acquisition of motor skills. This chapter will review a number of related topics to provide a broad-based perspective on the skill acquisition process.



Scaled-down equipment for children is a must for proper skill learning. Imagine how you would feel in an environment where everything was twice its normal size.

Stages of Learning a Skill

> "Knowledge advances by steps, and not by leaps."
> LORD MACAULAY

Research and practice have identified three general stages that individuals must go through as they learn and develop motor skills. These three stages (cognitive, associative, and autonomous) are summarized in Table 12.1 and are discussed in more detail in this section. We will outline the changes that occur as motor learning takes place and the important features that are unique to each stage.

Cognitive Stage

The cognitive (understanding) stage begins when the task is first introduced to the learner. As the skill is completely new, the first major goal for the learner is to determine cognitively the general shape of the particular skill and the goals to be achieved. Questions concerning what, when, and how predominate at this early stage as the learner tries to get a feel for the activity.

Instruction, demonstrations, films, videos, and vivid descriptions serve to convey the general idea of the skill to the learner. Some learners even verbally guide themselves through skills by engaging in self-talk. Giving themselves some verbal reminders as they attempt a skill for the first time offers security and begins to instill the major ideas associated with performing the skill.

Terminology A!ert

Because much of the early ideas and instructions are verbally transmitted to the learner, the cognitive stage is sometimes referred to as the **verbal stage**.

For example, a beginner in gymnastics may remind herself to tuck her head on the forward roll or to stay balanced on the beam. However, this strategy demands concentration and does not allow other information to be processed simultaneously. But during this initial stage, verbal activity can give the learner a rough idea of what the skill is all about and even facilitate rapid learning and considerable improvement.

Although performance at this stage may be slow, jerky, highly variable, and even awkward at times, it serves as a good foundation on which to build.

DID YOU KNOW?

Learners do not make abrupt shifts from one stage to the next. In most learning environments there is a gradual transition or change in the learner's performance characteristics from stage to stage, which makes it difficult to detect which stage a learner is in at any given moment.

Associative Stage

With some practice, the learner can move to the associative (practice) stage of learning. This second stage is focused on performing and refining the skill by organizing more appropriate movement patterns. Now that most of the stimuli related to the skill have been identified and defined, a greater amount of concentration can be directed to refining details.

For example, the learner can experiment with how timing can be improved by using environmental cues, as well as how movements can become more efficient and executed with increased speed. Practice allows the learner to make certain movements more automatic and controlled. The motor programs introduced in Chapter 11 can begin to develop and make skilled movements more fluid and consistent. Variability of performance from one attempt to another also begins to decrease. As performers discover what constitutes an effective performance, their confidence increases.

Table 12.1 Three-stage model for learning a motor skill.

Cognitive Stage	Associative Stage	Autonomous Stage
Learners get the general idea or overall concept of the skill	Focus on smaller details leads to skill refinement	Skill execution is automatic, allowing focus on other aspects of performance
Performance may be slow, jerky, and highly variable with many errors	Performance is more fluid, controlled, and consistent with fewer errors	Performance is effortless, relaxed, and accurate with few errors
Early practice involves demonstrations and vivid descriptions with lots of verbal input from instructors and self-talk by learners	Lots of practice takes place over long periods of time with expert instruction	Practice helps maintain skills with less dependency on instruction and more self-monitoring
Performance serves as a foundation on which a learner can build	Rapid performance improvements occur with vast potential for growth	Performance improvements are relatively slow with less room for improvement
		
Understand.	**Practice.**	**Apply.**

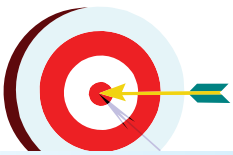
Performance improves quite rapidly at this stage. Self-talk diminishes considerably, and anticipation and consistency continue to improve. The ability of learners to detect some of their own errors in performing various skills represents an important development at this stage. Generally, the associative stage lasts longer than the cognitive stage for most individuals.

Autonomous Stage

In the autonomous (application) stage, movements become almost automatic and very proficient. Attention demands are dramatically reduced, providing an opportunity to focus on other aspects of performance, such as creativity and strategy. The ability to analyze environmental stimuli is enhanced during this advanced stage, and relevant cues are quickly detected with increased accuracy.

At the peak of their careers, professional hockey players are clearly operating in the autonomous stage. Their hockey skills are so well developed from years of practice and experience that they are able to concentrate on creative plays on the ice that often seem impossible to the average player.

It is equally remarkable to see a refined pianist play with speed and fluidity, but also with creative or imaginative flair. Such performances are the result of a great deal of practice and dedication. Performance improvements during this stage, however, are relatively slow because the learner has already reached such a high level of proficiency before the stage begins. This is not to say that learning stops here, because other less obvious gains (such as a reduction in anxiety and mental effort required for skill execution and an improvement in techniques) may result.



An increased ability to self-correct and make minor adjustments to the execution of a skill is one of the hallmarks of an individual in the autonomous stage.

Feedback for Skill Learning

Although practice alone does not make perfect, practice with appropriate feedback does.

When we practice motor skills we are continually receiving information that is related to our movements, both during the performance and as a result of it. This information constitutes **feedback** in the true sense, which plays a strong role in motivating, reinforcing, and shaping behavior in a skill-learning environment. Feedback informs the learner about significant strengths or weaknesses that may have been detected during a performance. Without it, practice and, in turn, learning and performance become far less effective.

There are various types of feedback, and the following sections will highlight some of the strategies instructors may use when providing feedback to learners. Feedback is either intrinsic or extrinsic and can be further subdivided into knowledge of results and knowledge of performance (Figure 12.1).

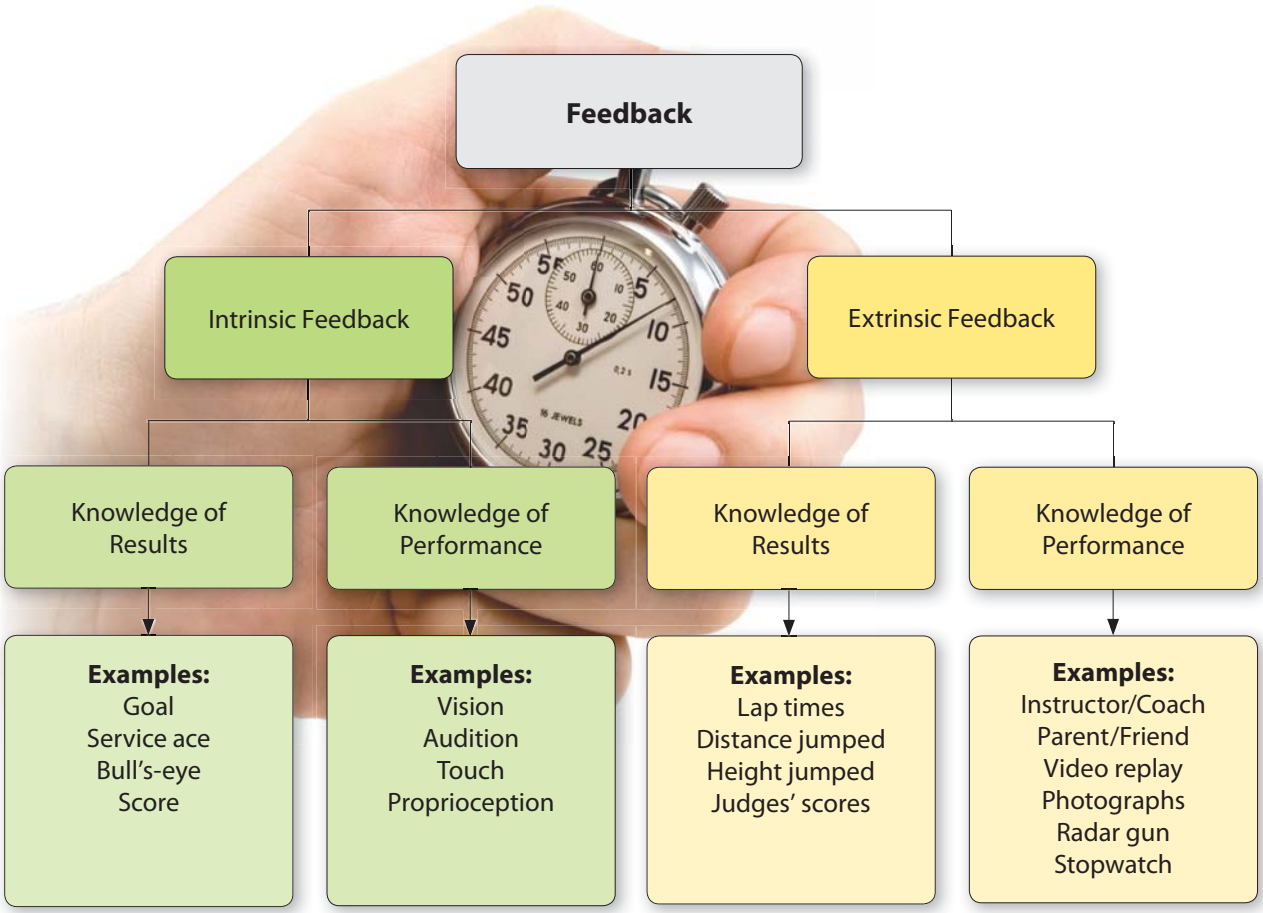


Figure 12.1 Feedback is either intrinsic or extrinsic and each type can be further subdivided into knowledge of results and knowledge of performance.

Intrinsic Feedback

Information that is provided as a natural consequence of performing an action is considered intrinsic feedback. For example, when you throw a dart, you can feel your arm extend, you can see the dart fly through the air, and you can hear it make contact with the board as it hits the bull's-eye. These are all examples of intrinsic feedback.

Knowledge of Results

When you are practicing free-throw shooting, the success (or failure) of your shots provides intrinsic feedback. More specifically, this is an example of knowledge of results (KR) feedback. Other examples of this type of feedback include seeing the dart hit the bull's-eye, watching the tennis ball land in the opponent's court, or covering an excellent distance in a 12-minute walk/run test.

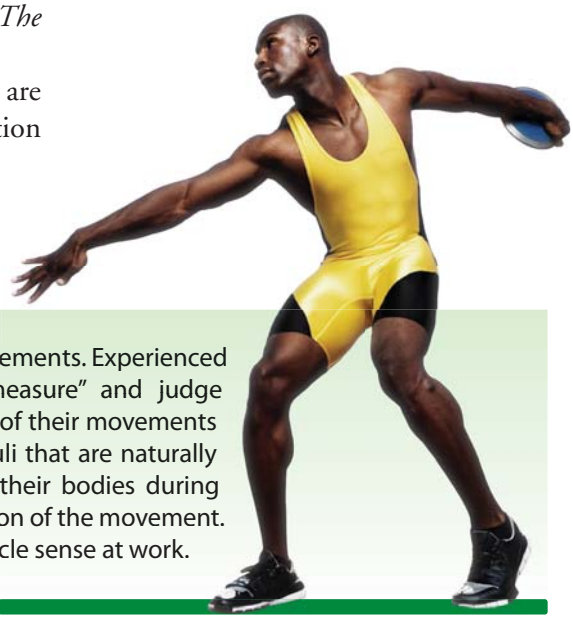
Knowledge of Performance

The feel of your arm extension is related to information about your performance and is thus known as knowledge of performance (KP) feedback. This type of feedback involves the use of the senses for obtaining more or less direct information. Examples include the fine finger sensations felt when playing the piano (feeling of touch), or the crowd noise associated with college basketball games (audio sensation), or the pull in your shoulders when you are pulling on the oar as part of a rowing crew. These sensations are related to the muscle sense that athletes experience (see the box *The "Secret" Language of the Muscles*).

Particularly in the second learning stage, many of these movements are relatively easy to detect directly, without the need for verbal instruction from the instructor or coach.

"Intrinsic feedback from the muscles gives athletes a feel for their performances."

Muscle sense gives an indication of the strength, force, speed, duration, direction, and extent of any movement.



The "Secret" Language of the Muscles

Seasoned athletes can tell how good their performance was, almost as well as a panel of judges, by instinct alone. "On my first try, I knew it was a good jump as far as rhythm and takeoff. But the second try was even better. I really noticed it." Good long and triple jumpers or even discus or javelin throwers can often tell with great accuracy how far they have jumped or thrown without even looking at the measurements. Experienced athletes "measure" and judge the quality of their movements using stimuli that are naturally present in their bodies during the execution of the movement. That is muscle sense at work.

Muscle Sense For any activity, hundreds of muscles are normally involved in a highly specialized interplay to gather information about the movement and its execution. This muscle sense (or muscle feeling) can be thought of as the sum of all the sensations that result from every movement of all the limbs in the body (Table 12.2). Special receptors in the muscles, tendons, and joints (called "spindles" because of their appearance) constantly supply information about the position of each joint (i.e., about fixed body positions and the course of the movements). The stimuli that cause these movements are the result of pressure and tension in the muscles and tendons. Without a well-developed muscle sense, athletes would have difficulty performing at their best, and mastering any movement or even trying to execute movements already learned would be almost impossible without this important source of intrinsic feedback.

Muscle sense is not alone, however, in gathering information about movement sequences. Other sensory organ receptors are stimulated simultaneously with every movement, meaning muscle sense works in close

Terminology A!ert

The term *muscle sense* is often used interchangeably with the terms *kinesthetic sense* and *proprioceptive feedback* in motor learning literature.