

## Music, Movement, and Learning

CARLOS R. ABRIL

Music and movement of the body are two naturally linked phenomena of human proportions. This is evident from the earliest years of life, when infants orient their heads toward a music-generating sound source (e.g., Fassbender, 1996), to later years, when children move their bodies to music with greater control and in culturally stylized ways (e.g., Blacking, 1967; Campbell, 1998; Moog, 1976) or adults move to music for therapeutic purposes (e.g., Frego, 2009). In fact, movement may be among the first human responses to music. Noting children's propensity to move as they produce music, some researchers have claimed the two behaviors might be one and the same (Moorhead and Pond, 1978). Others contend that the inherent properties of music create the real or imagined sense of movement. For example, philosopher Steven Davies claims that "movement is heard in music" and music is "experienced as significantly similar to human behavior" (2003, p. 132).

The connection between movement and music may reside in the human brain, where the motor and auditory systems are neurologically linked (Dura, 1998; Janata and Grafton, 2003; Repp, 2006; Sacks, 2007). Movement, music, and nonverbal processing of spatial information are all thought to be the responsibility of the right region of the brain, and much of that region has been found to become activated when people move their bodies, with or without music (Hanna, 2008). Researchers have found that music practice which includes physical movement "results in enlarged representations of somatosensory [*sic*] and auditory cortex... as well as the motor areas in the brain" (Davidson, 2009, p. 365). Daniel Levitin (2006) suggests that music experiences such as singing and playing instruments were a part of the evolutionary process, helping humans refine their motor skills. Regardless of whether the nature of music invokes movement or there are neural or

evolutionary links between the two, clearly, humans are predisposed to respond to the properties of music through bodily movement (Blacking, 1973; Campbell, 1998; Hsu, 1981; Moog, 1976; Moorhead and Pond, 1978; Trehub, 2003). As such, movement is an integral component of musical experience, cutting across time, culture, and geography.

### Movement as Ends and Means

Movement as part of any musical experience can be viewed as ends or means. When people spontaneously move to music, they often do so naturally, for sheer pleasure. This is commonly observed when an adult spontaneously taps his foot while listening to music or when a preschooler jumps rhythmically to a song she is singing. In these cases, movement is an end in itself. Another example is the formal practice of creating and/or performing to music, using the body as the primary artistic medium of expression as in ballet or modern dance. Movement is a unique way of expressing emotions that cannot be contained in words or a way of emulating the emotions expressed in music.

Movement as part of the musical experience can also serve as a means to an end. The most obvious example, which relates directly to producing music, is moving to create musical sounds on an instrument or the body. This is accomplished through fine motor movements such as plucking a string on a cello, or gross motor movements such as striking a taiko drum. However, lines between means and end can become blurred when, for example, children march for the simple pleasure of moving to music, as well as for the sound they might produce with their feet.

In educational settings, movement is used for a variety of reasons. It might be used as a means to develop or reinforce conceptual knowledge, skill, or understanding. For example, music teachers who seek to reinforce the concept of steady beat might ask their students to walk to the beat of a song. Movement can also be used as a nonverbal means to make music perception and interpretation visible. It can also be used as a means for accommodating and/or developing the kinesthetic learning style.

### Movement as Knowing

Although verbal and mathematical ways of knowing are most highly prized in Western societies, other forms of knowing are important because they offer the potential for communication, understanding, and expression. In fact, Gardner (1983) proposed that kinesthetic intelligence is one of many human intelligences, representing a unique way of thinking, solving problems, and representing knowledge. The Cartesian notion of a mind-body dualism, which had at one time been a prevalent way of thinking, has been rejected by many who contend that bodily movement can represent important

forms of knowing and thinking (Dura, 1998; Juntunen and Hyvonen, 2004; Reimer, 2003; Seitz, 2005). Some assert that purposeful movements or gestures are ineffable reflections of a person's knowledge and represent ways ideas can be conveyed without the use of discursive forms (Garber, Alibali, and Goldin-Meadow, 1998; Wis, 1993). Like music, movement and dance are ways of expressing that which words cannot contain (Dura, 1998; Reimer, 2003). Juntunen and Hyvonen (2004) go as far to argue that movement is a metaphor for music and serves as a conceptual bridge to musical learning. While movement might be a unique way of knowing, discrete from music, the evidence seems overwhelming that the two are related. The body can serve as an important medium through which to embody music and demonstrate musical knowledge.

### Movement in Music Teaching and Learning

Given the undeniable relationship between music and movement, and the fact that music making requires the simultaneous application of various sensory modalities, including the kinesthetic, it follows that the use of movement would be a logical part of music learning and teaching processes. Its use is suggested in K-8 music textbook series (Bond et al., 2008), as well as music methods texts for preservice educators (Anderson and Lawrence, 2004; Campbell and Scott-Kassner, 2006; Richardson and Atterbury, 2001). It also plays a prominent role in some commonly used music teaching approaches, most notably Dalcroze and Orff. Using movement to develop learning may be done based on the assumption that these experiences help students internalize or reinforce certain music concepts. Pedagogical articles and books advocate for its use in developing rhythmic competence (Dalby, 2005; Sheban, 1987; Weikart, 1989), musical expressivity (Carlson, 1980; Schnebly-Black and Moore, 1997), conceptual knowledge (Neil, 1990), and overall musicality (Campbell and Scott-Kassner, 2006; Woods, 1987). Furthermore, learning dances from specific cultures is thought to deepen understanding of musical practices and people (Longden and Weikart, 1998; McCarthy, 1996; Shehan, 1984).

The pedagogical literature on movement in music education is primarily geared toward working with students at the preschool and elementary levels. And while there is some discussion about using movement with students in instrumental music and/or at the secondary level (O'Toole, 2003; Regelski, 2004; Schleuter, 1997), it is limited in scope and far less prominent. This may be a consequence of the nature of music programs in secondary schools, which are primarily large Western European-style performing ensembles (Abril and Gault, 2008), or the notion that movement is more relevant and effective for use with children than adolescents or adults.

Music and movement are inextricably connected and mutually reinforcing phenomena. This might explain why movement is an inherent part of the

musical experience, where it is enacted in culturally specific ways that serve as both ends (e.g., artistic expression, body awareness) and means (e.g., musical skill development, producing music). One area of movement and music that is of particular interest to music educators is how it might be used to facilitate musical learning. This is what the present chapter seeks to examine in further depth.

### Purpose, Procedures, and Terminology

While there are pedagogical and theoretical books in which movement is central to the music-learning experience (e.g., Abramson, 1998; Jaques-Dalcroze, 1921; Schnebly-Black and Moore, 1997) and a respectable body of research literature on movement has emerged in the last 30 years, there seem to be no monographs or cohesive book sections in the music education literature that focus on research examining the relationship between movement and music learning. Intuitively, many educators believe that engaging learners in purposeful movement experiences is beneficial to general and specific facets of musical ability and knowledge. Extant research might be able to shed light on these beliefs and practices. The purpose of this chapter is to provide a broad view of the research literature on movement for its potential to inform future research and application in myriad learning settings.

Initial searches for articles and monographs on movement, education, music, understanding, and learning yielded hundreds of citations that were categorized into one of three categories: historical/theoretical, contextual, and empirical. Because the literature on movement was so large and encompassed so many disciplines, documents that did not examine movement in terms of its relationship to music or music-learning processes were not included. Studies were read and judgments were made as to their relevance, importance, and suitability for the chapter. Research on conducting, of which there was a respectable amount, was included only if it examined conducting not as an end, but as a means for developing musical understanding and knowledge. While music education was the primary focus, research in other fields was included if it was thought to shed light on movement's relationship to musical understanding.

The chapter begins by examining the use of movement in music teaching and learning processes from a historical and theoretical perspective. This is followed by a consideration of several contextual issues that influence the ways movement is currently being used by music teachers and the ways learners respond to these experiences. The next major section encompasses a review of evidence-based research literature that relates directly to the music experience. The chapter concludes with a discussion of patterns, implications for practice, and suggestions for future research.

Terminology related to movement and music education has been applied inconsistently in various bodies of literature. In an effort to remain consistent

within this chapter, here are some operational definitions of commonly applied terms. *Dance* is thought to be a Western concept with no corollaries in other cultures outside the West (Kaepler, 2000). While music and dance are seen as one and the same in some cultures (Merriam, 1964; Nertl, 2005), in the West, these two concepts remain distinct. Dance researchers use the term *dance* to include any expressive human movement arising from creative processes (Barr and Lewin, 1994; Hanna, 2008; Kaepler, 2000). It should come as no surprise, then, that dance is usually viewed as being peripheral to music education. For the purposes of this chapter, dance is a creative process of moving the body in space and time, in structured and culturally recognized ways.

*Purposeful movement* will be used to refer to external body movements used as a means to a nonmovement or dance end. While purposeful movement can be dancelike, it differs from dance in that it is not created or experienced for its own sake (Hanna, 1982). Purposeful movement, or just *movement* herein, can be a creative manipulation of the body, but the primary function is not centered on movement for its own sake. Purposeful movement can be subdivided into *directive movement*, which is directed and/or planned out by one or more people (i.e., choreographed), and *creative movement*, which is learner-driven, exploratory, and free.

*Locomotor* refers to any movement in which a person travels through space, from one place to another. Examples of locomotor movement include walking, skipping, crawling, and galloping. *Nonlocomotor* movement takes place around the axis of the body and does not carry a person from one place to another. Examples of nonlocomotor movements include clapping, stomping, and kicking. Other terms are described as they arise in the context of this chapter.

### Historical and Theoretical Issues

In a historical study of movement in music education, Campbell (1991) traced the use of movement in American music education to the late-19th- and early-20th-century efforts of educational reformers like John Dewey, Friedrich Froebel, and G. Stanley Hall. These leaders of the progressive movement in education believed that instruction in schools should be child-centered, meaning classroom activities should arise from children's natural interests and curiosities. They advocated for the inclusion of music and movement in the school curriculum because they were considered to be of natural interest to children and a way they learn.

Around the same time, the experiments and writings of Emile Jaques-Dalcroze were noticed by music educators in the United States (Lewis, 1998; Mark and Gary, 2007). Jaques-Dalcroze developed a system of rhythmic training through movement called Eurhythmics, which is just one part of a three-pronged approach commonly referred to as "Dalcroze." The other

parts of this approach to music education include solfège *rhythmique* and improvisation. The games, exercises, and activities used in this approach are thought to help students develop musicianship by the internalization of sounds through muscles and nerves and externalizations through bodily movements. Seitz (2005) provides some examples of Dalcroze-type activities: "students will toss bean bags or balls across the floor in rhythm... tap on the piano to different rhythms in unison, [or] clap their hands together while making lower leg movements in different meters" (p. 423).<sup>1</sup> Jaques-Dalcroze theorized that people should develop their musicality and kinesthetic awareness through active sensory experiences before more cerebral musical training begins (Schnebly-Black and Moore, 1997). He believed that the use of movement served as primary vehicle to access musical understanding and as a way to connect the mind, body, and spirit in the musical experience (Jaques-Dalcroze, 1921). The Dalcroze approach continues to be discussed and practiced in music education around the world today. Many consider it to be a viable approach for facilitating the development of musical skill, knowledge, and understanding for children and adults.

In 1908, Charles Farnsworth traveled to Europe to study innovative music education practices of the time. That is where he first observed Dalcroze teaching approaches in practice and recognized its potential for use in American music education (Mark and Gary, 2007). In a book published one year later, he advocated using movement in music education as a way to motivate children to focus on songs and to develop rhythmic competence (Farnsworth, 1909). In the 1920s, Mabelle Glenn was responsible for incorporating many of the movement-based ideas of Dalcroze Eurhythmics in the textbook series she edited, *World of Music* (Mark and Gary, 2007). Another influential leader in music education, James Mursell (1937), asserted that muscular responses to music were essential to learning rhythm. Specifically, he believed that movement was necessary for developing an understanding of melodic rhythms (phrasing) (Campbell, 1991). In the United States, the work of the aforementioned individuals helped to provide a theoretical, practical, and empirical basis for using movement in music classrooms.

While there was a momentum toward including movement in classrooms, there was some resistance to its application in the music curriculum (Campbell, 1991). In the early 20th century, Thaddeus Giddings (1929) asserted that movement was not an effective or efficient way of using time during music instruction, believing efforts should focus on developing students' ability to read music instead. He recommended that rhythmic movement be taught within the physical education curriculum. Although there were some exceptions, music textbooks at the time focused primarily on singing, with few to no pedagogical suggestions for the use of movement (Campbell, 1991). In most schools of the early 20th century, dance and rhythmic movement education fell under the auspices of physical education, not music education (Carter, 1984; Volk, 1998).

Rudolf von Laban was another major figure in movement and dance education who had an impact on music education. He believed that movement

should be learned by all people as a way to develop self-awareness and creativity (Laban and Ullmann, 1971). Although his theories of movement (developed before 1950) were more typically applied in dance and physical education, they eventually made their way into music teaching and learning practices (Brooks, 1993; Gordon, 2007; Lewis, 1998). Laban asserted there were four factors of bodily movement (time, space, flow, and weight) and eight basic actions (punch, slash, dab, flick, press, wring, glide, and float) (Laban and Ullmann, 1971). These concepts were thought to encompass a movement vocabulary that could be notated or used pedagogically. The application of Laban's ideas to music education came in interpreting movements through music and expressing music perceptions through movement, using the aforementioned factors and actions as guiding prompts or conceptual frames (Gordon, 2007; Nash, 1974; Woods, 1987). In recent years, there has been an emerging interest in applying Laban's ideas to conducting (e.g., Billingham, 2009; Gambetta, 2005).

Music educator and composer Zoltan Kodály sought to apply movement as a means to better singing in his method of music education (Choksy, 1981; Johnston, 1986). This primarily entailed the use of hand signs (commonly attributed to John Curwen and Sarah Glover), which represented different solfège syllables that could be used in conjunction with singing (Landis and Carder, 1990). Engaging the visual and kinesthetic modalities was thought to help children develop a better sense of intervallic relationships (Choksy, Abramson, Gillespie, Woods, and York, 2001; Choksy, 1999). While folk dances, action songs, and other forms of movement might be used as part of the Kodály method, they are considered tangential, not fundamental (Choksy et al., 2001). Kodály believed that movement should be used only as a means to help children develop musical knowledge and eventually be weaned away. In the words of Kodály: "You can truly understand music only if you hear music with no bodily movement at all—only in your brain, only if the music is flying freely in your head without any touch to the earth" (Johnston, 1986, p. 14).

The Orff approach to music teaching and learning evolved, in part, based on the assumption that dance arises from music and music arises from dance. In the early years of its development, Carl Orff and his collaborators experimented with integrating dance and musical arts by providing dancers with the opportunity to make music and musicians the opportunity to dance (Choksy et al., 2001; Shamrock, 1997). Carl Orff and Gunild Keetman (his close collaborator) were greatly influenced by the ideas of Jaques-Dalcroze and Laban (Orff, 1977). Many years after these initial experiments in music and dance education, Orff continued to posit that movement was a vital component of the music-learning experience. He stated that music should not be taught on its own; he believed that it should be a "unity with movement, dance, and speech" (1977, p. 6). Much like proponents of the progressive movement in education, Orff (1977) believed that movement was important in the education of children because it was a natural way they responded to their world in general and music in particular. An underlying assumption of

the Orff approach is that movement is inextricably linked with music and that the two are mutually reinforcing (Frazee and Kreuter, 1987). Orff (1977) asserted that Western society generally stifled the innate human need to move to music, which limited people's ability to fully develop as human beings. In the Orff approach, movement is used to provide students with opportunities to move in free, creative, and expressive ways (creative movement), as well as in structured and planned ways (directive movement) (Choksy et al., 2001). Today, teachers who seek certification in the Orff approach are required to successfully complete course work in movement, among other areas of study.

Physical education specialist Phyllis Weikart developed a teaching approach called education through movement. It is grounded in the belief that movement serves as a way to enhance learning in many subjects, including music (Weikart, 1989). She describes key movement experiences as an important grounding for music learning. The key experiences are acting upon directions for movement, describing movements, moving in both nonlocomotor and locomotor ways, and moving with objects. It is primarily focused on children in preschool through grade three. Weikart's teaching model includes three components meant to be applied in sequence: (1) separate, or teach movement through modeling using only one of three modes of presentation at a time (visual, aural, or kinesthetic); (2) simplify, or teach movement by starting with the simplistic actions and gradually building on them; and (3) facilitate, or provide students with opportunities to engage with movement ideas such that they construct knowledge for themselves. Weikart (1989) also developed a detailed hierarchy of movement types, based on their level of difficulty. In their book on elementary music education, Carlton and Weikart (1994) assert that a foundation in movement (the Weikart method) is essential in laying a foundation for musical development.

Edwin Gordon's music learning theory (MLT) has been characterized as a comprehensive method for developing audiation, a term used to describe hearing and comprehending music cognitively, without the presence of the sound (Gordon, 2007). The application of movement in MLT has been strongly influenced by the work of Laban, Jaques-Dalcroze, and Weikart and is thought to serve as a vehicle for facilitating musical thinking (Valerio, Reynolds, Taggart, Bolton, and Gordon, 1998). Claiming that rhythm is not an intellectually processed concept (unlike audiation), Gordon (2007) contends it is best learned kinesthetically—through body movements. Specifically, movement is used as a way to develop awareness of rhythmic concepts (i.e., meter, macro and micro beats, melodic rhythms), which are thought to improve musical performance. Like many music educators before him, Gordon asserts that movement is an essential means to improved musicianship. He states that "young children depend on uninhibited movement to grasp meaning of and to eventually audiate meter in a consistent tempo. Thus, when children are given freedom to explore movement, they develop a relaxed feeling as they move, which is the best foundation for formal music instruction" (Gordon, 1997, p. 247).

The National Standards in Music Education (Consortium of National Arts Education Associations, 1994) do not include movement as one of nine content standards, but it is addressed as one of several fundamental ways students can respond to music, as well as develop skills and knowledge in music. More specifically, movement is described as a way children (K-4) can demonstrate their perceptions of music and learn music through direct sensory experiences. Interestingly, involving students in movement experiences is not included in the standards above the fourth grade. Dance, however, is mentioned in reference to one of many arts forms students should be able to relate to music. Active experiences moving in the classroom may be seen as more relevant and/or effective for use with children in music instruction than it is for use with adolescents or adults.

Movement has played a role in American music education from as far back as the early 20th century. It has been applied in myriad ways to reach the specific learning goals that align with a given music education philosophy. Many teaching approaches and methods consider the use of purposeful movement as a means to help learners reach specific goals (e.g., better singing, rhythm, expression). This speaks to the somewhat pervasive pedagogical assumptions among advocates for movement in music education, that movement is an effective tool for developing skills, knowledge, and understanding.

## Contextual Issues

### *Developmental Issues in Young Children*

It seems clear that humans are predisposed to physically move to music, yet many questions remain: What is the nature and context of those movements? How do they change as people mature? Researchers have examined spontaneous movements to music in the earliest years of life, a period that is least affected by culture. This knowledge might provide educators and researchers with a better understanding of the ways humans process and come to understand music, which have implications for practice and research.

The first human responses to music are manifest through movements of the body. Researchers have found that infants respond to music-like sounds through movements of their heads and eyes, as ways of orienting toward a given sound source (Papousek, 1996; Pouthas, 1996; Trehub, 2003). These physical responses are thought to serve as indicators of music perception, including preference and attention (Ilari, 2002). Although movement in the earliest months of life does not seem to reflect specific properties of music, movement toward a sound source is a purposeful physical response to music.

The music-like sounds infants choose to move to provide clues about their perceptions. Research has found a strong relationship between a mother's speech, which is quite music-like (Ilari, 2009), and an infant's movements (Condon and Sander, 1974; Gruhn, 2002). Some have theorized that elemental syntactic and prosodic language structures are innately processed by infants through bodily movements (Condon, 1975). Interestingly, Nakata and Trehub (2004) noted decreased limb movements and increased attentiveness (measured through visual fixation) when infants were presented with audiovisual displays of maternal singing. Researchers claim that decreased spontaneous movement is a direct result of increased attention. Another theory is that children feel comforted by the sounds of their mothers' voices, which leads to reduced heart rates, associated with decreased body movements. These studies suggest links between infants' movements to sound and cognition.

Other researchers have studied the nature of movement responses to music in the first months of life. In a classic study of young children, Moog (1976) found that the first physical movements to music included limb extensions, bouncing, and swaying; prior to the 18th month, children moved to music in repetitive but unsynchronized ways. As the infants matured, however, they became better able to control their movements, which permitted them to respond to music in ways that seemed (to observers at least) to reflect the music. Hicks (1993) also found that children 6 and 14 months of age responded to music most often through physical responses but noted a sequence of movement types. Children most commonly and first moved through orienting responses, followed by nonpulsating, then pulsating movements in the body. These purposeful physical responses were found to precede vocal responses to music, furthering the case that movement is a primary form of response to music. These two observational studies note developmental trends in the ways children move to music, indicating greater direct relationships between musical stimuli and movements.

Movement and musical production also seem to be closely related in young children. In their landmark study of young children's unhampered music making, Moorhead and Pond (1978) stated: "The constant simultaneous occurrence of musical production and rhythmically bodily movement, as beating a drum or ringing a bell while marching, led to the belief that the rhythmic factors of physical movement and musical production are related if not identical" (p. 31). At times, music seemed to spark movement; at other times, movement seemed to invoke music making. Children moved for the sheer enjoyment of moving; at other times, they seemed to move as a means of making sounds. For example, children stomped to make sounds with their feet. Similar reasons for moving were observed and described in a more contemporary ethnographic study of children's music making in the United States (Campbell, 1998).

Moorhead and Pond (1978) noted patterns in the unique, recurring movement habits of individual preschool children as they engaged with music. Some children moved in ways that reflect scenes from life (someone

swimming or driving a car). Other children moved in more stylized and dance-like ways to music that was being played or to music they produced. Rhythmic movements observed seemed to be reproductions or interpretations of the rhythmic qualities of music. Other times, they were performed for the purpose of creating sound. Children were often observed chanting and singing softly as they walked around the room, yet running was often accompanied by louder chants. Movement speed (or intensity) may be a way children naturally express dynamics (or intensity) of music they produce. We can speculate that this might be the same for music transmitted through another performer or a recording.

Children's creative movement responses to music were examined in another observational study (Sims, 1985). Children between the ages of 3 and 5 were asked to move freely to three different musical excerpts in an experimental environment that controlled for peer or adult modeling. Music excerpts lasted a little under a minute each and were chosen to represent a variety of styles and tempi. Responses were videotaped, and two observers were asked to analyze the type of movements in 5-second intervals based on the following *a priori* movement categorizations: locomotor, axial movements (nonlocomotor, large body movements), and small motor movements (nonlocomotor, small body movements). Among all 22 children tested, the frequency of movement types was distributed almost equally: locomotor movements (28.69 percent), axial movements (21.88 percent), small motor movements (21.67 percent), and no movements (27.33 percent). Most individual children limited their movement types to a few. Older children who moved rhythmically were found to synchronize with the beat more often than young children. There were no significant differences in movements by gender. These findings might not be indicative of the way children move in naturalistic settings. Children are likely to move very differently when they are in their bedrooms listening to music or making music by themselves or in more social environments. Nonetheless, it is interesting that children were rather limited in their movement vocabularies, and their abilities to express music through movement continued to develop with age.

In a study of preschool children's creative movements to music in free play conditions of a classroom, Metz (1989) observed that children were in tune to certain elements of the music heard. For example, children would cease movement during silences and resume when the music played again. Although the speed and intensity of their creative movements changed for each musical example, indicating they were aware that the music was different, their movements did not always correspond to the style, pitch, or dynamics of the music. Curiously, Moorhead and Pond (1978) noted that children were able to perceive dynamic changes as inferred by changes in their movements. It may be that children are able to encode and express through movement, music they produce more effectively than music they hear. Findings suggest that certain music elements or ways music is transmitted are more easily perceived or naturally expressed through movement than are others.

### *Sociocultural Factors*

The social environment plays a role in the ways children respond to music through movement. One study reported that children with severe intellectual disabilities responded with movements to music sung or played by a caregiver more frequently than to other nonhuman music stimuli, such as music recordings and music toys (DeBedout and Worden, 2006). Metz (1989) reported that when adults provided verbal suggestions, descriptions, or encouragement, children's physical responses became more aligned with the musical elements. Teacher modeling and verbal prodding were also found to be effective in increasing the diversity of movement responses in young children. Children are also affected by those they observe. From as young as 18 months, children copy movements they see modeled by teachers and caregivers when listening or performing music (Metz, 1989; Reynolds, 1995). Research findings indicate that preschool (Flohr and Brown, 1979) and upper elementary students (Ferguson, 2004) are highly influenced by their peers when moving creatively to music. Clearly, the ways humans move are highly influenced by individuals in their social environs.

Researchers have sought to determine if there are gender differences in the ways children move to music. In an observational study of 3- through 5-year-old children, Miller (1983) found that girls had a tendency to move to music more often than boys. The older girls were found to imitate one another's movements more often than boys. In another observational study of children's natural music-making behaviors, Campbell (1998) noted that "both boys and girls exhibited continuous motor activity, but while boys typically used their whole bodies, the movement of girls often showed an isolation of one or two body parts, such as clapping and stamping" (p. 18). Other gender differences were noted by Boone and Cunningham (2001) in the ways that boys and girls expressed emotion in music through movement (described further in the section on expressivity). In contrast to these studies, Sims (1985) found no differences in movement type by gender—possibly explained by the experimental testing conditions or the *a priori* categories used to measure and classify movements. Despite these findings, the research suggests gender differences in the quality and effort of movements.

The studies of children described in this section provide a window into the ways humans spontaneously move to music. Despite common beliefs, research has demonstrated that from the earliest years of life, children move in purposeful ways to music. Although those movements might not be directly or obviously reflective of music to an adult observer, even from the earliest months of life, they do serve a purpose. A lack of movement, while not indicative of the music elements, might be an indicator of increased attention to music. There seem to be developmental trends, where movements are more closely related to music elements with maturity. These responses can come into greater alignment with music with suggestions or through modeling provided by a teacher or other caregiver.

Children's movements to music are diverse and unique to each individual but are also highly dependent on and mediated by social context. Obviously, as children mature, their environment has an increased impact on how they choose to move (or not move) with and to music. The body of research on spontaneous movements to music made and heard in the preschool years suggests a number of movement categories that might be helpful for purposes of classification: (1) *functional*, or movement that serves a specific function (e.g., orienting one's head or eyes to a sound source) and is not an expression or interpretation of the music heard or performed; (2) *rhythmic*, or movement that is reflective of the rhythmic elements of the music produced or heard that might be realized for the sounds it produces (e.g., stomping feet) or the kinesthetic feeling it induces; (3) *creative*, or movement that expresses a combination of elements (e.g., dynamics, melody, expression) in music produced or heard, freely created by the mover; (4) *dramatic*, or movement that imitates some scene from life experience (e.g., someone cooking or swimming); and (5) *dance*, or stylized movement that is culturally recognized as dance. Any of these five movement categories can be nonlocomotor, locomotor, or a combination. They have all been commonly observed in children's natural engagements with music.

### *Time and Nature of Instruction*

Given humans' propensity to move to music and the historical preponderance of pedagogical endorsements regarding the use of movement in music instruction, one might assume that its use is pervasive in music education practices. A number of studies have measured the amount of time devoted to movement in the music classroom. About 30 years ago, researchers found that movement was commonly used in many elementary music classrooms, although it only comprised a small proportion of class time (Forsythe, 1977; Moore, 1981; Wagner and Strul, 1979). In another study examining uses of music class time, researchers reported that elementary music teachers trained in Orff Schulwerk used movement an average of 26.14 percent, which was more than any other music activity (Wang and Sogin, 1997). It should be noted that there was a high degree of variability among teachers across all music activities that were observed. Connors (1995) reported that elementary specialists in a large urban school district used movement in their music classes with all grade levels, although it was used more often in lower than upper elementary grades. In addition to knowing "if," "how much," and "with whom," some researchers have questioned "how" and "to what ends" movement is being applied in practice.

In a recent study, American preschool teachers surveyed claimed to use directive movement activities with preschool students in conjunction with singing (Nardo, Custodero, Persellin, and Fox, 2006). The majority of these teachers (72 percent) reported teaching movement by serving as models and asking students to imitate them. The most common use of movement was in

relation to action songs. Movement was important to teachers because they believed it was a reflection of students' ethnic cultures and it helped them develop their kinesthetic intelligence. Temmerman (2000) studied Australian preschool programs to observe how movement was being utilized in music instruction and what meaning it had for children. Movement was found to be an integral part of preschool music curricula and was used for a variety of means and ends. For example, it was used during listening activities, to accompany singing, to reinforce music concepts, to develop bodily awareness, and to develop social skills. The children in these programs were asked to describe their preference for myriad music classroom activities. Of all music activities that were part of these programs, movement and dance were ranked most positively among students. In describing why, the children referred to the active nature of movement and the joy they felt moving freely and creatively to music.

### *Student Attitudes and Preferences*

Researchers studying student attitudes and preferences have found that movement is a classroom activity generally enjoyed by students. Carlson (1983) studied the effects of a movement-based instructional curriculum on fifth-grade students' attitudes toward the music program. Results indicated that students in the movement group were more positive toward overall music instruction than those in a control group (no movement). Males in the treatment group responded more positively to movement-based instruction than did their female counterparts. Besides the gender difference, similar results were reported for high school students in a choral ensemble (McCoy, 1989). It should be noted that these results might be explained by the Hawthorne effect, which suggests any new or special treatment will yield a positive result. Bowles (1998) found that students were more positive toward moving creatively than toward moving in a directive, dance-like manner, across and within grade levels (K-5). While playing instruments was the preferred music activity (chosen by 50 percent of students), dancing/moving was ranked second (15 percent), followed very closely by singing (14 percent).

Some researchers have examined students' preferences for various presentation modalities (i.e., visual, kinesthetic, aural). When asked to interpret music through listening experiences, Kerchner (2000) found that second- and fifth-grade students preferred using visual (iconic images representing music) to kinesthetic (creative movements representing music) modes of representation. Similarly, Dunn (1994) found that students preferred to have music presented through visual rather than kinesthetic modalities in a classroom setting. It would be interesting to know if the preference for visual modalities noted in these studies can be explained by the manner in which music is transmitted and/or experienced in contemporary culture. Alternately, visual modes of presentation or representation might seem more valuable to

children because of their permanence. In contrast, kinesthetic modes of representation are temporal and fleeting. Children might also be more self-conscious about using kinesthetic representations in the company of their peers.

Research confirms that movement is being used in music instruction, especially at the preschool and elementary levels. The reasons for using movement in music instruction vary, from developing body awareness, to honoring student cultures, to reinforcing music concepts. While movement is not necessarily the preferred music classroom activity or mode of representation or presentation, there is evidence that students express positive attitudes toward movement throughout various grade levels. Students' preferences for movement activities are likely to be dependent on the nature of the experiences provided by teachers. It should be noted that with the exception of one, all of the studies in this section on uses and attitudes focused on formal learning experiences of elementary and preschool age children.

## Research on Movement and Music Learning

### *Rhythm*

Musical rhythm has many direct corollaries to movement. For example, when people talk about moving their bodies to music, they rarely say they are moving to a melody or a particular harmony; people move to the beat or rhythm. Furthermore, the ability to synchronize to music is a necessary skill for both music and dance—two inextricably linked art forms. From the fine motor skills needed to play the sitar, to the gross motor skills needed to play a marimba, the very nature of performance depends on one's ability to move rhythmically. Aware of these connections, Jaques-Dalcroze (1921) went as far as to claim that musical rhythm is movement and movement is rhythm. It should come as no surprise that experiences moving may serve as a way to develop or reinforce rhythmic skills or perceptions. A number of studies have examined the relationship between movement and rhythm, as well as the viability of using movement as an instructional tool for rhythmic learning.

### *Personal Tempo*

Personal tempo is the natural pulse or beat created by an individual through locomotor or nonlocomotor movements (e.g., walking or clapping) without any music stimuli. Knowledge of personal tempo is thought to be important because it provides instructors with a baseline understanding of natural rhythmic tendencies. Walters (1983) reported that personal tempo was fairly consistent for individuals but highly variable among individuals. Kindergarten through third-grade students were found to have personal tempi that ranged from 40 beats per minute (bpm) to 210 bpm. Research findings consistently

indicate that increases in age correspond with decrease in personal tempo, for both locomotor and nonlocomotor movements (Drake, Jones, and Baruch, 2000; Frego, 1996; Loong, 1999; Walters, 1983). Physical (limbs) and physiological (heartbeat rates) differences might explain these maturation differences.

Like Walters (1983), Loong (1999) found that individual children were fairly consistent in their personal tempi for a given performing task. However, tempi performed by these preschoolers varied according to the task and were found to be less variable among individuals. There were significant differences in mean beats per minute between instrument types used to create a beat. The following are personal tempo ranges by instrument type: scraping instruments (111.09–113.53 bpm), striking instruments (140.18–142.39 bpm), and shaking instruments (162.90–167.93 bpm). This is likely to be a result of the size of the movements required to make a sound on each of the instrument types and the greater complexity of playing a scraping or striking instrument, which involve two hands, each responsible for different types of movement. It is interesting to note the small variability among children on a given instrument type.

*Beat* Synchronization studies have examined the ways people maintain a beat to music using movements. Synchronization refers to the "coordination of rhythmic movement with rhythmic sensory stimuli" and is considered fundamental to both music and dance (Repp, 2006, p. 55). People have been found to have a tendency to anticipate the beat when synchronizing taps (small motor, nonlocomotor movements) to a metronome, yet when the stimulus includes additional tones in between the beat, or when additional movements are inserted between taps, the anticipation tendency disappears (Repp, 2006; Snyder and Krumhansl, 2001). Trained musicians also anticipate the beat when tapping, although their asynchrony is far less pronounced than it is for nonmusicians (Aschersleben, 2002). In reviewing a large body of literature on synchronization, Aschersleben (2002) surmised that "synchronization error is in no way an artifact of the experimental situation but seems to be necessary for persons to gain the subjective impression of being in synchrony" (p. 67). These studies might help to explain the general tendency people have of rushing a pulse expressed through locomotor and nonlocomotor movements.<sup>2</sup>

Several studies have examined the relationship between personal tempo and the ability to synchronize to a beat. Children of various ages (6, 8, and 10) and adults with and without formal musical training were tested on beat-tapping ability (with and without a musical stimulus) and tempo discriminations (Drake, Jones, and Baruch, 2000). Researchers reported developmental changes corresponding with increased age and amount of music training, which included a decreased personal tempo and an improved ability to synchronize with music and discriminate tempi. Results also indicated that children were more successful on a synchronization task when the music was closest to their personal tempo. Slower tempi were generally

more challenging for students than were faster tempi. This particular finding is consistent with an earlier study of preschool children (Frega, 1979). Furthermore, students classified as having a consistent personal tempo were found to be significantly more successful on the synchronization test than those classified as having an inconsistent personal tempo. Both of these studies suggest that maturation plays a role in ability to synchronize to a beat. As such, performance improvements in moving to a beat might be expected with advanced age, as well as music training.

Clearly, certain movements of the body are going to pose a greater challenge than others for students. In her teaching method, Phyllis Weikart (1989) recommends that children experience keeping a steady beat in a variety of ways but that they should follow a particular sequence, which she posited moved gradually from simple to more complex. One study sought to measure the validity of this sequence by testing children from 3 through 7 years of age (Jordan, 1994). Beat coordination was found to be significantly more difficult using the lower body movements (stomps) than upper body movements (claps); movements without an end point were significantly more difficult than those with an end point; movements asymmetrical to the body were more difficult than symmetrical movements. As found in many prior studies, ability to keep a beat improved with each successive age level. These findings were confirmed by a similar study in physical education research (Derri, Tsapakidou, Zachopoulou, and Gini, 2001). Both of these studies served to validate the sequence of movement types (by level of difficulty), as recommended by Weikart in her education through movement teaching method (Weikart, 1989).

Some studies have examined the different means through which children can express rhythm through movement. In a study of preschool children's rhythmic abilities using different movement types, researchers concluded that large motor movements were more challenging to control than small motor movements (Rainbow and Owen, 1979). This is supported by another study that found that kindergarten through third-grade students had more difficulties echoing rhythmic patterns through stepping than for clapping or chanting (Schleuter and Schleuter, 1985). As in other studies, there was a positive relationship between rhythmic test scores and grade level, suggesting maturation and/or training effect. Rainbow (1980) found that 3- and 4-year-old children are more successful at performing rhythms when doing so through vocalization rather than movement tasks. The addition of speech while moving during music training might also improve the rhythmic accuracy and expressivity of rhythmic movements performed by children (McFarland, 2006). Larger movements of the body seem to be more difficult for children to control with the precision required of rhythmic or synchronized movements. That might explain why children were more successful chanting or speaking rhythms than moving the rhythms through small or large motor movements.

*Impact of Instruction on Rhythmic Skills* A large number of studies have sought to determine the impact of movement instruction on rhythmic

performance skills. Dalcroze Eurhythmics has been used as an instructional treatment in several of these studies. Rose (1995) measured the effects of Eurhythmics on the beat competency of students in kindergarten, first grade, and second grade. Three classes received music instruction through a Dalcroze approach, and three classes (control groups) received music instruction primarily through verbal explanations and no movement. At the conclusion of the 32-week treatment period, a test of beat competency was administered. Results revealed a significant difference between groups, in favor of those who received the movement training through a Dalcroze approach. Other studies have found that using a movement approach in music instruction (Dalcroze or Laban) had a positive effect on 4- and 5-year-old children's ability to perform macro and micro beats with a song (Blesedell, 1991). No differences were found between the two teaching approaches. It may be that these two approaches were not distinct enough as they were applied in the instructional treatment. In another study, sixth-grade students who received 10 weeks of movement instruction in the instrumental music classroom were significantly better at a synchronization test than were students who received traditional rhythm instruction, without the use of movement (Rohwer, 1998).

One study tested the effect of instruction customized to students' personal tempi on a variety of synchronization tasks (Nelson, 1990). Results indicated that there was no significant difference between those who received the treatment and those who received training in beat keeping that was not customized to students' personal tempi. This finding stands in contrast to a prior study that did find that children were more successful when tasks were closer to their personal tempi (Drake, Jones, and Baruch, 2000). Another study found no difference in synchronization abilities if young children were trained primarily through locomotor or nonlocomotor movements (Croom, 1998). It seems that any training or movement experiences maintaining a steady beat on one's body can result in an increase in kinesthetic synchronization abilities. Maturation and other informal experiences with music seem to be the primary explanation for these results. Maturation is a significant factor leading to improvements in motoric music abilities (Gilbert, 1980; Zimmerman 2002).

Perceiving a steady beat is thought to be fundamental to accurate music performance. Therefore, physically moving one's body to a steady beat while performing seems to be a logical way to ensure beat perception and improve performance. To test this notion, Boyle (1970) studied the effects of foot tapping on 191 high school instrumentalists' sight-reading abilities. In a carefully constructed experimental design, instrumentalists were divided into two groups. All groups received instruction in listening to the beat, as well as playing and practicing rhythmic patterns, but one group was instructed to tap the beat as they performed and the other was not. Results indicated that students who were instructed to tap their feet to the beat were more successful at a rhythmic sight-reading task than those who were not.

Other studies have specifically examined the effect of rhythmic movement training on rhythmic achievement. Children in one study were provided with movement instruction—20 minutes, once a week, for 28 weeks (Douglass,

1977). A control group received rhythmic training using traditional verbal counting systems. Froseth's "Physical Response to Rhythm in Music" (PPR) test was used as pretest and posttest measures to determine the ability to echo rhythms on a woodblock and clapping. Analysis of the results showed a significant difference in rhythmic performance abilities, in favor of the movement group. Moore (1984) also found movement training (through an Orff approach) to have a positive impact on the rhythmic abilities of second- and third-grade students, as measured through an aptitude test. In another study, the use of Laban movement efforts (flow, weight, time, and space) in music instruction was found to improve rhythmic performance skills but not rhythmic perceptions of high school students, as measured by several author-constructed tests (Jordan, 1986).

Most studies examining the impact of movement on rhythmic learning have done so in terms of a particular instructional treatment. Kuhlman (1996), on the other hand, tested the effects of prior participation in a movement-based music instruction on beginning instrumentalists' abilities to express duple and triple meters in performance. One group of instrumentalists had participated in the 3-year, weekly music program that used education through movement (Weikart method) prior to starting the instrumental program. Another group did not have this background. All participated in the same instrumental lessons during the period of the study. Results indicated no significant difference between groups on the ability to express meter in a performance on their instruments. Studying the long-term impact of a particular approach to movement or music education is ripe with possibilities. In this study, the dependent variable might have been too limited in its scope and focus. We can only speculate that a series of varied performance tests may have provided some evidence of the impact of past movement training on current performance skills. Alternately, it is possible that students were not able to make transfers of learning between the 3 years of instruction in general music and the current instruction in learning to play an instrument.

*Impact of Instruction on Rhythmic Perception* Educative movement experiences with music have been found to shape rhythmic perceptions. In a carefully designed and controlled experiment of rhythmic perception, infants listened to a 2-minute rhythmic pattern without accented beats (Phillips-Silver and Trainor, 2005). As the rhythm played, half of the infants were bounced by an adult on every second beat (duple) and half on every third beat (triple). After the treatment, listening preferences were tested for two versions of the same rhythmic pattern but with accents on every third or second beat added. The experiment was repeated a second time, with infants being blindfolded. Results were consistent for both experiments: infants preferred the version (duple or triple) that corresponded with the way they had been moved. This suggests that experiences of moving to music affect our music perceptions.

Joseph (1982) studied the impact on rhythmic perceptions of kindergarten students of year-long music instruction with a major emphasis on movement

through a Dalcroze Eurhythmics approach. Findings indicated that children in the treatment group were more successful in identifying and responding to familiar rhythmic patterns found in unfamiliar musical examples than those in a control group who did not receive movement instruction. Findings from both of these studies suggest that as early as infancy, movement experiences affect rhythmic perceptions and identification skills.

Other studies have yielded confounding results. In one study, sixth-grade beginning instrumentalists who participated in a movement-based instructional treatment were no more successful than the control group (who received traditional beginning instrumental instruction) on a test "that assessed the students' abilities to perceive degrees of steadiness and tempo change in compared isochronous tap sets" (Rohwer, 1998, p. 418). Lewis (1986) found no significant differences in her study evaluating the effectiveness of movement-based instruction on music perceptions of first- and third-grade students. Scores on the rhythmic portions of the dependent measures (i.e., meter, rhythm patterns, and tempo) were no different between the control (no movement) and treatment groups (movement).

Gates (1993) found evidence that a visual-aural mode of instruction was more effective than a kinesthetic-aural mode on first-grade children's rhythmic achievement. Students who participated in the kinesthetic music classes (i.e., movement-based) scored significantly lower on a rhythmic achievement test (aural rhythmic discrimination and rhythmic matching tasks) than those in the visual group. Rhythmic instruction emphasizing movement seemed to be less effective than similar instruction emphasizing visual modalities. These findings might be explained by the tests used to measure achievement, which relied on the kinesthetic less than the aural and visual modalities. Interestingly, other studies have found that children prefer visual modes of representation over kinesthetic modes (Dunn, 1994; Kerchner, 2000).

Rhythmic movement is an essential skill in most music-making endeavors. It is an area of the literature that has been of interest to researchers in both music education and psychology of music. Certain patterns were noted in the literature. First, maturation plays a significant role in myriad rhythmic abilities. As children mature, their ability to synchronize to a beat improves, as do their general rhythmic achievements. Second, when asked to maintain a steady beat to music, people have a tendency to anticipate the beat. Musical training, as well as the type of music stimuli, plays a role in decreasing that asynchrony. Third, certain movements are more challenging to children to perform with precision. Large motor, locomotor movements are more difficult than small motor, nonlocomotor movements. In fact, nonmovement tasks (verbalizations) seem to be the easiest ways of producing rhythm in childhood. This is not to say that they should not perform rhythms through the body at some point, but it might suggest a particular teaching sequence. Fourth, there is no evidence from the research that one movement approach is more effective than another in developing rhythmic skills or perceptions. Studies reviewed indicate that any type of movement training is effective in improving learners' rhythmic skills. The effectiveness of movement instruction

in music instruction on rhythmic skills seems to be more convincing than it is for rhythmic perceptions. In part, this might be explained by the fact that movement activities were closely related to the dependent measures, which required movement. In other words, instruction was most closely linked to the test.

### Pitch

Many of the English-language terms applied in reference to pitch are metaphorical and suggest space, movement, and time. Terms such as *up*, *down*, *higher*, *lower*, *step*, and *leap* are used refer to both the relative position of pitch and specific movements of the body. While movements of the body are concrete and provide visual and kinesthetic cues, pitch is abstract and has less obvious bearing on the terms used to describe its movement—except maybe in standard notation. Given this semantic relationship, movement might be used as a means for developing understanding of pitch concepts.

Several studies have sought to determine if instruction that includes substantial movement experiences would have an effect on pitch discrimination abilities. One study examined the effect of a Dalcroze-based approach on 76 first-graders' melodic perceptions (Crumpler, 1982). Two intact classes were provided with twelve 30-minute lessons on melodic concepts using lessons from a popular textbook series that included no movement. The other two intact classes received instruction on the same melodic concepts, taught making extensive use of Dalcroze-based instruction (i.e., movement games and activities). After the treatment period, students were tested, using a researcher-developed measure, on their ability to make pitch register and contour discriminations. In contrast to the textbook group, children in the Dalcroze group made significant gains from the pretest to the posttest. While there were significant differences on mean pretest scores between groups (in favor of the textbook group), there were no differences on posttest scores. Results from a similar study with third- and fifth-grade students support these findings (Berger, 1999).

Other studies have also confirmed the positive effects of movement instruction on pitch perceptions. In one study, kindergarten students were provided with either music instruction that included singing and movement or another that only included singing. After 6 weeks of instruction, kindergartners in the movement group performed significantly better than their counterparts on tests of pitch discrimination (Montgomery, 1997). Steeves (1985) examined the effect of using Curwen hand signs<sup>3</sup> on interval identification. Results indicated that children in the hand sign group were more accurate and quicker to identify intervals than children who were in the group that did not use them. In another study, Dunne-Sousa (1988) found that children were able to identify a song most accurately through movement cues (corresponding movements for a song) than through other cues, such as chanted rhythms. These studies provide support for the use of movement in

music instruction as a means to improve students' awareness and understanding of pitch-related concepts.

However, mixed results were reported in one study. Mueller (1993) sought to determine the effect of movement-based instruction on the melodic perception of third-grade students. The instructional treatment, designed to teach melodic concepts through movement, was administered twice weekly (30 minutes) over the period of 9 weeks. A control group received music lessons focused on melodic concepts without the use of movement. The melodic concepts included pitch register (high and low), direction (up, down, and same), and progression (steps, leaps, and repeats). Components of Colwell's (1979) *Silver Burdett Music Competency Test* were used to measure the aforementioned melodic concepts. Results indicated a significant difference between the treatment and control group test scores for melodic progression, in favor of the movement group. However, no significant gain scores were found for either group on measures of pitch register and direction. One wonders if there was a ceiling effect in this study, given the simplicity of the dependent measure for these children. It may be that any training would have had little impact, one way or another, on test scores.

### Vocal Performance

Children have a natural tendency to move as they sing (Campbell, 1998), and singing while moving has been noted to seem more "free" than in other conditions (Moorhead and Pond, 1978, p. 41). Several studies have sought to better understand the relationship between movement and singing, two seemingly linked phenomena.

In a longitudinal study on the development of young children's musical potential, Gruhn (2002) studied a group of 1- and 2-year-old children in a stimulating musical setting for 15 months, focusing on their attention, movement, and vocalization. One of the most pertinent results of this study was the strong correlation found between the coordination, fluency, and synchronization of movements and the accuracy of pitch reproduction in the voice (Gruhn, 2002). Based on the findings of the study and knowledge of the literature, Gruhn stated that "it is difficult to find a neurologically plausible explanation because there is no overlap of the cortical areas for movement and voice production, but there is evidence for a neurophysiological link between gross and fine motor control in body movement and in muscles engaged in the vocal apparatus" (pp. 65–66). These results suggest a relationship between fine motor movements that affect singing intonation and pitch accuracy.

Bodily movement might both improve singing and reflect the music sung. In a case study of singer Annie Lenox, Davidson (2001) found evidence to suggest that Lenox's singing voice was physically supported and sustained through the use of certain external body movements. Liao and Davidson (2007) reported that children's movements were reflective of their vocal qualities. For example, "the size of the movement reflects the different dynamic levels and the continuity of movement reflects the articulation" (p. 91). One

study found a positive correlation between the size of performers' movements and the level of expressive intention (Davidson, 2009). In part, these findings are corroborated by other observational studies in the literature (Campbell, 1998; Moorhead and Pond, 1978). Movements may be used not only as a means to support the singing voice but also as a way to reflect expressive intentions and production.

Movement has also been used as an instructional tool, for the purpose of improving singing. To test its viability, Kim (2000) compared the effects of 10 weeks of singing instruction and singing instruction that included Laban-based movement activities (with a focus on Laban efforts) on first-grade students' singing abilities. A control group received no singing instruction. Children were tested singing a criterion song. Its quality was measured by three evaluators using Rutkowski's "Singing Voice Development Measure" and a researcher-created measure of tonality. Results indicated no significant differences between the two treatment groups (movement and singing-only) and the control group, although there was a small difference in mean group scores between the movement and singing-only groups. It seems that any singing instruction, with or without movement, can positively affect children's singing. Building on this study, Chen (2007) tested the effect of locomotor and nonlocomotor movement activities in music instruction on Taiwanese first-grade children's overall singing performance abilities. Students in the locomotor group were found to significantly outperform their counterparts in the nonlocomotor group.

A similar study was conducted using the high school choral ensemble as the unit of analysis. Holt (1992) tested the effect of Laban-based movement instruction in choral rehearsals on overall group performance. Four choirs received 5 hours of rehearsals and instruction; for two of the choirs, the instruction included Laban-based movement experiences. The researcher controlled for music singers' music aptitudes. Each group's performance on a criterion piece was evaluated by judges using a researcher-designed rating scale. Analysis of the results revealed a significant difference between the groups, in favor of the movement group. One must use caution in generalizing these results, given that the unit of evaluation was the choir, and there were only two choirs in each treatment group. The effects of movement instruction on singing abilities remain inconclusive, given the results of the reviewed studies and limited body of literature in the area of pitch-related concepts.

### *Expressivity*

Bodily movement plays a critical role in musical performance. In fact, it is thought to reflect and generate the sounds being produced (Davidson, 2001, 2009). Surprisingly, however, few empirical studies have examined the direct relationship between movement instruction and the ability to perform expressively or perceive expression in music.

In a unique study, Boone and Cunningham (2001) examined 4- and 5-year-old children's ability to encode emotion in music through creative movements. To do so, researchers provided children with a model of ways they could move a teddy bear to express four different emotions (happiness, sadness, anger, and fear), along with corresponding music. Afterwards, children were asked to move a teddy bear themselves to express the emotions they perceived in eight different music excerpts. Each of their performances was videotaped so that adults could view them (without audio) to determine what emotion each child was attempting to express through the movements of the teddy bear. Results indicated that children were able to accurately express emotional meaning in music through creative movements at a level beyond chance. Subsequent analysis found that children were more successful at expressing sadness and happiness than they were fear and anger. Five-year-old children were more accurate than their 4-year-old counterparts, suggesting developmental differences. Gender differences were also noted. Boys were more apt to express happiness and anger with more intensity through faster tempi and more upward movements than were girls. Girls were found to express happiness through more facial affect than boys. Findings of this study suggest that young children are able to encode emotions in music and express them creatively through movement. A confounding variable in this study was facial affect, which may have provided substantive cues to judges who were charged with determining what emotion children were expressing. In other words, it is not solely movement that was being judged. Given their limited vocabularies at this age, movement might provide children with a way to communicate emotions expressed through music.

In another study examining emotions, Ebie (2004) sought to determine the effect of four different teaching approaches on 56 middle school students' abilities to express four emotions (happiness, sadness, fear, and anger) in their singing. The four instructional approaches were (1) traditional (verbal instructions given by the teacher), (2) aural modeling (the teacher provided examples of how to sing), (3) kinesthetic (students were able to explore different ways of expressing emotions through their bodies), and (4) audiovisual (students viewed pictures while listening to pieces of music representing each of the four emotions). Results indicated a significant difference between the traditional approach and the other three approaches, in favor of the latter three. No differences were found among those three approaches. Findings from this study indicate that instruction that includes movement explorations in the choral classroom is more effective in facilitating expressive singing than verbal-directions alone. With that said, aural modeling and audiovisual approaches were just as effective as movement.

Another study examined the effect of Laban-based practices and ideas (i.e., effort and shape) in conducting instruction, on college-age students' abilities to perceive expressivity in various performances (Neidlinger, 2003). Students who received the Laban-based conducting instruction applied a greater number of movement terms to describe and distinguish between various levels of expressive movement in four movement-based performances

than did those students in a control group. However, there were no significant differences on their general perceptions of expressivity in the various movement-based arts forms. It seems logical that, given the Laban instruction, participants would apply newly learned terminology in a judgment task. Results of this study are inconclusive as to how Laban methods in conducting instruction might affect students' perceptions of expressivity. These findings might be a result of the short treatment period (approximately 3 hours and 20 minutes). Future research on the application of Laban ideas and practices on learners' perceptions of expressive performance and performance expressivity are warranted.

### *Music Listening and Perception*

Movement experiences may affect the ways people perceive and represent music while and after listening. In a study of preschool children, Sims (1986) found that children who were engaged in movement experiences that corresponded to the music were more attentive during music-listening experiences than those children who listened passively. While these findings stand in contrast to those of a previously reviewed study with infants (Nakatta and Trehub, 2004), there may be differences in the ways children of these diverse age groups respond to and process music. Gromko and Poorman (1998) sought to compare (1) the effect of listening to music while following a visual map with (2) listening while moving to the music with a teacher in terms of perceptions of form. Children who moved to the music scored significantly better on the measure of form perception than their visual-map counterparts. These findings are corroborated by a similar study (Sutter, 1999).

Experiences of moving spontaneously (i.e., creatively) to music were found to improve children's ability to create graphic notation representing rhythm and phrasing in a piece of music (Fung and Gromko, 2001). In contrast, findings from a carefully controlled study measuring three instructional treatments (passive, creative movement, structured movement) on listening map-reading skills showed no significant difference by treatment group (Gromko and Russell, 2002). These results do not support the findings of the aforementioned studies. Given that the treatment provided only one listening of the musical work before map-reading skills were assessed, the researchers suggested that future work on the effectiveness of movement and aural experiences on music perception provide participants with at least one trial before administering a test.

Although there is one study that does not corroborate the others, evidence leans in favor of using movement with children during listening tasks. Movement experiences, whether directive or creative, may provide children with opportunities to process the music on their own terms and construct understanding of the music they hear. Passive listening may not be the most effective in facilitating children's thinking about and/or symbolically representing music. While anecdotal evidence seems to suggest that children enjoy

moving as they listen to music, future research might consider ways to uncover how and why kinesthetic experiences add to the construction of musical meaning or identity. It would also be interesting to know the long-term effects of such experiences on students' music perceptions and abilities to listen to music attentively.

### *Creative Thinking*

In the only empirical study found examining movement, music, and creativity, Gibson (1988) compared the impact of 10 weeks of music instruction (focused on improvisation) with music instruction including movement and visual art on sixth- and seventh-grade students' creativity, as measured by Webster's "Thinking Creatively with Music" and the *Torrance Tests of Creative Thinking* (Torrance, 1999). Students in the multiple arts group made significant gains from pretest to posttest on both measures; students in the music-only group also made gains, but they were not significant. Results of this study suggest that providing students with opportunities to incorporate various artistic media, learning modalities, and senses may be beneficial for improving their creative thinking. It cannot be determined from this study if the movement components, the visual arts components of the lesson, or both made the difference. Research that isolates factors could be helpful in pinpointing what impact, if any, movement has on creativity.

### *Patterns and Future Directions*

The striking connections between music and movement have not gone unnoticed in music education. For centuries, music educators have intuitively believed that movement could be a way to develop and reinforce music skills and understandings, as well as a way students can demonstrate their knowledge. Movement continues to be an area of great interest to music educators, as evidenced by the number of pedagogical materials, workshops, and practices that include movement. Its application, however, has mostly been limited to use with children in formal learning settings. Concomitantly, a body of research on movement and music learning has emerged, mostly focusing on the aforementioned age groups and settings. This is the literature's strength, as well as its limitation. Movement, as a teaching and learning tool, may contain untapped potential for use with adolescents, adults, and older adults in myriad music-learning settings.

The ways humans respond to music through movements of the body vary greatly by culture as early as childhood (Blacking, 1973), and there are likely to be marked differences in people's attitudes, behaviors, and learning styles depending on their cultural backgrounds. The majority of studies on movement and learning in the English-language literature were conducted in North America and Europe, so caution should be used in generalizing these

findings beyond their cultural contexts. Future research in music education might examine movement and music learning from diverse cultural perspectives, as a way to better understand human cognition and uncover commonalities and differences among cultures. Given the increasing diversity of students in schools across North America and the globe, music education research might seek to examine the relationship of culture and the ways people respond to and learn music through movement. These findings could suggest new culturally informed pedagogical practices.

Many studies reviewed in this chapter compared "traditional" lessons or curricula with those that included movement. In reading some of the studies, movement treatments seemed to be more innovative and dynamic than those provided to control groups. Future research should carefully examine the reliability of the planned and implemented treatments, which might reflect researcher or implementer biases, respectively. This could also help to control for the Hawthorne effect, which posits that any new or special treatment will yield positive results. In some studies, it was difficult to discern if it was participation in movement activities, the innovative nature of the movement lessons, the implementer's bias for a particular treatment, or some other factor that explained the positive effects on musical skills and perceptions.

Studies that use instructional treatments as their independent variables should describe these lessons or curricula in as much detail as possible. Otherwise, replications and application are next to impossible. Furthermore, to say that a control group received "traditional" instruction is not enough to know what we are comparing. Some studies were excluded from this chapter because there was little way of discerning the nature of the instructional treatment provided. Detailed descriptions can better serve educators who might seek to apply these ideas in their own teaching.

Studies measuring the effect of movement instruction on rhythmic performance seemed to be more conclusive than those measuring rhythmic perceptions. This may be because the former used dependent variables for the measures that were more closely related to the independent variable. In other words, there were fewer transfers of learning required of participants. Those treatments that are further removed from the chosen measures may require an extended treatment period. Alternately, the instructional treatment should provide participants with trials in making relevant transfers. Measures are likely to be most effective when all forms of validity, as well as reliability, have been considered.

There are still important questions that remain unanswered: Does movement have a different impact on music learning in childhood than in adolescence or adulthood? If so, what is the nature of these differences, and how might this knowledge reshape music education practices in secondary and tertiary schools? How can expanded forms of movement (beyond foot tapping and rhythm clapping) be applied in instrumental music settings as a way to develop music skills, improve expressivity, and deepen understanding of music? Given limited classroom contact time, one might ask if movement is the most effective use of time. How do people, of various cultures, use

movement as a way to facilitate learning in their everyday lives? Can transfers be made to music teaching and learning? Can movement serve as a way to spark creativity? How and to what ends? To date, we cannot answer these questions. Future research might seek to fill these and other lacunae in the literature.

### Summary and Implications

Patterns in the research findings of this chapter suggest implications for music teaching and learning. Research has consistently shown that children have a natural need and desire to move to music. Teachers from preschool on should capitalize on this knowledge by providing students with myriad opportunities to move to music. This can give teachers a window into children's music perceptions and also help them develop their understandings of music. While initial experiences of moving freely and creatively to music may yield limited responses, teachers can expand the range of movement types by providing verbal suggestions and visual models, which might draw attention to specific elements of music. Moreover, movement can provide children with opportunities to show what they know through nonverbal means, which might provide an equally valid way of demonstrating knowledge. This is especially pertinent for students who have difficulties or are unable to communicate through a given language (Abril, 2003).

Studies examining personal tempo and synchronization offer some implications for practice. Research suggests that children are more successful at rhythmic tasks when they are within a reasonable range of their personal tempo. Therefore, teachers should take general tempo ranges into consideration when asking children to play instruments or move in certain ways. Tasks required of music students should be sequenced from simple to more complex. Various studies support the application of Weikart's (1989) hierarchy of movement types with children. Maturation does seem to play a significant role in both an individual's personal tempo and beat-keeping abilities. Research overwhelmingly supports the case that children will naturally improve their synchronization and rhythmic abilities with age and experience. It may be that teachers do not need to spend exorbitant amounts of time developing skills in keeping a beat when holistic experiences engaging with music through listening, moving, playing, and singing may suffice.

No clear differences in the impact of various movement-music approaches (i.e., Dalcroze, Kodály, Orff, Laban) on learning were noted in the literature. With the exception of a few studies, it seems that any form of movement instruction was effective in affecting positive changes in participants' rhythmic performance abilities and in some facets of perception. As such, teachers should consider their curricular objectives and goals, consider if movement experiences closely relate to them, and make a decision as to the suitability of incorporating movement experiences in instruction. The particular approach

to movement instruction may be less important than its actual alignment with specific learning outcomes.

As compared with rhythmic concepts, the literature examining the impact of movement instruction on pitch is less developed. However, there is support for the application of movement in developing pitch perception. Given the abstract nature of pitch, and the need for learners to perceive pitch changes, movement experiences might provide more concrete ways (visual and kinesthetic) of developing conceptual understanding. The use of Curwen hand signs and other movements of the body that represent the movement of pitch might be effectively used in a variety of learning settings. While there does seem to be some positive relationship between movement and singing performance, the impact of movement instruction on singing abilities is not well established as of yet.

Creative and directive movements in the classroom seem to provide children with opportunities to develop a heightened understanding of the music. Actively listening to music through movement has been found to be more effective than passive listening in getting children to attend, perceive, and represent music iconically. Furthermore, lessons that include a variety of media (movement and visual arts) are thought to be beneficial for improving children's creativity. Teachers might design listening lessons that actively engage students through movement. The literature on expressivity suggests that movement can be an effective way for children to represent the emotions they encode in music listening. As an instructional tool, movement can also serve to make singing more expressive. Teachers might consider creating lessons that incorporate a variety of modalities (kinesthetic, aural, visual) to develop their students' expressivity and general creativity.

Research finds that students are generally positive about movement's applications in their music learning. This might be because of the physical nature of movement or the change of pace it provides for students who spend the majority of a school day sitting at desks. But is that enough? The fact that children enjoy movement activities should not be the primary reason to include it in music instruction. Teachers should know why and how to use movement such that it has the greatest impact on their pupils' music learning. Research reviewed in this chapter provides clues as to why, how, and to what ends. Developing musical skills, knowledge, and understanding should be the primary reason to incorporate the use of movement in music instruction. Ultimately, involving students in instructional experiences they enjoy can motivate them and prime them for music learning.

#### ACKNOWLEDGMENT

I would like to acknowledge R. J. David Frego for his assistance in initial conceptualizations of the chapter, in locating a number of the empirical studies reviewed, and in contributing to this project in its infancy.

#### NOTES

1. See the following references for more examples: Abramson, 1998; Boyarsky, 2009; Schnebly-Black & Moore, 1997.
2. For a more detailed review of literature on synchronization from a psychological perspective, see Repp (2006).
3. A system of using hand gestures and movements to represent pitch, commonly applied in the Kodaly teaching method.

#### REFERENCES

- Abramson, R. M. (1998). *Alfred Feel it! Rhythm games for all*. Miami, FL: Warner Brothers.
- Abril, C. R. (2003). No hablo ingles: Breaking the language barrier in music instruction. *Music Educators Journal*, 89(5), 38-43.
- Abril, C. R., & Gault, B. (2008). The state of music in secondary schools: The principal's perspective. *Journal of Research in Music Education*, 56(2), 68-81.
- Anderson, W. M., & Lawrence, J. E. (2004). *Integrating music into the elementary classroom* (6th ed.). Belmont, CA: Thomson Schirmer.
- Aschersleben, G. (2002). Temporal control of movements in sensorimotor synchronization. *Brain and Cognition*, 48, 66-79.
- Barr, S., & Lewin, P. (1994). Learning movement: Integrating kinaesthetic sense with cognitive skills. *Journal of Aesthetic Education*, 28(1), 83-94.
- Berger, L. M. (1999). *The effects of Dalcroze Eurhythmics instruction on selected music competencies of third- and fifth-grade general music students*. Unpublished doctoral dissertation, University of Minnesota, Minneapolis.
- Billingham, L. (2009). *The complete conductor's guide to Laban movement theory*. Chicago: GIA.
- Blacking, J. (1967). *Venda children's songs: A study in ethnomusicological analysis*. Johannesburg, South Africa: Witwatersrand University Press.
- Blacking, J. (1973). *How musical is man?* Seattle: University of Washington Press.
- Blesedell, D. S. (1991). *A study of the effects of two types of movement instruction on the rhythm achievement and developmental rhythm aptitude of preschool children*. Unpublished doctoral dissertation, Temple University, Philadelphia, PA.
- Bond, J., Boyer, R., Campbelle-Holman, M., Crocker, E., Davidson, M., DeFrece, R., Ebinger, V., Goetze, M., Henderson, B., Jacobson, J., Jothen, M., Judah-Lauder, C., King, C., Lawrence, V., McCullough-Brabson, E., McMillion, J., Miller, N., Rawlins, I., Snyder, S., & Soto, G. (2008). *Spotlight on music*. New York: Macmillan/McGraw-Hill.
- Boone, R. T., & Cunningham, J. G. (2001). Children's expression of emotional meaning in music through expressive body movement. *Journal of Nonverbal Behavior*, 25(1), 21-41.
- Bowles, C. L. (1998). Music activity preferences of elementary students. *Journal of Research in Music Education*, 46(2), 193-207.
- Boyarsky, T. (2009). Dalcroze Eurhythmics and quick reaction exercises. *Orff Echo*, 41(2), 15-19.

- Boyle, J. D. (1970). The effect of prescribed rhythmical movements on the ability to read music at sight. *Journal of Research in Music Education*, 18(4), 307-318.
- Bowles, C. L. (1998). Music activity preferences of elementary students. *Journal of Research in Music Education*, 46(2), 193-207.
- Brooks, L. M. (1993). Harmony in space: A perspective on the work of Rudolf Laban. *Journal of Aesthetic Education*, 27(2), 29-41.
- Bumanis, A., & Yoder, J. W. (1987). Music and dance: Tools for reality orientation. *Activities, Adaptation, and Aging*, 10(1/2), 23-33.
- Campbell, P. S. (1991). Rhythmic movement and public school music education: Conservative and progressive views of the formative years. *Journal of Research in Music Education*, 39(1), 12-22.
- Campbell, P. S. (1998). *Songs in their heads*. New York: Oxford University Press.
- Campbell, P. S., & Scott-Kassner, C. (2006). *Music in childhood: From preschool through the elementary grades* (3rd ed.). Belmont, CA: Thomson Schirmer.
- Carlson, D. L. (1980). Space, time, and force: Movement as a channel to understanding music. *Music Educators Journal*, 67(1), 52-56.
- Carlson, D. L. (1983). *The effect of movement on attitudes of fifth grade students toward their music class*. Unpublished doctoral dissertation, University of Tennessee, Knoxville.
- Carlton, E. B., & Weikart, P. S. (1994). *Foundations in elementary education. Music*. Ypsilanti, MI: High/Scope.
- Carter, C. L. (1984). The state of dance in education: Past and present. *Theory into Practice*, 23(4), 293-299.
- Chen, R. M. (2007). *Effects of movement-based instruction on singing performance of first grade students in Taiwan*. Unpublished doctoral dissertation, Temple University, Philadelphia, PA.
- Choksy, L. (1981). *The Kodály context: Creating an environment for musical learning*. Englewood Cliffs, NJ: Prentice-Hall.
- Choksy, L. (1999). *The Kodály method: Comprehensive musicianship* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
- Choksy, L., Abramson, R. M., Gillespie, A. E., Woods, D., & York, F. (2001). *Teaching music in the twenty-first century* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.
- Colwell, R. (1979). Silver Burdett Music Competency Tests. Morristown, NJ: Silver Burdett Company.
- Condon, W. S. (1975). Speech makes babies move. In R. Lewin (Ed.), *Child alive: New insights into the development of young children* (pp. 77-85). London: Temple Smith.
- Condon, W. S., & Sander, L. W. (1974). Neonate movement is synchronized with adult speech: Interactional participation and language acquisition. *Science*, 183(4120), 99-101.
- Connors, D. N. (1995). *The use of movement by elementary general music specialists in the Los Angeles Public Schools*. Unpublished doctoral dissertation, University of Cincinnati, Cincinnati, OH.
- Consortium of National Arts Education Associations. (1994). *Dance, music, theatre, visual arts: What every young American should know and be able to do in the arts*. Reston, VA: Music Educators National Conference.
- Croom, P. L. (1998). *Effects of locomotor rhythm training activities on the ability of kindergarten students to synchronize non-locomotor movements to music*. Unpublished doctoral dissertation, Temple University, Philadelphia, PA.
- Crumpler, S. E. (1982). The effect of Dalcroze Eurhythmics on the melodic musical growth of first grade students. Unpublished doctoral dissertation, Louisiana State University, Baton Rouge.
- Dalby, B. (2005). Toward an effective pedagogy for teaching rhythm: Gordon and beyond. *Music Educators Journal*, 92(1), 54-60.
- Davidson, J. W. (2001). The role of the body in the production and perception of solo vocal performance: A case study of Annie Lenox. *Musicae Scientiae*, 5(2), 235-256.
- Davidson, J. W. (2009). Movement and collaboration in musical performance. In S. Hallam, I. Cross, & M. Thaut (Eds.), *The Oxford handbook of music psychology* (pp. 364-376). Oxford: Oxford University Press.
- Davies, S. (2003). *Themes in the philosophy of music*. Oxford: Oxford University Press.
- DeBedout, J. K., & Worden, M. C. (2006). Motivators for children with severe intellectual disabilities in the self-contained classroom: A movement analysis. *Journal of Music Therapy*, 43(2), 123-135.
- Derri, V., Tsapakidou, A., Zachopoulou, E., & Gini, V. (2001). Complexity of rhythmic ability as measured in preschool children. *Perceptual and Motor Skills*, 92, 777-785.
- Douglass, J. A. (1977). *Rhythmic movement and its effect on the music achievement of fourth-grade children*. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.
- Drake, C., Jones, M. R., & Baruch, C. (2000). The development of rhythmic attending in auditory sequences: Attunement, referent period, focal attending. *Cognition*, 77(3), 251-288.
- Dunn, R. E. (1994). *Perceptual modalities in music listening among third-grade students*. Unpublished doctoral dissertation, Northwestern University, Evanston, IL.
- Dunne-Sousa, D. (1988). *The effect of speech rhythm, melody, and movement on song identification and performance of preschool children*. Unpublished doctoral dissertation, Ohio State University, Columbus.
- Dura, M. T. (1998). *The kinesthetic dimension of the music listening experience*. Unpublished doctoral dissertation, Northwestern University, Evanston, IL.
- Ebie, B. D. (2004). The effects of verbal, vocally modeled, kinesthetic, and audio-visual treatment conditions on male and female middle-school vocal music students' abilities to expressively sing melodies. *Psychology of Music*, 32(4), 405-417.
- Farnsworth, C. H. (1909). *Education through music*. New York: American Book Company.
- Fassbender, C. (1996). Infants' auditory sensitivity towards acoustic parameters of speech and music. In I. Deliège & J. Sloboda (Eds.), *Musical beginnings: Origins and development of musical competence* (pp. 56-87). Oxford: Oxford University Press.
- Ferguson, L. S. (2004). *I see them listening: A teacher's understanding of children's expressive movements to music in the classroom*. Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign.
- Flohr, J. W., & Brown, J. (1979). The influence of peer imitation on expressive movement to music. *Journal of Research in Music Education*, 27(3), 143-148.

- Forsythe, J. L. (1977). Elementary student attending behavior as a function of classroom activities. *Journal of Research in Music Education*, 25(2), 228-239.
- Frazee, J., & Kreuter, K. (1987). *Discovering Orff*. New York: Schott.
- Frega, A. L. (1979). Rhythmic tasks with 3-, 4-, and 5-year-old children: A study made in Argentine Republic. *Bulletin of the Council for Research in Music Education*, 59, 32-34.
- Frego, R. J. D. (1996). Determining personal tempo in elementary-aged children through gross motor movements. *Southeastern Journal of Music Education*, 8, 138-145.
- Frego, R. J. D. (2009). Dancing inside: Dalcroze Eurhythmics in a therapeutic setting. In J. L. Kerchner & C. R. Abril (Eds.), *Musical experience in our lives: Things we learn and meanings we make* (pp. 313-330). Lanham, MD: Rowman & Littlefield.
- Fung, C. V., & Gromko, J. E. (2001). Effects of active versus passive listening on the quality of children's invented notations and preferences for two pieces from an unfamiliar culture. *Psychology of Music*, 29(2), 128-138.
- Gambetta, C. L. (2005). *Conducting outside the box: Creating a fresh approach to conducting gesture through the principles of Laban movement analysis*. Unpublished doctoral dissertation, University of North Carolina at Greensboro.
- Garber, P., Alibali, M. W., & Goldin-Meadow, S. (1998). Knowledge conveyed in gesture is not tied to the hands. *Child Development*, 69(1), 75-84.
- Gardner, H. (1983). *Frames of mind: A theory of multiple intelligences*. New York: Basic Books.
- Gates, C. A. (1993). *The effect of perceptual modality on rhythmic achievement and modality preference of first-grade children*. Unpublished doctoral dissertation, University of Kentucky, Lexington.
- Gibson, S. M. (1988). *A comparison of music and multiple arts experiences in the development of creativity in middle school students*. Unpublished doctoral dissertation, Washington University, Seattle.
- Giddings, T. P. (1929). Seeing rhythm. *Music Supervisors' Journal*, 15(3), 23-27.
- Gilbert, J. (1980). An assessment of motor music skill development in young children. *Journal of Research in Music Education*, 28(3), 167-175.
- Gordon, E. (1997). *Learning sequences in music: Skill, content, and patterns: A music learning theory*. Chicago: GIA.
- Gordon, E. (2007). *Learning sequences in music: A contemporary music learning theory*. Chicago: GIA.
- Groene, R., Zapchenk, S., Marble, G., & Kantar, S. (1998). The effect of therapist and activity characteristics on the purposeful responses of probable Alzheimer's disease participants. *Journal of Music Therapy*, 35(2), 119-136.
- Gromko, J. E., & Poorman, A. S. (1998). Does perceptual-motor performance enhance perception of patterned art music? *Musicae Scientiarum*, 2(2), 157-170.
- Gromko, J. E., & Russell, C. (2002). Relationships among young children's aural perception, listening condition, and accurate reading of graphic listening maps. *Journal of Research in Music Education*, 50(4), 333-342.
- Gruhn, W. (2002). Phases and stages in early music learning. A longitudinal study on the development of young children's musical potential. *Music Education Research*, 4(1), 51-71.
- Hanna, J. L. (1982). Is dance music? Resemblances and relationships. *World of Music*, 23(1), 57-71.
- Hanna, J. L. (2008). A nonverbal language for imagining and learning: Dance education in K-12 curriculum. *Educational Researcher*, 37(8), 491-506.
- Hicks, W. K. (1993). *An investigation of the initial stages of preparatory audition*. Unpublished doctoral dissertation, Temple University, Philadelphia, PA.
- Holt, M. M. (1992). *The application to conducting and choral rehearsal pedagogy of Laban effort/shape and its comparative effect upon style in choral performance*. Unpublished doctoral dissertation, University of Hartford, CT.
- Hsu, G. O. B. (1981). Movement and dance are child's play. *Music Educators Journal*, 67(9), 42-43.
- Ilari, B. S. (2002). Music perception and cognition in the first year of life. *Early Child Development and Care*, 172, 311-322.
- Ilari, B. (2009). Songs of belonging: Musical interactions in early life. In J. L. Kerchner & C. R. Abril (Eds.), *Musical experience in our lives* (pp. 21-38). Lanham, MD: Rowman & Littlefield.
- Janata, P., & Grafton, S. T. (2003). Swinging in the brain: Shared neural substrates for behaviors related to sequencing and music. *Nature neuroscience*, 6(7), 682-687.
- Jaques-Dalcroze, E. (1921). *Rhythm, music and education*. Trans. H. Rubinstein. London: Dalcroze Society.
- Johnston, R. (1986). *Kodály and education: Monograph III*. Ontario, Canada: Avondale.
- Jordan, F. L. (1994). *A validation of the Weikart sequence of levels of beat coordination for children aged 3-7*. Unpublished doctoral dissertation, Indiana University, Bloomington.
- Jordan, J. M. (1986). *The effects of informal movement instruction derived from the theories of Rudolf von Laban upon the rhythm performance and discrimination of high school students*. Unpublished doctoral dissertation, Temple University, Philadelphia, PA.
- Joseph, A. S. (1982). *A Dalcroze Eurhythmics approach to music learning in kindergarten through rhythmic movement, ear-training and improvisation*. Unpublished doctoral dissertation, Carnegie Mellon University, Pittsburgh, PA.
- Juntunen, M.-L., & Hyvonen, L. (2004). Embodiment in musical knowledge: How body movement facilitates learning within Dalcroze Eurhythmics. *British Journal of Music Education*, 21(2), 199-214.
- Kaeppler, A. L. (2000). Dance ethnology and the anthropology of dance. *Dance Research Journal*, 32(1), 116-125.
- Kerchner, J. L. (2000). Children's verbal, visual, and kinesthetic responses: Insight into their music listening experience. *Bulletin of the Council for Research in Music Education*, 146, 31-50.
- Kim, S. (2000). *The effects of sequential movement activities on first-grade students' solo singing abilities*. Unpublished doctoral dissertation, University of Southern Mississippi, Hattiesburg.
- Kuhlman, K. L. (1996). *The effects of movement-based instruction, meter, and rhythmic aptitude on beginning instrumental music students' abilities to communicate metric structure in performance*. Unpublished doctoral dissertation, University of North Carolina, Greensboro.
- Laban, R., & Ullmann, L. (1971). *The mastery of movement*. London: MacDonald & Evans.
- Landis, B., & Carder, P. (1990). The Kodály approach. In P. Carder (Ed.), *The eclectic curriculum in American music education* (pp. 55-74). Reston, VA: MENC, Music Educators National Conference.

- Levitin, D. J. (2006). *This is your brain on music: The science of a human obsession*. New York: Dutton.
- Lewis, B. (1998). Movement and music education: An historian's perspective. *Philosophy of Music Education Review*, 6(2), 113-123.
- Lewis, B. E. (1986). *The effect of movement-based instruction on the aural perception skills of first- and third-graders*. Unpublished doctoral dissertation, Indiana University, Bloomington.
- Liao, M.-Y., & Davidson, J. W. (2007). The use of gesture techniques in children's singing. *International Journal of Music Education*, 25(1), 82-96.
- Longden, S. H., & Weikart, P. S. (1998). *Cultures and styling in folk dance*. Ypsilanti, MI: High/Scope Educational Research Foundation.
- Loong, C.-Y. (1999). *The effects of tempo in rhythm of young children under five years old*. Unpublished doctoral dissertation, Kent State University, Kent, OH.
- Mark, M. L., & Gary, C. L. (2007). *A history of American music education*. Lanham, MD: Rowman & Littlefield Education.
- McCarthy, M. (1996). Dance in the music curriculum. *Music Educators Journal*, 82(6), 17-21.
- McCoy, C. W. (1989). The effects of movement as a rehearsal technique on performance and attitude of high school choral ensemble members. *Contributions to Music Education*, 16, 7-18.
- McFarland, A. L. (2006). *Effects of overt speech upon accuracy and expression of rhythmic movement*. Unpublished doctoral dissertation, Temple University, Philadelphia, PA.
- Merriam, A. (1964). *The anthropology of music*. Evanston, IL: Northwestern University Press.
- Metz, E. R. (1989). Movement as a musical response among preschool children. *Journal of Research in Music Education*, 37(1), 48-60.
- Miller, L. B. (1983). *Music in early childhood: Naturalistic observation of young children's musical behaviors*. Unpublished doctoral dissertation, University of Kansas, Lawrence.
- Montgomery, A. J. H. (1997). *The influence of movement activities on achievement in melodic pitch discrimination and language arts reading readiness skills of selected kindergarten music classes*. Unpublished doctoral dissertation, University of Southern Mississippi, Hattiesburg.
- Moog, H. (1976). *The musical experience of the pre-school child*. Trans. C. Clarke. London: Schott.
- Moore, J. L. S. (1984). *Rhythm and movement: An objective analysis of their association with music aptitude (Orff Schulwerk, Weikart movement)*. Unpublished doctoral dissertation, University of North Carolina, Greensboro.
- Moore, R. S. (1981). Comparative use of teaching time by American and British elementary music specialists. *Bulletin of the Council for Research in Music Education*, 66-67, 62-68.
- Moorhead, G. E., & Pond, D. (1978). *Music of young children*. Santa Barbara, CA: Pillsbury Foundation.
- Mueller, A. K. (1993). *The effect of movement-based instruction on the melodic perception of primary-age general music students*. Unpublished doctoral dissertation, Arizona State University, Tempe.
- Mursell, J. L. (1937). *The psychology of music*. New York: W. W. Norton.
- Nakata, A., & Trehub, S. E. (2004). Infants' responsiveness to maternal speech and singing. *Infant Behavior and Development*, 27(4), 455-464.
- Nardo, R. L., Custodero, L. A., Persellin, D. C., & Fox, D. B. (2006). Looking back, looking forward: A report on early childhood music education in accredited American preschools. *Journal of Research in Music Education*, 54(4), 278-292.
- Nash, G. C. (1974). *Creative approaches to child development with music, language and movement*. Van Nuys, CA: Alfred.
- Neidlinger, E. J. (2003). *The effect of Laban Effort/Shape instruction on young conductors' perception of expressiveness across arts disciplines*. Unpublished doctoral dissertation, University of Minnesota, Minneapolis.
- Neill, J. (1990). Elementary music con moto. *Music Educators Journal*, 76(5), 29-31.
- Nelson, D. D. (1990). *Personal tempo as a consideration in the rhythmic training of first-grade students*. Unpublished doctoral dissertation, University of Florida, Gainesville.
- Nettl, B. (2005). *The study of ethnomusicology: Thirty-one issues and concepts*. Champaign: University of Illinois Press.
- Orff, C. (1977). Orff-Schulwerk: Past & future. In I. M. Carley (Ed.), *Orff Re-Echoes: Book I* (pp. 3-9). Cleveland, OH: American Orff Schulwerk Association.
- O'Toole, P. A. (2003). *Shaping sound musicians: An innovative approach to teaching comprehensive musicianship through performance*. Chicago: GIA.
- Papousek, H. (1996). Musicality in infancy research: Biological and cultural origins of early musicality. In I. Deliege & J. Sloboda (Eds.), *Musical beginnings* (pp. 37-55). Oxford: Oxford University Press.
- Phillips-Silver, J., & Trainor, L. J. (2005). Feeling the beat: Movement influences infant rhythm perception. *Science*, 308(5727), 1430.
- Pouthas, V. (1996). The development of the perception of time and temporal regulation of action in infants and children. In I. Deliege and J. Sloboda (Eds.), *Musical beginnings* (pp. 115-141). New York: Oxford University Press.
- Rainbow, E. (1980). A final report on a three-year investigation of rhythmic abilities of preschool aged children. *Bulletin of the Council for Research in Music Education*, 66/67, 69-73.
- Rainbow, E. L., & Owen, D. (1979). A progress report on a three year investigation of the rhythmic ability of pre-school aged children. *Bulletin of the Council for Research in Music Education*, 59, 84-86.
- Regelski, T. A. (2004). *Teaching general music in grades 4-8: A musicianship approach*. New York: Oxford University Press.
- Reimer, B. (2003). *A philosophy of music education: Advancing the vision* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
- Repp, B. H. (2006). Musical synchronization. In E. Altenmueller, J. Kesselring, & M. Wiesendanger (Eds.), *Music, motor control and the brain* (pp. 55-76). Oxford: Oxford University Press.
- Reynolds, A.-M. (1995). *An investigation of the movement responses performed by children 18 months to three years of age and their caregivers to rhythm chants in duple and triple meters*. Unpublished doctoral dissertation, Temple University, Philadelphia, PA.
- Richardson, C. P., & Atterbury, B. W. (2001). *Music every day: Transforming the elementary classroom*. Boston: McGraw Hill.
- Rohwer, D. A. (1998). Effect of movement instruction on steady beat perception, synchronization, and performance. *Journal of Research in Music Education*, 46(3), 414-424.

- Rose, S. E. (1995). *The effects of Dalcroze Eurhythmics on beat competency performance skills of kindergarten, first-, and second-grade children*. Unpublished doctoral dissertation, University of North Carolina, Greensboro.
- Sacks, O. W. (2007). *Musophilia: Tales of music and the brain*. New York: Alfred A. Knopf.
- Schleuter, S. L. (1997). *A sound approach to teaching instrumentalists: An application of content and learning sequences* (2nd ed.). New York: Schirmer.
- Schleuter, S. L., & Schleuter, L. J. (1985). The relationship of grade level and sex differences to certain rhythmic responses of primary grade children. *Journal of Research in Music Education*, 33(1), 23-29.
- Schnebly-Black, J., & Moore, S. F. (1997). *The rhythm inside: Connecting body, mind, and spirit through music*. Portland, OR: Rudra.
- Seitz, J. A. (2005). Dalcroze, the body, movement and musicality. *Psychology of Music*, 33(4), 419-435.
- Shamrock, M. (1997). Orff-Schulwerk: An integrated foundation. *Music Educators Journal*, 83(6), 41-44.
- Shehan, P. (1984). Teaching music through Balkan folk dance. *Music Educators Journal*, 71(3), 47-51.
- Shehan, P. (1987). Movement: The heart of music. *Music Educators Journal*, 74(3), 24-30.
- Sims, W. L. (1985). Young children's creative movement to music: Categories of movement, rhythmic characteristics, and reactions to changes. *Contributions to Music Education*, 12, 42-50.
- Sims, W. (1986). The effect of high versus low teacher affect and passive versus active student activity during music listening on preschool children's attention, piece preference, time spent listening, and piece recognition. *Journal of Research in Music Education*, 34(3), 173-191.
- Snyder, J., & Krumhansl, C. (2001). Tapping to ragtime: Cues to pulse finding. *Music Perception*, 18(4), 455-489.
- Steeves, C. (1985). *The effect of Curwen-Kodály hand signs on pitch and interval discrimination within a Kodály curricular framework*. Unpublished master's thesis, University of Calgary, Canada.
- Sutter, J. (1999). *Kinesthetic analogues: Perception of patterned art music among public school general music students*. Unpublished master's thesis, Bowling Green State University, Bowling Green, Ohio.
- Temmerman, N. (2000). An investigation of the music activity preferences of preschool children. *British Journal of Music Education*, 17(1), 51.
- Torrance, P. E. (1999). *The Torrance Tests of Creative Thinking: Norms and Technical Manual*. Bensenville, IL: Scholastic Testing Service. (Original work published in 1966.)
- Trehub, S. E. (2003). The developmental origins of musicality. *Nature Neuroscience*, 6(7), 669-673.
- Valerio, W. H., Reynolds, A. M., Taggart, C. C., Bolton, B. B., & Gordon, E. E. (1998). *Jump right in! The early childhood music curriculum, music play*. Chicago: GIA.
- Volk, T. M. (1998). *Music, education, and multiculturalism*. New York: Oxford University Press.
- Wagner, M. J., & Strul, E. P. (1979). Comparisons of beginning versus experienced elementary music educators in the use of teaching time. *Journal of Research in Music Education*, 27(2), 113-125.
- Walters, D. L. (1983). *The relationship between personal tempo in primary-aged children and their ability to synchronize movement with music*. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.
- Wang, C. C., & Sogin, D. W. (1997). Self-reported versus observed classroom activities in elementary general music. *Journal of Research in Music Education*, 45(3), 444-456.
- Weikart, P. S. (1989). *Teaching movement & dance: A sequential approach to rhythmic movement*. Ypsilanti, MI: High/Scope.
- Wis, R. M. (1993). *Gesture and body movement as a physical metaphor to facilitate learning and to enhance musical experience in the choral rehearsal*. Unpublished doctoral dissertation, Northwestern University, Evanston, IL.
- Woods, D. G. (1987). Movement and general music: Perfect partners. *Music Educators Journal*, 74(3), 35-36, 41-42.
- Zimmerman, M. P. (2002). Musical characteristics of children. In M. R. Campbell (Ed.), *On musicality and milestones* (pp. 127-150). Urbana, IL: School of Music, University of Illinois at Urbana-Champaign.