Motor Development
and the Young Dancer

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Introduction

Many young dancers begin their training by studying ballet, which gives a clear guide to teachers about the order and age of teaching material. A broader training palette is occurring in dance studios and schools, embracing additional dance forms from a variety of origins, cultural backgrounds, styles, and perspectives. It is important to understand age-appropriate movement training and devise class plans accordingly. The science of motor development provides an excellent tool for this purpose. First, principles of motor development add credibility to dance training by demonstrating scientific underpinnings. Second, health practitioners can gain a better understanding of dance training for various age groups through the lens of motor development. Third, it is not unusual to see television programs highlighting dance with young children, encouraging the execution of skills either too high level for the dancer or too extreme in nature, such as elevation work landing on the knees. It is probable that this is not the most effective way to train young dancers; teaching advanced skills may not be healthy for them physically, emotionally, and neurologically. This paper will examine motor development and how it can inform teachers, dancers, parents, and health practitioners about improved practices for dance.

Motor Behaviour: Development, Control, and Learning

The field of motor behaviour has three components: motor development, motor control, and motor learning. Motor development involves three characteristics: (1) it describes ongoing change in movement function and ability; (2) it examines these changes throughout stages of life, from prenatal to senior years; and (3) developments are progressive and irreversible, and they result from changes within the person

as well as from environmental interactions (Haywood & Getchell, 2009). *Motor control* explores how the nervous system organizes and directs the muscles and joints to produce coordinated movement, and how sensory information from the body (such as vision and hearing) and from the environment around the body is used to accomplish this task (Schmidt & Lee, 2011). *Motor learning* examines changes in a person's skill capabilities that are caused by experience or practice rather than development. These changes cannot be measured directly; rather, they are inferred by alterations in performance and are relatively permanent (Magill, 2011).

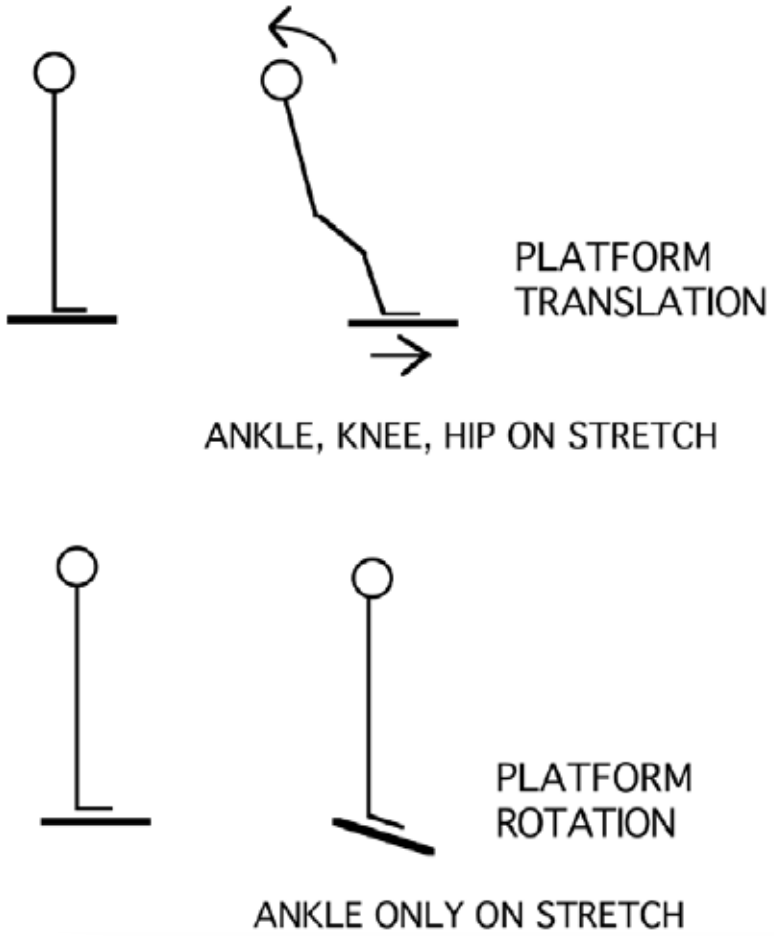
While early motor development theories only considered the genetic unfolding of skills and ideas about reflexes, the most current theory of motor development, the *ecological perspective*, emphasizes the interaction between the individual, the environment, and the task. There are two branches of the ecological perspective, which complement each other but emphasize different aspects involved in development. The first, called *dynamic systems approach*, states that people are attracted to certain movement patterns, but choice remains. For example, people typically walk with the hip joints in parallel position, but dancers can choose to walk with the hip joints in external rotation (turned out). The second, called *perception-action approach*, states that the development of movement and the development of perception cannot be separated. In the early developmental stages, an infant begins to lift the head to see the surrounding environment.

Postural Control and Balance

The discussion of motor development begins with postural control and balance, which underlie all movement in stance and traveling. *Postural control* is the ability to acquire, maintain, or regain a state of balance during physical activity. *Balance* is the ongoing loss and recovery of equilibrium during dynamic movement. The simple act of walking is the continual intended loss of balance from one foot and regaining balance on the other foot, even though we are not consciously aware of this pattern. There are two fundamental responses to disturbances to balance. One response, called *compensatory*, is reacting to unexpected or unplanned disturbances, such as someone bumping into you on the street. The other response, called *anticipatory*, is reacting to expected or planned disturbances, such as removing one's hand from the barre while in relevé passé during a ballet class or lifting one leg into Crane position in Tai Chi forms.

The early research in this field began with a simple device called the perturbation platform, which could translate forward and backward or rotate up and down, disturbing the balance of the participant.

Researchers learned that when the platform moved backward and the body swayed forward (imagine standing on a moving bus that comes to an abrupt stop), the muscles responded in a particular pattern: calves (gastrocnemius), back of the thigh (hamstrings), and back of the spine (erector spinae). When the body swayed backward, (the bus takes off as in the upper image to the right), the muscles that responded were front of the shin (tibialis anterior), front of the thigh (quadriceps), and front of the spine (abdominals). In both instances, there was a particular timing that was universal. Results were similar when the platform tilted. Later research examined a variety of conditions, such as disturbances known in advance, triggering anticipatory responses (such as lifting a suitcase), reactions during walking, supported disturbances (such as leaning on a bar), and eyes closed. These lessons yield important information about the necessity to train balance in a wide variety of conditions.



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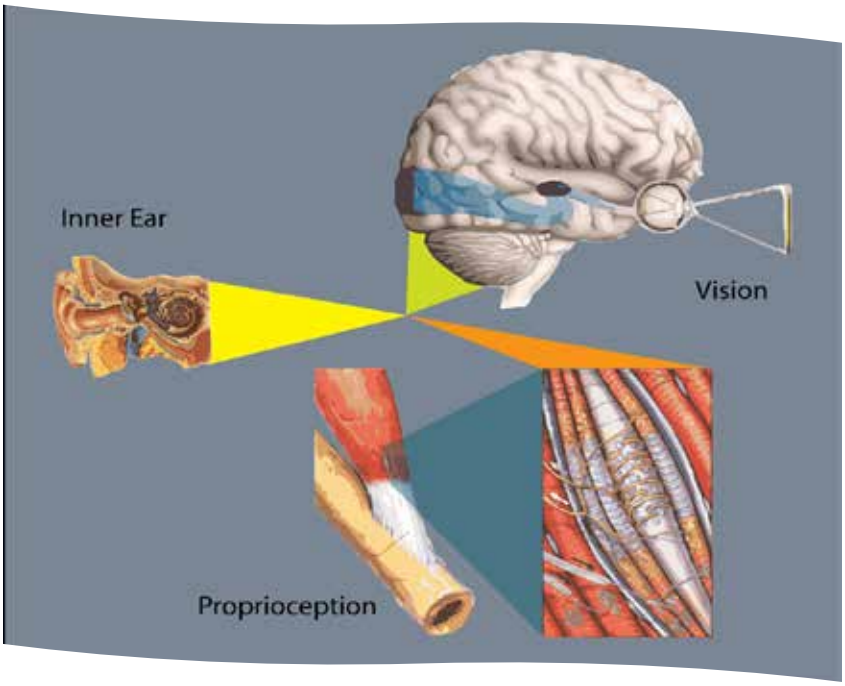
There are also sensory contributions to balance, from the visual system, the vestibular system (inner ear), and proprioception (nerve cells in muscles, tendons, ligaments, joints, etc.).



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These three systems develop in the very early stages of life, but are not immediately integrated, that is, they act independently. Therefore, the muscles that achieve balance have different responses at different ages, shown in the chart on page 4.

In the youngest walking subjects, both anterior (front of the body) and posterior (back of the body) muscles contracted at the same time with loss of balance, known as co-activation, and the children did demonstrate some balance control. From 4-6 years of age, muscles showed unpredictable reactions and demonstrated that balance was erratic,

Integration of the Three Systems	
AGE	**RESPONSE**
15-31 months (1-3 years)	Muscle co-activation, some balance control
4-6 years	Erratic muscle responses, high variability Inter-sensory integration
7-10 years	Similar to adults, slightly longer responses (slower)

often worse than in the younger children. This is the time when the three systems are integrating, and the brain is experimenting with differing attempts at balance. By the time children are 7-10 years old, their responses are similar to adults in muscle activation, but slightly slower. For dance teachers, this information gives some guidance in relation to age-appropriate material. Because the three systems have just fully integrated, 7-8 years old is an ideal time to challenge these mechanisms. If children are given extensive physical support (e.g., from a barre), head always upright, and using constant focus, they can become too visually dependent. Teachers need to challenge young dancers by having them work away from the barre, taking the head off the vertical, experimenting with eyes closed, and playing games that create opportunities for unpredictable loss of balance.

Implications for Technical Training

- **3-4 years:** Focus on creative play
- **5-6 years:** Beginning technique (body parts, alignment, locomotor)
- **7-8 years:** Technical training (no barre before this age)
- **10-12 years:** More skill acquisition (still explore creative movement, torso off centre

Other aspects of postural control develop even later, in the teen years and into adulthood. Dancers who rely on the mirror might develop a reliance on vision, which can impede the development of proprioception and body awareness. If trained with variety, dancers can become less dependent on vision, and more keenly aware of the vestibular and proprioceptive contributions to balance, which can give them a clear advantage when they perform on stage and are faced with lighting that can interfere with focus.

Teachers should be aware that growth spurts occur, usually between 11-14 years old, and can last 18-24 months. Modifications need to be made during these growth spurts. Arms and legs grow faster than the torso and left / right asymmetry can occur, causing variability in balance and coordination. Bone growth precedes muscle growth, causing a temporary loss of flexibility. Tendon attachments to bones are vulnerable to injury, and technique and control can regress. Proprioception matures up to the age of 13 years old, and the vestibular system matures even later, around 15 years old. It is essential that the work be adjusted during the adolescent years, and that teachers speak directly to these issues so that dancers do not suffer loss of self-esteem. Also, boys develop more slowly than girls during these early years, and teachers can give them encouragement and show patience.

Learning Movement in the Developmental Years

One question that arises in teaching beginners is the most appropriate way to describe and cue movement. There are two common approaches in sport science, and a third that dance teachers sometimes use. The first is called *external focus* and refers to describing movement by its outcome. In sports, this strategy often involves working with objects, such as throwing a ball to another person, shooting an arrow to a target, or kicking a football through the goal posts. The outcome is simply to get the object to its intended target. In dance, the cue for a leap might be to get the whole body in the air. The second approach is called *internal focus* and refers to describing components of a movement. A golf coach might work on the rotation of the pelvis or the follow-through of the swing of the arms. A dance teacher might focus on the timing of arms in a turn. The third strategy is to encourage the volitional (intentional) use of specific muscles to cause the movement. The reason this last strategy is not described in the

sports literature is that it is inefficient in patterning movement successfully and interferes with the brain's unconscious process of selecting the best muscle pathways. As for the other two strategies, they each have a place in dance instruction. When teaching beginners or advanced dancers who are learning a new skill, it is often necessary to describe movement components and break material down. Once a skill is learned, the dancer can simply think about a single image or vocabulary term, or idea, and accomplish the full task.

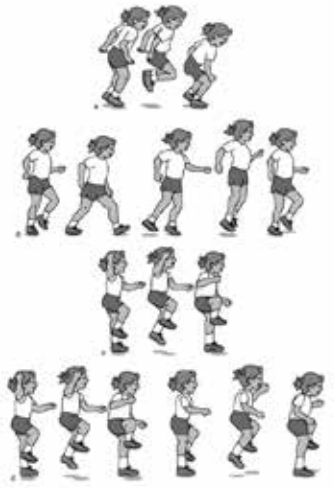
Early Locomotor Development

Given what is known about the integration of the balancing mechanisms, there are certain ideas that can be applied when teaching children in various developmental periods. In children from 0-3 years old, the first upright movement is walking, followed by running. After this stage, locomotor skills develop in the following order: jumping, galloping, hopping, and skipping.

Jumping is a skill going from two feet to two feet that begins in its simplest form at around 2 years old and continues improving from 3-7 years old. Galloping is an asymmetrical traveling step in which the same foot remains in front. Children begin to gallop between 2-3 years old and initially lead with the dominant leg. Hopping is a skill going from one foot to the same foot and integrates strength with balance. Few children younger than 3 years old can hop, and improvement continues past 5 years old. Skipping is a step followed by a hop, alternating legs, and places higher demand on coordination. It appears between 4 – 7 years old, but less than 20% of 4-year-olds can skip. These skills emerge when the child is ready in terms of motor development, and no amount of teacher persistence or practice can accelerate the process. It should be recognized that simply because a child demonstrates a skill early in development does not necessarily correlate with natural abilities in sports and dance.

Order of Locomotor Development

- **Jumping**
- **Galloping**
- **Hopping**
- **Skipping**



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Suggestions for Dance Class

With the understanding of the development of postural control and balance through childhood and adolescence, the following tools are suggested for teaching various age groups. For the youngest dance students, ages 3-6 years old, classes should focus on creative play. For children 7-8 years old, the three

balancing mechanisms can be challenged on a regular basis. The dancers can be introduced to movement that takes the head off the vertical and changes focus. They can play with eyes closed, and even attempt simple balances with no vision, such as balancing on one foot. Improvisation is a wonderful tool with this age group, as it challenges not only the balancing mechanisms, but also explores creativity and cooperation. All these ideas can continue right through the adolescent years.

Improvisation has been employed in dance classes for many years, but some of its benefits to motor development are under-appreciated. First, the number of movement ideas can be reduced from a fully choreographed combination using rhythm, space, dynamics, and several body parts, to focus on exploring just one concept, such as playing with weight, or levels. Second, improvisation often requires a compensatory response to loss of balance because of the unpredictable nature of the movement. In set technique, most balances are anticipated. Third, improvisation disrupts the habitual use of focus, by suggesting off-center work and other uncommon movement ideas. Finally, improvisation can utilize interactions with other dancers that encourage novel experiences and can help develop and strengthen social connections.

Other suggestions for designing classes during these adolescent years include modifying movement for either individuals or the whole group, to minimize injury. Jumping can be limited, as well as one-legged pointe work for the ballet dancers, and any movements that can stress the knees, such as grand plié. Excessive flexibility work should be avoided due to possible muscle tightness and weak connections of tendon to bone. Class can emphasize core and conditioning work, alignment, kinesthetic / somatic practices, and artistry. For a discussion of these topics in depth, you can read the Healthy Dance Canada resource paper “A Guide to Neutral Pelvis, Core Support, and Trunk Stabilization”.

Conclusion

The application of principles of motor development provides an excellent tool for understanding age-appropriate material for young dancers and constructing effective classes. Teachers and health practitioners can create an environment that supports the most effective ways to train young dancers and teach skills that are focused on physical and emotional health, without encouraging undue stress, injury, and anxiety. By knowing the age and developmental potential of the dancers in class, teachers can set reasonable expectations and encourage skill acquisition in a logical progression.

Recommended Readings:

1. Haywood KM, Getchell N. *Life Span Motor Development* (5th ed.). Champaign, IL: Human Kinetics, 2009.
2. Krasnow D, Wilmerding V. *A Guide to Neutral Pelvis*, Core Support, and Trunk Stabilization: A Resource for Dancers and Dance Educators. Resource paper. Healthy Dancer Canada, 2018.
3. Krasnow DH, Wilmerding MV. *Motor Learning and Control for Dance: Principles and Practices for Performers and Teachers*. Champaign, IL: Human Kinetics, 2015.
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7. Shumway-Cook A, Woollacott MH. *Motor Control: Translating Research into Clinical Practice* (4th ed.). Philadelphia: Lippincott Williams & Williams, 2012.

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The Dance Health Alliance of Canada