2007 Alliance Scholar Lecture

On the Problem of Motor Skill Development

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Motor skills do not develop miraculously from one day to the next. They must be taught and practiced.

As we begin the 21st century, the United States is in the midst of an obesity epidemic. The Centers for Disease Control and Prevention reported in 2004 that almost 18.8 percent of all children ages six to 11 and 17.4 percent of youths 12 to 19 are overweight (Centers for Disease Control and Prevention, 2007). As a way to address this serious issue, countless physical education classes have become fitness centers designed to raise heart rates and burn calories. No one takes issue with providing children more physical activity time, but an unintended consequence of this renewed fitness emphasis is the lack of attention to motor skill development. What are the implications of de-emphasizing the acquisition of motor skills in our physical education programs? This is not a new problem. Motor skill development, as a curricular focus, has long been marginalized in physical education. In this article, based on my Alliance Scholar lecture given at the 2007 AAHPERD convention in Baltimore, I discuss the problem of motor skill development with an eye to understanding why it has languished as a critical curricular focus in physical education and why it is important to keep it in our physical education programs. In addition, I include findings from the research I have done over the last four decades on the development of motor skills.

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2007 Alliance Scholar lecturer

The Maturation Misconception

The misconception that maturation underlies infants' and children's motor skill development undermines both research and the need for instruction and practice of motor skills in the early years. The view that maturation is the driving force behind an infant's changing motor behavior pervades our thinking about the motor development of toddlers, preschoolers, and young children in the early elementary grades. Running, jumping, galloping, hopping, kicking, throwing, and catching are among the many motor skills that seem to appear one day in the child's collection of newly found behaviors. Or so it would seem. Parents and educators have a strong sense that teaching motor skills to children is unnecessary until children are perhaps eight or 10 years old, when specific sport skills are introduced. This seems to be a deeply held misconception. What else could explain the lack of a requirement for daily physical education that would include motor skill instruction in the preschool and early elementary school years? But if motor skills do not develop primarily through maturation, then how do they develop?

In the first year of life, an infant progresses from a helpless newborn who can barely lift its head to the active walking toddler capable of using its hands to grab toys, food, and a variety of objects. Each month, the toddler almost miraculously learns new skills. One month the infant is sitting, and the next crawling. Infants appear to progress through the same sequences—rolling over, sitting, crawling, standing, and finally, around the infant's first birthday, walking. For the infant's parents, these motor skills "just mature." Since no one teaches the infant how to sit or stand, a belief emerges in the culture's folklore that *maturation* is the cause

Photo by Faye Egre

A first-grade student completes a modified vault. Motor skills need to be learned and practiced; they are not automatically acquired through maturation.

of these advancements in the infant's motor repertoire. In this sense, maturation would mean that these motor skills emerge regardless of the environment and without instruction or specific practice—as if these behaviors were "wired" into our bodies from the beginning of life. The problem with maturation as an explanation of motor skill development is that it is wrong.

Few would dispute the fact that certain motor behaviors, such as reflexes, are embedded in the newborn's nervous system. But the other motor behaviors of infancy, those that are called *species-typical* or phylogenetic, are far less predetermined. Indeed, these species-typical behaviors require environmental support for their appearance; however, this support is minimal and nonspecific. In fact, research would suggest that the environment needs to be "just good enough" for these preadapted behaviors to appear. This is the type of environment in which most infants grow up. But imagine an infant born in a space station circling Earth, where the pull of gravity is one-sixth of Earth's gravitational pull. Would we see sitting, standing, and walking emerging as we do on Earth? It would be unlikely, as most of our motor behaviors are in response to and modulated by gravity. Without Earth's large gravitational force, head and trunk control would be attained almost at birth, not at five or six months as it typically is. If maturation were the correct explanation for motor skill development, then it would not matter whether the infant was born on the moon or on Earth; the sequence of motor behaviors would unfold in the same way, regardless of the environment.

Motor Skill Development Is a Lifelong Journey

The belief that maturation is how motor skills develop puts more emphasis on the biological or hereditary aspects than on environmental factors. But the process by which motor skills develop is more complex. Motor skills change through an *interactive* process between the individual's biological constraints and the environment. The central nervous system, the muscles, and the skeleton all develop; some changes are prescribed by heredity, but our biological heritage is modulated continuously by our environment and our life experiences.

Humans come with *preadapted* motor behaviors that are built into the central nervous system. But even reflexes, such as the sucking and grasp reflexes, are quickly modified by the infant's experiences in the world. For the species' survival, these early experiences open a dialogue between the newborn and its new stimulus-rich world. This dialogue provides a cycle of perception and action with consequences. Hand (palm) contact with an adult's strand of hair results in the all-too-well-known hair grasp by the infant. The grasp reflex action gives the infant both sensory information about the hair in the hand (helping to form a perception of hair) and a social interaction with the adult. The infant's waking hours are filled with such cycles of action and perception, each providing the infant with a rich and rapidly expanding collection of perceptual-motor experiences. These experiences, of course, are not just for babies. All of our lives are spent expanding and adapting to our perceptual-motor experiences, and these experiences help to shape our motor skills as they change throughout our life.

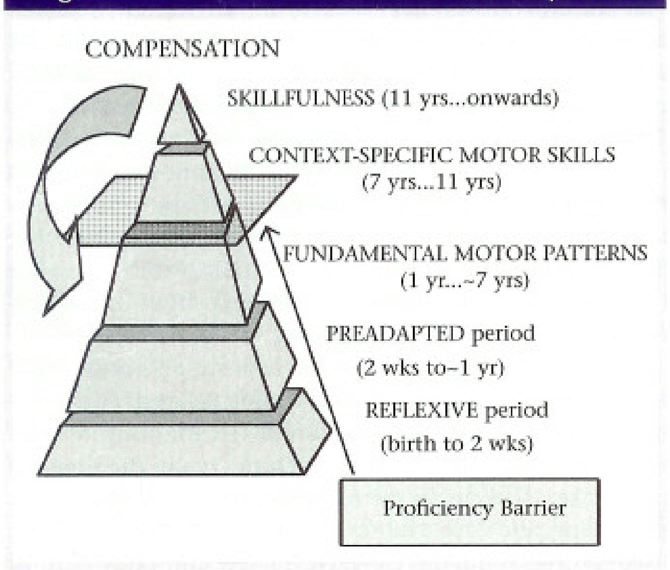
While the infant is born with innate motor patterns, these patterns are a basis for the development of motor skills that appear later. The process by which our motor skills change over time is not maturation, but adaptation and learning. These inborn motor patterns prepare the infant to adapt to its new world. They provide a basis that experience modifies and, over time, that the infant incorporates into more and more complex patterns of coordination that are better adapted to the environment.

I wrote two papers that provide a framework for this lifespan view of motor skill development (Clark, 1994; Clark & Metcalfe, 2002). They focused on describing the development of motor skills—not just any motor behavior, but those that are voluntary, goal-directed, and consistently performed. To identify these lifespan changes, the framework needed to describe the developmental characteristics that have been documented in the research literature. For example, during an individual's life there are periods of stability when behaviors seem to form a coherent assembly that we might label as typical for that time in a person's life. These periods would be expected to follow a specific order and would build one upon the other. The directionality in which the changes progress (toward some goal or end) would also be implied in a developmental framework.

With these characteristics in mind, we selected the metaphor of a journey up a mountain to illustrate the development of motor skills (Clark & Metcalfe, 2002). The "mountain of motor development" provides a framework to describe the global changes that occur in our motor skills from birth to death. Figure 1 is a schematic of the mountain broken into its many periods. Since the mountain has been described in detail in my previous two papers, I will only briefly describe it here and focus most of my attention on the preadapted period and the fundamental motor patterns period, on which my research has been centered.

The mountain's base sits upon the prenatal period, when the fetus, in the last two trimesters, is quite busy moving. But our mountain metaphor begins at birth with the *reflexive period,* which represents the infant's behaviors in the first two weeks of life as the infant adjusts to the bright, buzzing, and gravitational world. Reflexes, such as the rooting, sucking, and gag, insure the infant's survival. But very quickly (after about two weeks), the infant's behaviors are more spontaneous than reflexive, and some are actually goal-directed. This marks the beginning of the *preadapted period,* in which species-typical movements dominate. This period ends when the infant has attained the two most fundamental motor behaviors: independent walking and self-feeding. At that point, the human infant has all that it needs to "survive" at the most primitive level. The next period, the *fundamental motor patterns period,* is characterized by the acquisition of the basic coordinative patterns that form the basis for later-emerging sport, dance, game, and other culturally promoted motor skills. The fourth period, the *context-specific motor skills period,* is the stage in which patterns are modified for a specific purpose (e.g., running is modified for running the hurdles, or the striking pattern is adapted to sports such as baseball, tennis, and golf). Sitting at the top of the mountain is the *skillfulness period.* Reaching the top period of the mountain means the person has become a skilled motor performer. While there is a continuum of skillfulness that we all recognize, crossing the threshold into skillfulness puts the mover into this period, but clearly it is a long trek to the summit. For example, high school varsity athletes are skilled, but college players and professional athletes are more skilled. From playing high school basketball to playing at the professional level is a long and difficult journey; in the same way, a mountain climber might say that the last stage of getting to a mountain's summit is the most demanding. It is also important to note that we do not stay at the top of the mountain forever. When injury, aging, and other changes occur in our body, we adjust our motor performance to accommodate these changes. Thus, the *compensation period* represents that time in our motor development journey when we must compensate for these biological changes. Perhaps the injury will heal and we can return to our mountain climb. Or perhaps these bodily changes will result in our being less skillful than we once were, perhaps returning to a lower period on the mountain.

Figure 1. The Mountain of Motor Development



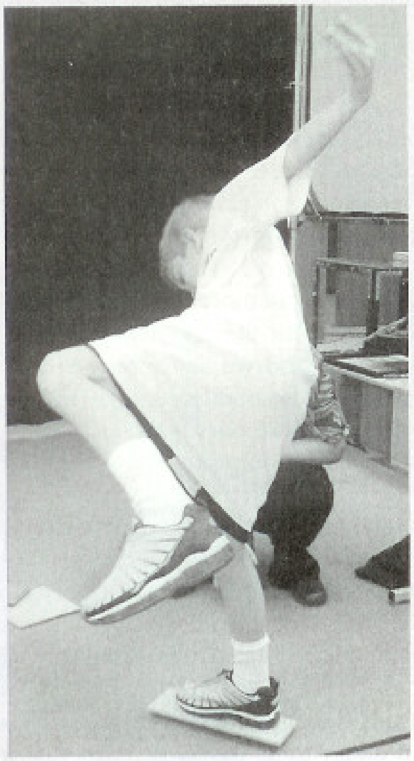
The Foundation Patterns of Coordination

From a theoretical and practical basis, the early periods when the preadapted and fundamental motor patterns develop appear to be the most critical to later skill attainment. Seefeldt (1980) suggested that if these patterns were not acquired, the child would encounter a "proficiency barrier" when trying to learn the transitional motor skills that lead to skillfulness. But what is it about these motor patterns that make them "fundamental" or essential to later skillfulness?

Figure 2 shows a young boy trying to balance on a small plate. To succeed at this task, all the body's segments (head, trunk, arms, and legs) have to align so that the pull of gravity is directly over the base of support (i.e., the foot). Small deviations from this alignment create a torque that pulls the body toward the ground. As with this child, the body has to find a way to regain that balance. Clearly this is not an easy task. Indeed, it takes almost six months for a human infant to learn to sit without support (a position with a very wide base compared to balancing on one foot). The human body's segmentation provides for a wonderful array of movements, but it also presents an incredible management problem for the neuromuscular system. Between each segment, there is a joint. Each joint is a potential location for collapse. As we move, each of these joint-segment combinations must be controlled. At birth, no segment is controlled. The top heavy head and trunk must be supported by the caregiver. It is not until about two months after birth that the infant is able to lift its head off the blanket and that is only when it is lying on its tummy. Months will go by before rolling over and prop sitting will occur. Standing alone and walking are achieved almost a year after birth. Clearly, learning to control and coordinate our multisegmented body is a long process.

For years, I studied two of these fundamental patterns of coordination: walking and jumping. In a series of studies on jumping (Clark & Phillips, 1985; Clark, Phillips, & Petersen, 1989; DiRocco, Clark, & Phillips, 1987; Jensen, Clark, & Phillips, 1994; Phillips, Clark, & Petersen, 1985; Phillips & Clark, 1997), we found that from the age of three to adult-

Figure 2. A Balancing Task



hood, there was an invariant coordination pattern for the hip, knee, and ankle (or the thigh, shank, and foot) as the jumpers extended their legs to create the force to lift the body off the ground. While we can see qualitatively different spatial patterns (the young children do not optimize their take-off angles for either vertical or horizontal jumps), the underlying force-producing pattern of coordination is the same across ages and outcome performances (i.e., how high or long they jump). These findings do not mean that jumping is innate and that no instruction or practice are needed. Quite the contrary, our results show that children must learn how to produce a jump that maximizes the height or the length of the jump. This involves learning to coordinate the arms, legs, and trunk before the take-off extension. It also means that children must learn to control the forces created by the segmental actions so as to maximize the take-off angle. Our cross-sectional studies suggest that skillful jumping takes many years to learn.

Similarly, our research on the development of walking revealed the early appearance of fundamental interlimb and intralimb coordination (Clark & Phillips, 1987; Clark & Phillips, 1991; Clark & Phillips, 1992; Clark & Phillips, 1993; Clark, Truly, & Phillips, 1990; Clark & Whitall, 1989; Clark, Whitall, & Phillips, 1988; Forrester, Phillips, & Clark, 1993; Whitall, Block, & Clark, 1992). But again, it was the flexibility and control of these coordinative patterns that emerged with increasing locomotor experience. Indeed it was in this latter set of studies that the idea of probing the *rate limiter* to the development of motor skills emerged. When infants were just learning to walk, for example, we found that giving them a light touch stabilized their interlimb coordination to that of an infant who had been walking for a month (Clark et al., 1988). Similarly, when infants first walk, they spend most of their time with both feet on the ground. It is not until they have been walking for about two months that they walk with the same stance proportion as adults (Clark & Phillips, 1993). Again as in our earlier work, we proposed that *postural control* was limiting the rate of locomotor development in the infants.

In fact, in both jumping and walking development, children struggled with postural control. Much like the child in Figure 2, the problem of generating the segmental forces to jump, walk, run, gallop, or skip creates a considerable challenge to the neuromuscular system of the developing child. Part of that challenge is how to manage the destabilizing forces that threaten our balance. Does postural control develop? And if so, how does it develop? What develops when postural control changes across the lifespan?

Postural Control: An Important Process

Postural control involves not only balance, but also the ability to assume and maintain a desired orientation. Every movement we make involves postural control. Whether we are standing quietly, running, hitting a tennis ball, or sitting at a desk, gravity is always acting on our bodies. The gravitational forces must be managed in all of our actions. To accomplish this, the central nervous system (CNS) must know where the body is: its orientation to the support surface as well as the positions of all the segments and their relationship to one another.

To help the CNS monitor the body, we have three major sensory systems. The *vestibular sensors*, located in the inner ear, are composed of the semicircular canals and the otolith organs (the utricle and the saccule). These sensors provide feedback to the CNS about the head's rotational movements (the semicircular canals) and the head's linear acceleration and its orientation to gravity (otoliths). *Vision sensors* provide information about what is in the environment as well as our movement in that environment. Both the vestibular and visual sensors are located in the head, whereas the third group of sensors is distributed throughout the entire body. This group is referred to as *proprioceptors*. They include the joint and muscle receptors as well as the pressure receptors that are located under the skin. Each of these sensors continuously sends information to the CNS about where the body is at any one moment. It is the task of the CNS to use this information to adjust the body's position in order to maintain or assume new positions.

This sensory feedback is critical to postural control, but it has one important limitation: it is time delayed. Beginning from the moment the sensor is stimulated, the delay includes the time it takes the signal to reach the brain; the time the brain takes to decipher the information, decide what needs to be done, and issue a motor command; and the travel time used by the command to reach the relevant body part. In many cases, this time delay is too long, rendering the sensory information useless for postural control. To work around this time delay, the CNS estimates where the body will be in the future and actually issues motor commands before receiving the sensory feedback. In other words, the CNS anticipates. This is an important ability that takes time to develop. In our studies of infant postural development (Barela, Jeka, & Clark, 1999; Chen, Metcalfe, Jeka, & Clark, 2007), predictive or anticipatory behavior is evident in infants about two months after they start to walk. Perhaps it is the dynamic experience of moving upright over two little feet that pushes this capacity to the forefront.

Our conceptualization of this predictive ability suggests that our CNS develops an internal model or sensorimotor map of the body and its world. This internal model provides us with an estimation of where we are and a prediction about where we will be if we carry out a particular movement. To build such an internal model requires that we have experiences that couple sensory information with movement repeatedly and with variation. Thus as the child stands up, attempts to step, and falls, the internal model uses this perception-action cycle to build up something like a body schema. The repeated attempts, successful and unsuccessful, enhance the internal model so that after a few months of independent walking, the infant can walk without falling despite creating a wide range of large torques as the trunk perches precariously atop the two wobbly legs. This concept of an internal model is just that: a concept. But as such, it provides us with a useful way to think about how the CNS is using perceptual-motor experiences to become more skillful. A strong internal model would allow for quick and reliable actions that constitute the graceful movements of the skilled performer.

The importance of postural control is striking in those first walking steps of the infant, but postural control is in every movement that we make, no matter our age or experience. This is very evident in children who are sometimes labeled "clumsy." Balancing on one foot can be almost impossible for these children. And the lack of postural control has the potential to make all their attempts to learn motor skills more difficult. We have been studying these children for the last few years. Years ago, they were merely classified as clumsy. Today, through careful screening, they may be diagnosed as having developmental coordination disorder (DCD). For more information on DCD, please see an article we wrote for this journal in 2005 (Clark, Getchell, Smiley-Oyen, & Whitall, 2005). Our findings from research with these children suggest that their internal models for movement are more broadly tuned than their age-matched peers (Kagerer, Bo, Contreras-Vidal, & Clark, 2004; Kagerer, Contreras-Vidal, Bo, & Clark, 2006). This leads to the variable and inaccurate movements that are characteristic of children with DCD.

Teaching for Motor Skill Development

Motor skills do not just come as birthday presents. They must be nurtured, promoted, and practiced. If we recognize the cultural misconception that motor skills just mature, then we must be proactive in dispelling that misconception. Motor skills take years to develop and require specific experiences and instruction. It is, therefore, important that motor skill development remain a central focus of physical education curricula. Teaching motor skills is not mutually exclusive with children being physically active. Indeed, if children do not feel a sense of efficacy regarding their motor skills, they are less likely to participate in physical activities as they grow older. If a child does not have good balance and has had limited experience and few locomotor skills, then he or she is not likely to accompany other children to a roller-skating or ice-skating party. A strong motor skill foundation at the start provides for new movement opportunities later in life such as skiing, rock climbing, tennis, golf, and many others that arise as we continue on our motor development journey. Just as educators recognize the importance of reading literacy to a lifetime of reading, physical educators need to recognize the importance of *motor* literacy for a lifetime of physical activity.

Also critical to the development of motor skillfulness is postural control. Although often assumed not to require specific instruction, postural control *is* learned and *does* require practice and instruction. Physical education teachers should remember to specifically teach for postural control by modifying tasks so as to reduce the base of support, change the body's orientation, or carry objects that make postural management more difficult. The body's internal model for movement and postural control need many and varied experiences to form a strong, reliable sense of where we are and what will happen when we make specific movements.

Children who leave elementary school without a strong foundation of motor skills are "left behind" in the same way that children are left behind when they leave without the prerequisite language or mathematical skills. At high school graduation, students who leave without a sport or other movement form and without the motor skills to learn new skills are also "left behind." As a profession, physical education needs to battle the maturation myth and teach motor skills from preschool to high school. Motor literacy is as important as reading literacy. If we want a nation of physically active citizens, then we need to help them acquire the motor skills that will allow them to participate in a wide range of physical activities. Physical education is the best public health delivery system our nation has. We need to exploit it as we promote both physical activity and motor skill development.

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Read to class

References

Barela, J. A., Jeka, J. J., & Clark, J. E. (1999). The use of somatosensory information during the acquisition of independent upright stance. *Infant Behavior and Development, 22,* 89-104.

Centers for Disease Control and Prevention. (2007) *Overweight and Obesity: Home.* Retrieved March 29, 2007 from http://www.cdc.gov/nccdphp/dnpa/obesity/index.htm

Chen, L. C., Metcalfe, J. S., Jeka, J. J., & Clark, J. E. (2007). Two steps forward and one back: Learning to walk affects infants' sitting posture. *Infant Behavior and Development, 30,* 16-25.

Clark, J. E. (1994). Motor development. In V. S. Ramachandran (Ed.), *Encyclopedia of Human Behavior* (3rd ed., pp. 245-255). New York: Academic Press.

Clark, J. E., Getchell, N., Smiley-Oyen, A. L., & Whitall, J. (2005). Developmental coordination disorder: Issues, identification, and intervention. *Journal of Physical Education, Recreation & Dance, 76*(4), 49-53.

Clark, J. E., & Metcalfe, J. M. (2002). The mountain of motor development: A metaphor. In J. E. Clark & J. H. Humphrey (Eds.), *Motor development: Research and reviews* (vol. 2, pp. 163-190). Reston, VA: National Association for Sport and Physical Education.

Clark, J. E., & Phillips, S. J. (1985). A developmental sequence of the standing long jump. In J. E. Clark & J. H. Humphrey (Eds.), *Motor development: Current selected research* (pp. 73-85). Princeton, NJ: Princeton Book.

Clark, J. E., & Phillips, S. J. (1987). The step cycle organization of infant walkers. *Journal of Motor Behavior, 19,* 421-433.

Clark, J. E., & Phillips, S. J. (1991). The development of intralimb coordination in the first six months of walking. In J. Fagard & P. Wolff (Eds.), *The development of timing control and temporal organization in coordinated action* (pp. 245-257). Amsterdam: Elsevier.

Clark, J. E., & Phillips, S. J. (1992). A dynamical systems approach to the development of intralimb coordination in the first year of walking. In M. H. Woollacott & F. B. Horak (Eds.), *Posture and gait: Control mechanisms* (pp. 350-353). Eugene, OR: University of Oregon Books.

Clark, J. E., & Phillips, S. J. (1993). A longitudinal study of intralimb coordination in the first year of independent walking: A dynamical systems analysis. *Child Development, 64,* 1143-1157.

Clark, J. E., Phillips, S. J., & Petersen, R. D. (1989). Developmental stability in jumping. *Developmental Psychology, 25,* 929-935.

Clark, J. E., Truly, T. L., & Phillips, S. J. (1990). A dynamical systems approach to understanding the development of lower limb coordination in locomotion. In H. Bloch & B. I. Bertenthal (Eds.), *Sensory-motor organizations and development in infancy and early childhood* (pp. 363-378). Dordrecht, Netherlands: Kluwer.

Clark, J. E., & Whitall, J. (1989). Changing patterns of locomotion: From walking to skipping. In M. H. Woollacott & A. Shumway-Cook (Eds.), *Development of posture and gait across the life span* (pp. 128-151). Columbia, SC: University of South Carolina Press.

Clark, J. E., Whitall, J., & Phillips, S. J. (1988). Human interlimb coordination: the first 6 months of independent walking. *Developmental Psychobiology, 21,* 445-456.

DiRocco, P. J., Clark, J. E., & Phillips, S. J. (1987). Jumping patterns of mentally retarded children. *Adapted Physical Activity Quarterly, 4,* 178-191.

Forrester, L. M., Phillips, S. J., & Clark, J. E. (1993). Locomotor coordination in infancy: The transition from walking to running. In G. J. P. Savelesbergh (Ed.), *The development of coordination in infancy* (pp. 359-393). Amsterdam: Elsevier Science.

Jensen, J. L., Phillips, S. J., & Clark, J. E. (1994). For young jumpers, differences are in the movement's control, not its coordination. *Research Quarterly for Exercise and Sport, 65,* 258-268.

Kagerer, F. A., Bo, J., Contreras-Vidal, J. L., & Clark, J. E. (2004). Visuomotor adaptation in children with developmental coordination disorder. *Motor Control, 8,* 450-460.

Kagerer, F. A., Contreras-Vidal, J. L., Bo, J., & Clark, J. E. (2006). Abrupt, but not gradual visuomotor distortion facilitates adaptation in children with developmental coordination disorder. *Human Movement Science, 25,* 622-633.

Phillips, S. J., & Clark, J. E. (1997). Temporal coordination and control in the development of the standing long jump. In J. E. Clark & J. H. Humphrey (Eds.), *Motor development: Research and reviews* (vol. 1, pp. 99-121). Reston, VA: National Association for Sport and Physical Education.

Phillips, S. J., Clark, J. E., & Petersen, R. D. (1985). Developmental differences in standing long jump takeoff parameters. *Journal of Human Movement Studies, 11,* 75-87.

Seefeldt, V. (1980). Developmental motor patterns: Implications for elementary school physical education. In C. H. Nadeau, W. R. Halliwell, K. M. Newell, & G. C. Roberts (Eds.), *Psychology of motor behavior and sport—1979* (pp. 314-323). Champaign, IL: Human Kinetics.

Whitall, J., Block, M. E., & Clark, J. E. (1992). The development of walking: Interlimb coordination as coupled limit cycle systems. In M. H. Woollacott & F. B. Horak (Eds.), *Posture and gait: Control mechanisms* (pp. 315-318). Eugene, OR: University of Oregon Books.

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McCall, R. M., & Craft, D. H. (2000). *Moving with a purpose: Developing programs for preschoolers of all abilities.* Champaign, IL: Human Kinetics.

Mitchell, D., Davis, B., & Lopez, R. (2002). *Teaching fundamental gymnastics skills.* Champaign, IL: Human Kinetics.

National Association for Sport and Physical Education. (2004). *Moving into the future: National standards for physical education* (2nd ed.). Reston, VA: Author.

O'Quinn, G. (1990). *Teaching developmental gymnastics: Skills to take through life.* Austin, TX: University of Texas Press.

Portman, P. A. (2003). Are physical education classes encouraging students to be physically active? Experiences of ninth graders in their last semester of required physical education. *Physical Educator, 60*(3), 150-161.

Sanders, S. W. (2002). *Active for life: Developmentally appropriate movement programs for young children.* Champaign, IL: Human Kinetics; Washington, D.C.: National Association for the Education of Young Children.

Werner, P. (2004). *Teaching children gymnastics* (2nd ed.). Champaign, IL: Human Kinetics.

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