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THE EFFECTS OF MOVEMENT-BASED INSTRUCTION, METER, AND RHYTHMIC APTITUDE ON BEGINNING INSTRUMENTAL MUSIC STUDENTS' ABILITIES TO COMMUNICATE METRIC STRUCTURE IN PERFORMANCE

by

Kristyn Lee Kuhlman

A Dissertation Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

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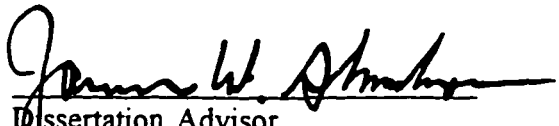
1996

Approved by



Dissertation Advisor

KUHLMAN, KRISTYN LEE., Ph.D. The Effects of Movement-based Instruction, Meter, and Rhythmic Aptitude on Beginning Instrumental Music Students' Abilities to Communicate Metric Structure in Performance. (1996).
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The principal purpose of the study was to investigate the effects of participation and nonparticipation in movement-based instruction, developed by Weikart, on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Secondary purposes were to examine (a) the effect of rhythmic aptitude, (b) the effect of differences in notated meter, and (c) the interactive effects of movement-based instruction background and level of rhythmic aptitude on students' abilities.

Students from Colorado, Massachusetts, and Washington served as subjects for the study (n = 155). Subjects in the movement group (n = 77) participated in weekly music classes in which a teacher was implementing principles of Weikart's *Education Through Movement: Building the Foundation* program for three years prior to beginning instrumental music instruction. The comparison group (n = 78) was comprised of students who had not participated in movement-based instruction, yet participated in the same beginning instrumental music programs as students in the movement group.

Meter performance testing involved subjects performing notated rhythm patterns: subjects' performances of one specific rhythm pattern notated in duple meter and the same pattern notated in triple meter were tape-recorded. Subjects' abilities to communicate metric structure were determined by an adjudication procedure whereby

judges listened to recordings of subjects' performances, and indicated the extent to which they could identify performances as communicating duple or triple meter. Subjects received separate scores for their performances of the duple meter rhythm pattern and the triple meter rhythm pattern.

An ANCOVA revealed that movement-based instruction background did not significantly affect subjects' meter performance abilities when accounting for rhythmic aptitude and music reading skill ($p > .05$). Rhythmic aptitude also did not significantly affect subjects' abilities as determined by an ANOVA ($p > .05$); however, a paired-difference t test revealed that subjects demonstrated greater abilities to communicate duple meter than triple meter ($p < .05$). A 2 X 3 ANOVA revealed no significant interactive effects of movement-based instruction background and level of rhythmic aptitude on students' abilities to communicate metric structure.

Factors which account for beginning instrumental students' abilities to communicate metric structure warrant further research. Also, the efficacy of instructional approaches for developing students' music performance abilities, including Weikart's *Education Through Movement*, must continue to be examined.

APPROVAL PAGE

This dissertation has been approved by the following committee of the

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CHAPTER I

INTRODUCTION

There is a natural relationship between music and movement in the development of rhythmic behaviors, a relationship which has been acknowledged and embraced by music educators since the early 1900s (Mursell, 1927). Advocates of movement-based music instruction suggest that students' rhythmic behaviors can develop best when children's body movements become the primary instruments for learning. Many researchers investigating rhythmic behaviors support the use of movement-based instruction in developing rhythmic skills such as maintenance of steady beats and recognition of meter (Wight, 1937; Boyle, 1970; McCoy & Ellis, 1992). However, despite these findings, and the early admonition by Mursell that rhythm must be taught through muscle motor response, many beginning instrumental method books present a fundamentally mathematical approach to teaching rhythm. Mursell and Glenn (1931) stated that embracing such an approach to rhythmic, and thus, metrical understanding "causes the student to completely lose hold of the rhythmic swing" (p. 310).

In the current study, rhythmic swing refers to that construct of music which causes listeners to clap their hands or tap their toes with the regularly recurring accented rhythmic events heard in music. There is a natural human tendency to organize sounds into regularly recurring patterns, and the "rhythmic swing" of musical

sound is a result of the perceived organization of rhythmic events into regularly recurring groupings of sounds and silences in a temporal sequence. These groupings of rhythmic events, events commonly referred to as "beats" or "pulses," are initiated by an accented beat or pulse and contain any number of unaccented beats. The most commonly employed groupings in Western music are groupings of two beats, one accented followed by one unaccented, and groupings of three beats, one accented followed by two unaccented. The organization of beats into groups of one accented beat followed by one unaccented beat constitutes duple meter. The organization of beats into groups of one accented beat followed by two unaccented beats constitutes triple meter (Lester, 1986).

Aural art forms, including music and poetry, are dependent upon the performer's communication of rhythmic information, such as regularly recurring groupings of accented and unaccented beats, as a means of helping a listener perceive the "rhythmic swing." Nursery rhymes such as *Humpty Dumpty* and *Peas Porridge Hot* typically possess either a duple or triple rhythmic swing, and performing or reciting these rhymes with a contrary rhythmic swing disrupts the structure of the poetry. In his discussion of English verse, Guest (1968) maintained that, indeed, there are very distinct differences between verses written and performed in duple meter and triple meter. According to Guest, the rhythmic swing, or meter, is chosen based on the content or subject of a verse, and a reader is responsible for performing the poem with the strictest observance of accents.

> It is the great renown of Chaucer, Milton, and Shakespeare that there is such a perfect adaption of the rhythm to the theme in hand, and any lack of observance of accents by the reader betrays his want of understanding that which he reads (p. 312).

Guest's discussion regarding communication of metric structure in the performance of verse is equally appropriate when discussing the communication of meter in music performance. Metric organization of music may reflect the subject of the music, and lack of observance of metric accents by a performer demonstrates "his want of understanding" of the music notation being read. For example, the performance of waltz music must communicate regularly recurring groupings of three beats or "triple meter" to fulfill its function as a certain classification of dance music, whereas performance of music which communicates groupings of two beats, "duple meter," may be better suited for marching than waltzing. Therefore, just as the reader is responsible for observing the meter of the poetry, the performer is responsible for observing the meter of the music, and, thereby, communicate the "rhythmic swing" of duple or triple to the listener.

Recognizing the natural relationship between music and movement, music educators have advocated movement as a viable means of developing this rhythmic swing in general music and instrumental music students. Movement and movement-based activities included in many contemporary approaches to music education, such as Orff Schulwerk and Dalcroze eurhythmics, acknowledge this seemingly natural relationship between rhythmic development and movement. Correspondingly, advocates of movement-based instructional strategies assume that music educators employing movement possess knowledge fundamental to the appropriate use of the

body. Knowledge of established principles of child and human motor development, however, is necessary if physical movement used to support the development of music concepts, such as rhythmic swing or meter recognition, is to be developmentally-appropriate and meaningful for students (Weikart & Carlton, 1995).

There is a lack of empirical data to support that traditional approaches to instrumental music instruction develop students' abilities to communicate duple and triple meter when performing. There also is a lack of consensus in the existing literature regarding the efficacy of movement-based instruction as a means of developing students' rhythmic performance abilities. Few researchers have examined instrumental music performance as a measure of students' rhythmic abilities; that is, little published research exists which examines instrumental music students' abilities to communicate metric structure when performing using their music instruments. Therefore, the principal purpose of the current study was to investigate the effects of participation and nonparticipation in movement-based instruction, developed by Weikart, on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Secondary purposes of the study were to examine (a) the effect of rhythmic aptitude, (b) the effect of differences in notated meter, and (c) the interactive effects of movement-based instruction background and level of rhythmic aptitude on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. In the current study, participation was defined operationally as participating in three or

more years of movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction. Students receiving no movement-based instruction developed by Weikart constituted the comparison group. Students receiving movement-based instruction developed by Weikart, but having fewer than three years, were excluded from the study. Students' abilities to communicate metric structure were determined by an adjudication procedure whereby experienced instrumental music teachers, serving as judges, were required to discriminate aurally the meter of rhythm patterns performed by students. Judges indicated the extent to which students communicated duple and triple metric structure when reading and performing rhythm patterns using their music instruments.

Rhythm

Rhythm is essential for the existence of music; however, there is little consensus among musicians and theorists about what constitutes rhythm. Most traditional definitions of rhythm stress that rhythm is the organizational and dynamic force in music (Radocy & Boyle, 1979). Creston (1961) defined rhythm as "the organization of duration in ordered movement." Cooper and Meyer (1960) defined rhythm as the groupings that arise from the organizational power of accent on any given structural level: "Rhythm may be defined as the way in which one or more unaccented beats are grouped in relation to an accented one" (p. 6). Smith (1983) identified "beats" as events that subdivide the temporal sequence of sound into equal time intervals; and according to Gabrielsson (1993), the grouping of regularly recurring beats serves as the foundation for the organization of rhythm. Gabrielsson also

maintained that perception of these beat groupings provides the framework necessary for performers to realize, and listeners to identify, the metric structure of music. Identification of meter and accents, as well as communication of metric structure in a musical performance, will be addressed in the following discussion.

Meter

Gabrielsson (1981) stated that rhythm is a "response that may occur when you listen to certain kinds of sound sequences" and is defined by a listener (p. 24). When experienced by listeners or performers, these sound sequences are characterized by (a) regular, underlying beats, (b) the organization of beats into groups, and (c) regularly recurring accented or stressed beats within the sound sequences (Gabrielsson, 1981). These regularly recurring accented beats, alternating with unaccented beats, are rhythmic elements which Lerdahl & Jackendoff (1981) considered to be fundamental to the concept of meter.

Clarke and Windsor (1992) maintained that meter is arguably the most important framework within which the rhythm of music is perceived and understood. Emphasizing the importance of meter, Clarke and Windsor stated:

> Although there are styles of music which do not employ a metric structure, the great majority of the art music and folk and popular music of the world makes use of metrical structures. Metre is thus a more general structure principle in world music than tonal pitch organization though the latter has received far more emphasis in both empirical and theoretical research (p. 105).

Despite a lack consensus on a definition of meter, theorists agree that the criteria necessary for the existence of meter are (a) a stream of beats or pulses, and (b) the organization of these beats into regularly recurring groupings of accented and

unaccented beats (Wedge, 1927; Lerdahl & Jackendoff, 1981; Clarke, 1985; Lester, 1986; Palmer & Krumhansl, 1990; Drake & Palmer, 1993). Lester explained that, at the single level of metric interaction, or the "primary metric level," the number of beats in each regularly recurring group is either two or three. In addition, Lester stated that the organization of beats into groups consisting of one accented/strong beat followed by one unaccented/weak beat is referred to as duple meter. The organization of beats into groups consisting of one accented/strong beat followed by two unaccented/weak beats constitutes triple meter.

A review of widely recognized instrumental method books revealed that duple and triple meter constitute the extent to which meter and metric organizations typically are studied by beginning instrumental music students (Pearson, 1993; Feldstein & O'Reilly, 1988; Anzalone, 1983; Pearson, 1982). Successful performance of the music contained in instrumental method books is dependent on students' abilities to communicate to a listener the rhythmic information of the music (Cone, 1968), information which necessarily includes the organization of accented and unaccented beats into groups of two or three. Frequently, however, beginning instrumental music method books emphasize the theoretical understanding of meter and meter signature rather than awareness of, and sensitivity to, duple and triple metric structure in performance. According to Gordon (1989), music theory, such as the mathematical understanding of meter signature, should be taught only as an outcome of students' musicianship. He stated that "it is harmful for a student to be exposed to music theory" without first achieving skill in (a) perceiving and performing music in duple

and triple meter including singing, chanting, and moving rhythmically to what is heard, (b) associating the labels of duple and triple with music which is heard and performed, (c) recognizing and identifying duple and triple meter in familiar music, and (d) reading and writing music in duple and triple meter comprised of familiar rhythm patterns in a familiar or unfamiliar order. This skill-learning sequence proposed by Gordon provides a framework within which the instrumental teacher may work in order to assess and diagnose the level of students' understanding of metric structure.

Accents

Central to the concept of meter is the concept of "accented beats," the sounds which receive stress in order to mark the beginning of each metric grouping, thus enabling a listener to identify the meter. In A History of English Rhythm, Guest (1968) discussed the importance of accents in the performance of English verse, stating that an accent means "the stress which is laid upon a syllable during pronunciation" (p. 74). In his discussion of the characteristics that contribute to the "stress" that distinguishes accented syllables from those immediately adjoining, Guest included increased loudness, increased sharpness of tone quality, and the tendency to dwell upon the syllable. Guest maintained, however, that characteristics contributing to the existence of accents have been a matter of dispute.

Structural accents. In musical sequences, the stress that distinguishes accented beats from unaccented beats takes many different forms, the stressed sounds creating either "structural accents" or "metrical accents." According to Lerdahl and

Jackendoff (1981), structural accents are a result of melodic, harmonic, textural, and temporal events inherent in the notation of the musical composition which cause a beat to be perceived by listeners as accented. Pitch-based melodic accents, pitch-interval melodic accents, and tonal melodic accents are classified as structural accents because these accents are inherent in the melodic notation of the music (Jones, 1993). Likewise, harmonic, timbral, and textural changes notated in a musical score may initiate perceived groupings, and also are considered structural accents. According to Lester (1986), harmonic changes are the strongest accentual factors capable of establishing a metric grouping. Metric groupings also may be initiated by temporal accents, accents inherent in the music which result from a notated duration pattern containing long or short sounds or silences relative to the established beat (Jones, 1993). In general, structural accents are the deliberate result of a composer's effort; that is, they are sound events inherent in the notational representation of a musical composition. Thus, the listener's perceived sense of metric structure or "rhythmic swing" is a response to those accented events inherent in the notated music, not those germane to a particular performer's interpretation of the composition.

Metric accents. Listeners also may perceive accents when the performer stresses particular beats, stress for which no indication is given in the notational representation of a musical composition. These accents, referred to as "metric accents," differ from structural accents in that metric accents are the result of performers' intentional expressive variations or deviations from the strict notational regularity (Gabrielsson,1974; Gabrielsson, Bengtsson, & Gabrielsson, 1983).

Sloboda (1983) referred to these accents designed to enhance the musical effect of the performance in some way as "performance markers," because perceived accent is directly dependent on the way notes are performed rather than on inherent properties of musical notation. According to Gabrielsson (1974), a performer has many means to achieve intended metric accents, such as increasing the duration of a metrically strong tone, increasing its intensity, or slightly deviating its pitch. Changes in vibrato, tuning, timbre, and articulation by the performer also aid in expressing and communicating metric accents (Clarke, 1985). Clarke and Windsor (1992), however, maintained that

> in a sense, it doesn't matter too much how a metre is established (by means of dynamic differences, durational differences, or any others) but only that it is established and which metre is established (p. 110).

Communication of Metric Structure in Performance

According to Cone (1968), successful musical performance depends on communication of rhythmic information to a listener. This rhythmic information necessarily includes metric structure, which a performer must communicate by performing accented and unaccented beats with expressive sound qualities so that regularly recurring groupings of these beats are detectable by the listener (Jones, 1993). Essens and Povel (1985) also placed the burden of a meaningful music performance experience on the performer, suggesting that a listener's inability to form a metric representation of duple or triple meter is caused by a nonmetrically representative performance. According to Gabrielsson (1975), studies involving music performance are of particular interest due to the incompleteness of musical notation,

which is "supplemented by many unwritten rules, which the performer learns from other sources" (p. 82).

Gordon (1989) also referred to music notation as incomplete and imprecise, thereby suggesting that a performer who depends solely on notation for performance instructions will produce a musically incomplete performance. In his discussion regarding the development of students' abilities to read music notation, Schleuter (1984) maintained that a performer must not look to the notation for meaning, but rather, bring meaning to the notation. Gordon stated specifically that a good instrumentalist "gives appropriate meter" to an instrument (p. 26). Both Gordon and Schleuter have promoted movement-based instruction to be what Gabrielsson labeled "another source from which students learn." According to Schleuter, a kinesthetic understanding of meter is essential to produce meaningful music performances. In this current study, therefore, the researcher will investigate the effects of participation and non-participation in movement-based instruction, developed by Weikart, on beginning instrumental music students' abilities to "give appropriate meter" to their instruments when reading performing rhythm patterns using their music instruments.

Gabrielsson (1975) stated that music performance is for the purpose of affecting the listener; therefore, according to Gabrielsson, music performance must be examined in relation to what the listener experiences. Researchers have examined performers' uses of systematic performance variations to emphasize metrically important beats; however, few have done so in relation to a listener's response. Sloboda (1983) was one researcher who investigated performers' abilities to

communicate metric structure by determining the degree to which listeners accurately identified the meter of the performance. Based on Sloboda's procedures, therefore, students' abilities to communicate metric structure were determined in the current study by an adjudication procedure whereby experienced instrumental music teachers, serving as judges, were required to discriminate aurally the meter of rhythm patterns performed by students. Judges indicated the extent to which students communicated duple and triple metric structure when reading and performing rhythm patterns using their music instruments.

Movement

In his description of children's motor development, Gallahue (1982) stated that, during the elementary schools years, children are involved intently in the process of learning to move, and moving to learn. Gallahue promoted the integration of academic concepts with movement activities, suggesting that movement provides an effective avenue for reinforcing concepts of curricula across all disciplines. He stated that children's basic inability to conceptualize at a sophisticated level makes it difficult for them to learn through formal means of education; therefore, movement becomes one of the primary avenues by which children grasp fundamental cognitive and affective concepts. Also promoting the use of movement to develop students' cognitive and affective abilities, Weikart stated that developing the kinesthetic intelligence and building the movement foundation of each learner is essential for students' physical and motor development, as well as for supporting concept development in other curricular areas, including music (Weikart & Carlton, 1995).

Movement and Music Education

There is a natural relationship between music and movement, a relationship music educators have advocated in the development of students' rhythmic behaviors. This relationship was recognized by Mursell as early as 1927.

> If we want to know how the feeling for rhythm can best be trained, if we want to know what is the matter with the pupil in whom it is lacking, and if we want to build it up in those with whom it is weak, the primary thing to understand is that it depends on muscular reaction (p. 40).

Orff Schulwerk and Dalcroze eurhythmics are two examples of approaches which advocate the use of movement experiences including dance, movement games, and creative movement to educate children musically. According to Chosky, Abramson, Gillespie, and Woods (1986), the most important instrument in Orff Schulwerk practice is the body, about which the *Orff-Schulwerk Teachers Manual* (Hall, 1960) stated the following.

> Rhythmic perception can be heightened and accented by simple body movements which do not require delicate and precise co-ordination. But whether these consist of clapping, patschen (slapping the knee or thigh with the palm of the hands), stamping, finger snapping, or combinations of all four, movement must be free and unhindered (p.12).

Chosky, Abramson, Gillespie, and Woods (1986) also stated that movement is the key to rhythmic development in Dalcroze eurhythmics, and that in eurhythmics, "feelings for beat, meter, and rhythm may be encouraged by having children step, clap, tap, and move in a variety of ways while singing" (p.38). The Dalcroze eurhythmics approach lacks specific materials and exercises, or any pre-determined sequences of activities, and teachers are expected to be flexible and creative when using movement in the music classroom (Bachman, 1991).

Movement and Meter. Gordon (1989), a music learning theorist, also recognized the relationship between music and movement. He specifically acknowledged the relationship between movement and meter, stating that, before the advent of music notation, meter was determined correctly through dance.

> It follows that the meter of a piece of music is most appropriately determined through movement of the body . . . rather than by an inadequate and misleading definition of the measure signature (p. 149).

Typically, beginning instrumental music students learn the traditional definition of measure or meter signature as the number of beats in a measure with a certain note equal to one beat. For example, the Music Educators National Conference's course of study for teaching wind and percussion instruments (MENC, 1991) embraced such an approach when introducing 3/8 meter at performance levels I and II. Authors of the course of study instructed teachers to

> explain bottom number of the time signature by putting the number one over the bottom number to create a fraction. This fraction, 1/8, becomes the note receiving one pulse (p. 46).

Certainly, this decidedly mathematical interpretation of meter contributes to a performer's cognitive understanding of the music notation; however, Schleuter (1984) maintained that meaningful music performance requires a "feeling" for meter. This feeling for meter, according to Mursell and Glenn (1931), is not a feeling of "one-two-three-four," but a sense of the rhythmic swing of the music. The authors proposed that this sense of "rhythmic swing" must be taught through muscular motor responses, and admonished that "unless this is done, it can never be taught properly" (p. 188).

> In teaching instrumental music, we cannot build rhythmic grasp properly unless we work in and through large physical movement. Activities of this kind should be initiated long before the child is ready for any organized instrumental work . . . If the child is accustomed to sensing and realizing rhythm through large physical movement, there is no reason why something along this line cannot be done in the instrumental class when a new piece is being learned (p. 310).

Movement-based instruction, as a strategy for developing students' rhythmic behaviors, has been regarded by learning theorists, teachers, and musicians as being educationally sound (Lewis, 1990). In a comparison of teaching methods to determine the effect of movement activities on the sight-reading abilities of instrumental music students, Boyle (1970) concluded that the use of prescribed rhythmic movements during rhythmic training instruction increased students' rhythmic performance accuracy. Wight (1937), who examined physically handicapped children, also concluded that the ability to reproduce aurally-presented rhythm patterns improved through the use of rhythmic movement activity. Cheek (1979) discovered that instruction which included systematic psycho-motor experiences increased students' meter discrimination abilities. Meter discrimination test scores for college non-musicians were found by McCoy and Ellis (1992) to be higher for the group whose instruction included responding physically to beat groupings with large muscle movements. There is, however, a lack of research specifically examining instrumental music students' abilities to produce metrically representative performances, and the type of past music training which contributes to such performances.

Disparity in Research on Movement-based Instruction Applied in Music Education

Lewis (1990) suggested, that, when movement-based instruction has been subjected to examination by researchers, "the findings do not uniformly support . . . the efficacy of movement-based instruction" (p. 15). Researchers have proposed differing reasons for the disparity in research findings. According to Lewis, differing results among researchers may be due to variations in length of the movement treatment periods. McCoy and Ellis (1992), however, suggested that research results pertaining to the efficacy of movement-based instruction vary due to differences in movement training programs employed in the studies.

Length of Treatment Period. Based on a two month treatment period, Wight (1937) concluded that children's rhythm performance abilities were subject to improvement through movement training. Fardig (1966), however, found no differences in subjects' rhythm discrimination abilities resulting from nine weeks of daily activity including rhythmic bodily movement in accordance with Dalcroze eurhythmics. McCoy and Ellis (1992) stated that, often, treatment periods are of insufficient length. In their study, however, which examined the effect of one 45 minute treatment period of movement-based instruction on meter discrimination, the researchers reported significant differences between students who did and did not participate in movement activities, and, thereby, concluded that movement experiences are helpful in teaching students to discriminate meter.

Cheek (1979) reported positive effects of psychomotor experiences on students' learning of certain music elements, and stated that, if such results could be obtained

with this 15-week study, results obtained in a longer study would be of great interest. A longer study was conducted by Douglass (1977) to determine the efficacy of rhythmic movement training in teaching rhythm. Eurhythmic activities were incorporated into the music lessons for subjects in the experimental group for a period of 28 weeks. Douglass, however, reported no significant differences between the experimental and control groups on measures of aural perception of rhythm, physical response to rhythm, ability to sight-read rhythms, or rhythmic accuracy in instrumental performance. Findings reported in these studies tend to support Lewis's contention that differing results among researchers may be due to differences in length of treatment periods.

Regarding the length of treatment or "intervention" periods, Smock (1970) stated that short periods of intervention, whether it be a few months or a full year, are not likely to have lasting effects on children. Purves (1988), however, referred to the learning of motor skills as a sort of learning that is persistent over time and likely to have lasting effects. Mainwaring (1933) alluded to the persistent effects of motor activities, stating that, when a kinesthetic event and a cognitive event occur together, there is a formation of motor habits, thus, the events tend to establish a disposition to occur together again. Purves did acknowledge, however, that changes in behaviors associated with motor learning and development transpire almost imperceptibly over much longer periods of time.

Motor development is a sequential, continuous process, and each student has his or her own individual timetable for the development of movement abilities and

behaviors which transpire almost imperceptibly (Gallahue, 1982). Researchers investigating effects of movement on music behaviors, however, typically have measured the skill developed through movement immediately following the movement intervention period, ignoring what Smock (1970) described as possible delay effects of the intervention experience. Therefore, due to possible delay effects of movement experiences on students' music behaviors, the disparity in amount of time needed by students to develop movement abilities used to support development of music skills, and possible effects of long-term movement-based instruction on students' music performances, "experimental" subjects for the current study have received movement-based instruction, developed by Weikart, for a minimum of three years prior to beginning instrumental music instruction. Control subjects have received no movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction.

Movement programs. A review of the literature reveals that "training programs" have consisted of systematic psychomotor experiences consisting of creative movement, body rhythm, and hand gestures (Cheek, 1979), movement-based instruction involving body ostinati, conducting, and eurhythmics (Lewis, 1988), and rhythmic training involving tapping sticks and feet, marching, and folk and tap dancing (Wight, 1937). Kinesthetic rhythm activities utilized by researchers also have included rhythmic bodily movement accompanied by music planned in accordance with Dalcroze eurhythmics (Fardig, 1966). Many movement-based instructional approaches to music education, however, lack a pre-determined sequence of activities, with the

expectation that teachers will be flexible and creative when utilizing movement in the music classroom. Such approaches to music education encourage the use of movement to develop rhythmic behaviors; however, they fail to provide a movement sequence based on established principles of child and human motor development. Thus, the assumption is made that music educators implementing movement-based instruction possess knowledge of child and human motor development fundamental to the appropriate use of the body. Douglass (1977) stated that one major difficulty in designing research to measure the effectiveness of rhythmic movement is the lack of adequate preparation of music teachers in rhythmic movement methods. In a study of motor learning and music education, Sidnell (1986) stated that music educators must not treat the subject of motor learning lightly and without systematic inquiry. He maintained that music educators should research motor development in order to

> (a) understand motor learning processes better, (b) recognize and study the relationship between motor learning and other kinds of music learning, (c) economize our motor teaching procedures, (d) recognize variables in motor differences in child, and (e) discover optimum motor learning periods in children (p. 8).

Motor Development

Weikart (1995), a clinician and educator in rhythmic movement, stated that knowledge of established principles of child and human motor development is necessary if physical movement used to support development of music concepts, such as rhythmic feel, is to be developmentally-appropriate and meaningful for students. Motor development is defined as:

> the sequential, continuous age-related process whereby an individual progresses from simple movements to highly organized, complex motor skills, and finally to the adjustment of skills that accompanies aging (Haywood, 1986).

Gallahue (1982) supports Weikart, stating that, without a sound knowledge of the sequential process of child motor development, the educator can only guess at appropriate education techniques to use in skill development. Because motor development is an individualized process, an understanding of child growth and motor development also is the basis for adapting movement activities to accommodate size variations, differences in muscle strength, differences in limb proportions, and differences in developmental levels among children of the same age (Haywood, Loughrey, Imergoot, & Wilson, 1981).

Fundamental movement abilities. Specialists in the field of motor development (Gesell, 1946; McGraw, 1946) agree that physical maturation certainly plays a role in the process of fundamental movement, i.e., motor development. Fundamental movement abilities are defined as those movement behaviors which can be observed easily, behaviors generally that are classified into four categories: (a) locomotor skills enabling an individual to move from place to place, (b) non-locomotor skills done in a relatively stationary position with little or no movement from one place to another, (c) manipulative skills involving kicking or throwing an object from one place to another, and (d) perceptual-motor skills requiring coordination, form perception, and spatial awareness to help an individual perceive and react to forms and objects involved in action (Haywood, 1986). Gallahue (1982) warned of the major misconception concerning fundamental motor development, that is, the notion that these fundamental

abilities are determined solely by maturation of the central nervous system. Gallahue stated:

> For too many years, it has been assumed by parents and educators alike that through maturation children will automatically develop their movement abilities. Such a notion is absurd. There is little evidence to support the notion that fundamental movement abilities are developed automatically (pp.18-19).

Gallahue suggested that the premise which states that children are active, energetic, and moving beings is generally accepted. However, he further stated that the demands and constraints of our rapidly changing society, as well as the fascination with computer games and television, have motivated children away from active forms of participation, toward more sedentary activities. Because of this, Gallahue maintained that many children and adults have not developed fundamental movement abilities. Haywood (1986) concurred with Gallahue, stating that clearly, all persons do not master fundamental movements, such as jumping, in childhood or even adolescence. Educators must be aware of students' previous movement experiences, such as the ability to jump, before initiating movement experiences intended to support other curricula content. Weikart (1995) agreed that the sedentary lifestyle of today's students means that children's motor development may not be keeping pace with their cognitive development and chronological age; therefore, teachers must know students' motor strengths and weaknesses if developmental-appropriateness of the movement is to be a consideration when using movement to support the development of curriculum concepts. Motor development was defined as a continuous, sequential process, and this concept of "process" is key to motor development. According to Gallahue (1982),

this process of development should serve as a constant reminder about the individuality of students.

> Each individual has his or her own unique timetable for the development and extent of acquisition of movement abilities. Although our "biological clock" is rather specific when it comes to the sequence of acquisition of abilities, the rate and extent of development are individually determined. Typical age periods of development are just that; typical, and no more. Age periods merely represent approximate time ranges during which certain behaviors may be observed. Overreliance on these time periods would negate the concepts of continuity, specifically, and the individuality of the developmental process (p. 7).

Motor development process. Gallahue referred to the individuality of this process of development and acquisition of movement; however, researchers in motor development have identified some typical developmental sequences and general characteristics of the motor development of elementary school-aged children. Based on both the professional literature and observational assessment of numerous children, researchers in motor development have identified the principle of developmental direction, which refers to the orderly, predictable sequence of physical development that proceeds from head to the feet, and from the center of the body to its periphery. Head to feet, or cephalocaudal development, refers specifically to the gradual progression of increased control over the musculature moving from the head to the feet. Gallahue (1982) stated that children often thought to be clumsy, exhibiting poor control over lower extremities, display incomplete cephalocaudal development; therefore, children unable to march to the steady beat of music may not lack rhythmic skills, but rather, possess incomplete cephalocaudal motor development. Proximodistal development refers specifically to the child's motor progression from the center of the body to its most distant part. Children are able to control large muscles of the trunk

and shoulders considerably better than smaller muscles of the wrists and hands. Therefore, fundamental rhythmic movements, such as rocking, should be considered developmentally more appropriate than clapping and snapping rhythmic activities.

The teacher implementing movement activities also must be cognizant of the motor development principle of ipsilateral and contralateral movement, a principle evident in the movement pattern sequence of the throwing task. Ipsilateral movement refers to movements on the same side of the body, such as stepping forward with the right leg and throwing with the right arm, which is the less advanced movement ability. Contralateral movement, such as stepping forward with the left leg and throwing with the right arm, is the more efficient or advanced movement ability (Gallahue, 1982). Finally, Gallahue stated that elementary school children possess a reaction time that is still quite slow, causing difficulty with eye-hand and eye-foot coordination. Gallahue also stated that motor behaviors involving eyes and limbs develop slowly, and that activities such as striking, which would include the playing of mallet instruments, require considerable practice before mastery can occur.

In addition to established characteristics of motor development, there are developmental sequences for each separate movement task, locomotor or non-locomotor, the sequences again based on extensive literature and observation. The following is an example of a development sequence for the specific task of skipping (Gallahue and Uzone, 1989, p. 263).

A. Initial stage
   1. one-footed skip
   2. deliberate step-hop action
   3. double hop or step sometimes occur

4. exaggerated stepping action
5. arms of little use
6. action appears segmented

B. Elementary stage
1. step and hop coordinated effectively
2. rhythmical use of arms to aid momentum
3. exaggerated vertical lift on hop
4. flat-footed landing

C. Mature stage
1. rhythmical weight transfer throughout
2. rhythmical use of arms
3. low vertical lift on hop
4. toe-first landing

Gallahue (1982) stated that these various stages of development for each pattern of movement become apparent when observing and analyzing the fundamental movement abilities of young children. He also stated that it should "be obvious that differences in abilities exist between children" (p. 247), and an understanding of motor developmental sequences is the basis for adapting movement activities used to develop curriculum concepts to accommodate variations among children and differences in developmental level (Haywood, Loughrey, Imergoot, & Wilson, 1981).

Rationale for inclusion of movement activities. Researchers have tended to provide little rationale for the selection of movement activities included in their treatment or intervention programs. There is little evidence in the literature to suggest that motor development characteristics or specific motor task sequences are taken into consideration by music educators in the development of movement activities and movement training experiences. In addition, the literature reflects a lack of concern with the motor developmental level of learners participating in the movement

activities. Weikart (1995), however, maintained that, before initiating any movement experiences with students, teachers must question whether the experience to be introduced is appropriate for the development levels of the learners. Typically, music educators determine the appropriateness of the music experience to be introduced by assessing students' music foundations, past music experiences, cognitive abilities, and chronological ages. Movement activities in which students are engaged, however, often are selected on the basis of little more than their inclusion in published lesson plans for a particular grade level, the teacher displaying little or no regard for the movement backgrounds or abilities of the students. Movement activities to support the development of music behaviors frequently are undertaken with the assumption that the students possess the fundamental motor skills necessary for the successful accomplishment of the movement task. A child whose motor development has not matured to the required level may possess the music skill or knowledge, yet will fail to gain the experience with, and understanding of, the music concept as a result of the movement activity. There has been a failure by researchers, however, to provide information regarding subjects' abilities to successfully accomplish the movement tasks included in the treatment experience for the purpose of developing the music behavior being assessed.

"Moving to learn" is a strategy embraced by music educators in the development of many music behaviors; however, proponents of movement-based instruction often fail to acknowledge that students must also "learn to move." Therefore, educators utilizing movement to support curricular concepts often fail to

provide for the development of students' fundamental motor skills. Weikart, however, has proposed a sequential approach to movement-based instruction based on child and motor development principles in which students develop their movement foundation for physical development, as well as for supporting concept development in other curricular areas such as music. Although this approach is utilized by music teachers, as well as classroom and physical education teachers at all levels of education, there is a lack of research examining the effect of movement-based instruction developed by Weikart on students' music performance abilities. Therefore, the principal purpose of the current study was to investigate the effects of participation and nonparticipation in movement-based instruction, developed by Weikart, on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Secondary purposes of the study were to examine (a) the effect of rhythmic aptitude, (b) the effect of differences in notated meter, and (c) the interactive effects of movement-based instruction background and level of rhythmic aptitude interactively on students' abilities to communicate duple and triple metric when reading and performing rhythm patterns using their music instruments. Students' abilities to communicate metric structure were determined by an adjudication procedure whereby experienced instrumental music teachers, serving as judges, were required to discriminate aurally the meter of rhythm patterns performed by students.

Description of Principal Treatment

The child's body as the primary learning center is a basic premise of *Education Through Movement: Building the Foundation*, a program developed by Phyllis S. Weikart for which key experiences in movement provide a framework for developing each child's potential in the physical, cognitive, social, and artistic areas of living (Weikart, 1996). The program was developed by Weikart based on her experiences teaching movement to learners of all ages, ranging from preschool to adult. *Education Through Movement* incorporates an active learning approach and a teaching model which define the role of the teacher and learner. According to Weikart (Weikart & Carlton, 1995), the teacher's role is that of facilitator and partner in learning: students are engaged in the learning process, actively constructing their own knowledge.

The process-oriented approach of *Education Through Movement* operates within a kinesthetic framework, for which Weikart has provided nine key experiences in movement. Key experiences are defined as essential experiences that result in the development of specific observable processes that are relevant to a learner's understanding of a particular concept (Weikart & Carlton, 1995). According to Weikart, key movement experiences are used to help teachers recognize and assist students in learning fundamental movement abilities which are foundational to students' performance in all curriculum areas. As part of the *Education Through Movement* program, Weikart proposed the following nine key movement experiences, developmentally sequenced and described in terms of actions performed by learners.

1. *Acting Upon Movement Directions*
2. *Describing Movement*
3. *Moving in Locomotor Ways*
4. *Moving in Nonlocomotor Ways*
5. *Moving in Integrated Ways*
6. *Moving with Objects*
7. *Expressing Creativity in Movement*
8. *Feeling and Expressing Steady Beat*
9. *Moving in Sequences to a Common Beat*

Within the first key movement experience, *Acting Upon Movement Directions* (which are presented visually, verbally, and with hands-on guidance), Weikart has proposed Stages of Movement which progress sequentially from simple to complex, according to motor development principles. This sequence represents the stages of movement through which learners progress in the motor development process: the term "stages" stresses the universal, sequential, hierarchical appearance of the movements (Roberton, 1978).

The key movement experience, *Moving in Nonlocomotor Ways*, precedes *Moving in Locomotor Ways*, Weikart acknowledging cephalocaudal, or head to feet development of students. As part of the key experience, *Moving in Locomotor Ways*, Weikart proposed a movement menu in which locomotor movements, including jumping and hopping, are presented and ordered with regard to the development sequence of each movement task (Weikart & Carlton, 1995). *Moving in Integrated Ways* involves combining locomotor and nonlocomotor movement, and is more complex than the previous key movement experiences. Within this key experience, Weikart also proposed a simple to complex sequence of integrated movements. According to Weikart, objects also can be combined with each nonlocomotor,

locomotor, and integrated movement, including movements with any hand-held objects such as a music instrument.

Weikart maintained that *Feeling and Expressing Steady Beat* is one of the most primitive, yet most overlooked foundational abilities (Weikart, 1995). Stages of developing beat awareness involve students' abilities to move to their own internal steady beat, match a steady beat that is spoken verbally or modelled visually by others, and perform both locomotor and nonlocomotor movements to that steady beat. Beat competence indicates ability to identify, express, and keep steady beat using nonlocomotor and locomotor movements. Although she maintained that learners progress at their own rate and acknowledged that child motor development depends not only on age but maturation and experience, Weikart proposed approximate guidelines concerning the use of nonlocomotor and locomotor movement in developing beat competency (Weikart & Carlton, 1995). Within the final key movement experience, *Moving in Sequences to a Common Beat*, Weikart described Levels of Beat Coordination, suggesting that teachers can assist children in developing beat coordination by introducing them to rhythmically-timed movement of increasing complexity. Such rhythmically-timed movement includes international folk dance in duple, triple, and unusual meter, for which Weikart has established a learning sequence of simple to complex dance movements, and established a standardized language-to-dance vocabulary (Weikart, 1989).

Educators who have successfully completed the *Education Through Movement: Building the Foundation* training from Weikart have demonstrated the knowledge and

skills necessary to develop students' movement foundations essential for physical development, and development in other curricular areas such as music. Students whose educational experiences have included movement-based instruction developed by Weikart, based on the key movement experiences and developmentally-sequenced Level of Beat Coordination experiences, have developed rhythmic behaviors such as feel of duple and triple meter through purposeful movement. Therefore, the following research questions were addressed in this study.

1. What is the effect of three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction on beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments?

2. What is the effect of three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction on beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments?

3. What is the effect of level of rhythmic aptitude on beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments?

4. What is the effect of level of rhythmic aptitude on beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments?

5. What is the effect of differences in notated meter on beginning instrumental music students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instrument?

6. What are the interactive effects of movement-based instruction background and level of rhythmic aptitude on beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments?

7. What are the interactive effects of movement-based instruction background and level of rhythmic aptitude on beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments?

CHAPTER II

REVIEW OF LITERATURE

The published literature regarding factors related to performance of rhythmic information is extensive. Fewer research studies, however, exist regarding factors related to performance of metric structure information. Researchers have investigated the musically expressive means employed by performers for the purpose of establishing the metric structures of music, yet, few studies focus specifically on the communication of metric structure between performer and listener. This chapter provides a review of published research related to perception and performance of metric structure in music, including research on beat groupings, accents, expressive devices employed by performers to achieve accents, and perception and performance of duple and triple metric structures.

Numerous researchers also have investigated the efficacy of movement activities in developing rhythmic perception and performance abilities of students. However, there is little consensus among researchers regarding the effect of movement activities on students' rhythmic behaviors due to variations in length of treatment periods and in activities which constitute the movement training. In this chapter, a review of research related to the use of movement activities for the purpose of developing students' meter perception and performance abilities is provided, as well as an introduction to principles of child and motor development. A description of

Education Through Movement: Building the Foundation, a program developed by Phyllis S. Weikart, based on child and motor development principles–the main variable in the current study–also is provided.

Rhythm

There is a natural human tendency to organize sounds into regularly recurring patterns. A review of the literature reveals that listeners consistently perceive louder sounds as accented, and accented beats as initiating the regularly recurring patterns or groupings of beats. The traditional definition of accent, however, must be expanded to include any variation in performance which brings attention to a beat, causing that beat to be different from those immediately adjacent. Through the use of electronic measuring instruments, researchers have discovered that performers employ many different musically expressive devices for the purpose of accenting particular notes. Specifically, variations in dynamic level, duration, articulation, and timbre, which systematically deviate from the strict notational regularity, are employed by performers to accent metrically important beats, and establish metrical structure. Few researchers, however, have addressed the question of whether those electronically measured performance variations contribute to effective communication of metric structure to a listener, that is, if musically expressive intentions of performers are perceived by listeners. Few studies provide empirical data supporting the communication of metric structure information between performer and listener.

Perception of Groupings and Accents

Gabrielsson (1981) maintained that, for rhythm to exist, listeners first must perceive regularity, such as regularly recurring beats, and then must organize the beats into groupings. Bolton (1894), in his examination of what the mind does with a series of auditory impressions in which each sound is indistinguishable from any other, discovered the natural tendency of listeners to organize regularly recurring beats into groups. In his study, Bolton discovered that, when their subjects listened to a series of electronically produced auditory impressions in which there was absolutely no change of intensity, pitch, quality, or time-interval, they perceived sounds in groupings of two and three. Although listening to series of isochronous sounds, subjects reported hearing the first sounds of their perceived groupings as strongly accented. Thus, subjects' groupings of the auditory impressions presented in isochronous sound sequences were concluded to be based on their subjective perceptions of accents.

In contrast with this concept of subjective perception and grouping of sounds illustrated in Bolton's study, is the concept of objective grouping of sounds. In The Psychology of Music (Deutsch, 1982), Fraisse discussed the basis for what he termed objective grouping or "objective rhythmization" of sounds.

> As soon as a difference is introduced into an isochronous sequence of elements, this difference produces a grouping of the elements included between the two repetitions of the difference. One then speaks of objective rhythmization. This difference can be a lengthening of a sound, an increase in its intensity, a change in pitch or in timbre, or simply a lengthening of a interval between two elements (p. 157).

Bolton (1894) examined the concept of "objective rhythmization" by regularly varying intensity and duration of tones within a series of auditory impressions, to

determine the effects on listeners' perceptions of "rhythmical series." Bolton defined a rhythmical series as a group of regularly recurring sounds in which there is an alteration of strong and weak sounds. Subjects in his study listened to series of tones in which regular variations in intensity produced strong and weak tones throughout the series. As reported by Bolton, subjects identified strong tones as initiating new groupings. When duration of tones was systematically varied, subjects reported longer tones as initiating groupings.

The effects of systematic variations in intensity and temporal aspects on subjects' impressions of sound series was also the focus of a study by Woodrow (1909). To investigate the effects of intensity variations on listeners' perception of grouping, duration of electronically produced tones was held constant, and intensity altered to create patterns of strong and weak tones. Conversely, intensity was held constant and duration of tones altered to determine the effect of temporal variations on listeners' perceptions of groupings. Subjects' impressions of the sound series, as reported by Woodrow, indicated that regularly recurring differences in intensity and duration resulted in subjects' perceptions of groupings. Supporting Bolton's findings, Woodrow reported that subjects perceived louder sounds as initiating groupings. Contrary to Bolton's finding, however, was Woodrow's report that subjects perceived the last sound of a grouping as longer.

Performance of Groupings and Accents

In his discussion of objective rhythmization, Fraisse included variations or differences in pitch and timbre, in addition to duration and intensity, as means of

establishing groupings. Fraisse continued his discussion with the suggestion that these differences confer upon the effected sound the role of "accent," expanding the traditional definition of accent as a necessarily louder sound event. Instead, Fraisee regarded an accent to be any variation in performance which brings attention to the sound event, causing it to be different from notes to which it is immediately adjacent. In A History of English Rhythms, Guest (1968) discussed the importance of accents in the composition and performance of English verse, stating that accent, as it relates to verse, means "the stress which is laid upon a syllable during pronunciation" (p.74). In his discussion of what constitutes the "stress" that distinguishes the accented syllable from those immediately adjoining, Guest maintained that the topic has been a matter of dispute. He stated that, although increase in loudness is the only performance variation essential to English verse accent, performance of the accent almost always is accompanied by increased sharpness of tone. Guest further stated: "besides the increase of loudness and the sharper tone which distinguishes the accented syllable, there is also a tendency to dwell upon it, in other words, to lengthen its quality" (p. 75).

Increasing the loudness, sharpening the tone, or dwelling upon the pronunciation of a syllable are ways in which a performer can communicate accents of a verse or rhyme to a listener. Typically, written copies of poems and verses do not contain performance instructions regarding accent placement; therefore, readers must utilize performance variations according to established performance practices and desired interpretation of the poetry. Povel (1977) noted the occurrence of this same

phenomenon in performance of music notation, stating that "traditional notation of musical composition does not fixate all aspects of the composition, but leaves room for interpretation on the part of the performer" (p. 311). In a study examining performers' interpretations of music notation, Povel identified the following as "expressive means" employed by performers to accent sound events for which no indication was given in the notation: (a) changes in pitch such as adding vibrato, (b) changes in intensity, (c) changes in timbre, and (d) variations of temporal features. Certainly, performers decide the exact loudness with which to execute dynamic symbols contained within music notation; however, Povel proposed that performers also are free to introduce dynamic variations in places where no changes are indicated. Note duration and interval duration are temporal aspects about which Povel stated almost all grouping and accentuation effects can be achieved by taking advantage of the many possible temporal variations available to the performer.

Drake and Palmer (1993) concurred with Fraisse and Povel concerning the established role of accents in the segmentation of music sequences; however, they questioned the premise that accents truly are emphasized in music performance, and if so, what form this emphasis takes. These same questions were proposed many years earlier by Sears (1902), who recognized the discrepancy between the degree to which a trained musician accomplishes what the "notes set before him indicate," and the actual performance. According to Sears, written notes of equal durational value should be performed with equal duration unless a change of tempo is indicated; therefore, he sought to investigate the actual duration given to notes by competent musicians when

performing music from notation. Performances of several simple selections, for which each performer was given freedom to play in his own natural way, were recorded and analyzed. Sears discovered that, in the performances of selections, players deviated from the strict regularity of the notation, systematically increasing the duration of specific notes. Based on these results, Sears concluded that accented notes often are played longer than unaccented notes of the same temporal denomination.

In a study examining the performance of musical rhythm, Bengtsson and Gabrielsson (1980) also observed variations in duration of performed sound events in relation to the notation. The researchers proposed the hypothesis that live performances of musical rhythms usually are characterized by certain "systematic variations" which are important factors for bringing about the intended or desired rhythmic character of the music. Bengtsson and Gabrielsson defined systematic variations as the consistent, recurring deviation from the mechanical norm. As an example of a systematic variation, the authors cited the Viennese waltz which is performed with a 'short' first beat and a 'long' second beat, despite both having the same duration value. Subjects for their study performed a variety of monophonic pieces on piano, having been instructed to play in a way they thought natural and correct for the respective melody. Performances were recorded and analyzed electronically to determine deviation values which, according to the authors, represent the characteristics of live performances in relation to strict notation regularity. Analysis revealed pronounced systematic deviation values, from which the authors concluded that deviations in performed durations appeared in a very consistent way.

In a study regarding performances of rhythm patterns, Gabrielsson (1974) also examined the performances of pianists, as well as percussionists, and found systematic performance variations in their uses of dynamic levels. Subjects' recorded performances of four-measure rhythm patterns were analyzed with regard to duration and intensity. The data revealed deviations from the norms represented by the music notation, the most significant being that highest peak intensity invariably occurred on the first sound event of a measure. Gabrielsson concluded that, clearly, the increased loudness was intentional for the sake of a perceived accent on that position.

Through these studies, researchers have provided strong evidence that performers employ systematic performance variations in duration and intensity to accent musically important beats. In the studies, performers distinguished accented notes by playing the notes longer than unaccented notes of the same notated duration. Additionally, first notes of measures consistently were accented by increasing the dynamic level of the notes.

Performance of Metric Structure

Drake and Palmer (1993) continued the study of systematic performance variations in order to determine how pianists establish rhythmic groupings, melodic accents, and metric accents. The first experiment, conducted by the researchers as part of their study, involved the performances of musical stimuli which contained, as part of the notation, either metric, rhythmic, or melodic accents: (a) rhythmic accents were defined as separating a series of events by temporal gaps, (b) melodic accents were defined as segmenting sequences of notes into groups on the basis of changes in pitch

contour, and (c) metric accents were defined as dividing music into segments of equal duration based on the periodic alternation of strong and weak beats. Drake and Palmer maintained that metric accents tended to be the first events of music segments. The second experiment involved performances of notation in which accents were combined to determine whether a certain accent structure dominates when melodic, rhythmic, and metric accents conflict or coincide. The purpose of this combination of notated accents was to test the researchers' hypothesis that performance variations associated with each accent structure are independent of each other, and, therefore, should remain unchanged whether they conflict or coincide. In each experiment, subjects performed a line of music notation two times: (a) in a normal fashion, allowing for individual expression, and (b) in a flat, mechanical way without adding any expression beyond that indicated in the music score. Recordings of intensity, timing, and articulation value for subjects' performances revealed that the last events of rhythmic groups were played louder, and the event preceding it lengthened. Only when played in isolation were systematic variations related to melodic accent structure observed, with events such as melodic turns played louder. According to Drake and Palmer, however, both experiments revealed systematic performance variations related to metric accents, previously identified as the first beat of a measure. Experiment I revealed two systematic performance variations: (a) events on the first beat of the measure were played louder, and (b) events on the first beat of the measure were played less staccato than other beats. In Experiment II, the researchers again observed that events immediately preceding important metric accents were lengthened. Overall,

Drake and Palmer concluded that performers use systematic variations to accent important aspects of musical structure: rhythmic accent groupings were the most prominent, followed by metric accents. The authors also suggested that, based on their findings, the presence of other accent structures does not alter the relationship between metric and rhythmic grouping accent structures and their expression in performance.

The previous quote by Fraisse suggested that "differences introduced into isochronous sound sequences," i.e., accented sound events, are positioned for the purpose of producing groupings of sounds within a sound sequence. Lee (1985) referred to these groupings between accents as "metrical units," about which he stated:

> It seems intuitively clear that, given a sequence of notes of equal duration and pitch in which every note at some fixed interval is accented, one will hear the accented notes as initiating metrical units that include the following unaccented notes (p. 56).

In the book, Musical Structure and Cognition (Howell, Cross, & West, 1985) Clarke presented an overview of research conducted to examine the relationship between variable features of music performances and the structural features of the musical composition being performed. Clarke reported that variations in dynamics, duration, and directional force are employed by performers to establish metric structure. Dynamic intensity showed the highest degree of concordance with metric accents, leading Clarke to suggest that "metrical information may be most unambiguously conveyed by means of dynamic differences" (p. 216).

Drake and Palmer (1993) observed a similar phenomenon in their study of accent structures in music performances. According to the researchers, subjects' performances of a Beethoven sonata revealed that first beats of measures were

performed the loudest, with a graded "fall-off" in intensity for less important beat locations. Based on these results, Drake and Palmer concluded that differences in dynamics were the expressive means employed by concert pianists to convey important metric events.

Overall, research findings suggest that the first beat of a grouping is considered to be a metric accent, important for establishing metric structure of music. Researchers reported that beats which serve as metric accents are played louder and less staccato than other beats. Performers also employ variations in duration and directional force to establish the metric structure of the music.

Performance of Duple and Triple Metric Structure

Metrical units constituting duple meter and triple meter generally are recognized as the foundational, primary level of all metric structures. According to Guest (1968), these two metrical units have been hypothesized to be the roots "from whence had sprung all the varied measures of our language," and were connected immediately with duple and triple meter in music. Listeners' perceptions of duple and triple meter in music were examined by Windsor (1993) in a study investigating the relationship between performed accents and listeners' perceptions of meter. Windsor hypothesized that a pattern of events systematically differentiated only by intensity can support different metrical interpretations. The researcher constructed MIDI sequences, and manipulated intensities so that accented sounds created a continuum of patterns in duple and triple. Results revealed that subjects who listened to the sequences tended to perceive stable duple or triple meter in the majority of accent patterns. Based on

these results, Windsor concluded that intensity differences between events lead to perception of duple and triple metric structure if the differences are sufficiently large to allow subjects clearly to identify a regular pattern of accentuation.

In a study of the performance of musical rhythms notated in contrasting meters, Gabrielsson, Bengtsson, and Gabrielsson (1983) examined performances of identical melodies notated in duple meter and triple meter. The purpose of the study was to test the hypothesis that live performances of musical rhythms are characterized by various systematic variations in duration of the sound events in relation to strict notational regularity. Musicians performing on clarinet, flute, and piano read and performed melodies conventionally notated in duple and triple meter in a way they thought the most natural and correct for the example in question. These performances were recorded and analyzed electronically to determine deviation values of each note, deviation value defined by the researchers as the deviation of each duration of the beginning of a sound event to the beginning of the next sound event in relation to the strict mechanical performance. Deviation values of the different performances were subjected to factor analysis which revealed the presence of various systematic variations in the durations of sound events. Gabrielsson, Bengtsson, and Gabrielsson concluded that performance variations, such as lengthening first and third beats in triple meter, do affect the perceived groupings of successive sound events.

Communication of Metric Structure Between Performer and Listener

In a discussion regarding the analysis of music performance and music experience, Gabrielsson (1985) stated that relying on empirical measurements of

performance variables such as duration and intensity is preferable to relying on beliefs and assumptions about characteristics of music performance. However, Gabrielsson also acknowledged the limitations of research confined to empirical measurements.

> It is also obvious that the complex sound sequence found in music performance makes you feel somewhat suspicious of some experiments, in which the investigation uses physically simple sound sequences as stimuli to be judged or somehow responded to by listeners (p. 82).

Gabrielsson acknowledged the importance of examining music performance from the perspective of a listener, indicating that performance aims at affecting the listener. He further indicated that the relationship between performer and listener should be studied, and such studies should be conducted in carefully controlled listening experiments without prejudicing the subjects.

Sloboda (1983) acknowledged the necessity of communicating accents which initiate the metric units of accented and unaccented beats, to listeners. According to Sloboda, a successful musical performance is defined by a listener's ability to determine and identify the meter of music. In his study examining the communication of musical meter of piano performances, Sloboda sought to test the following hypotheses: (a) pianists convey the meter of music through expressive features in performance, and (b) the ability to convey meter is related to the level of pianistic skill. Pianists who served as subjects for this study each performed 12 short music passages with the right hand alone. Contained within the 12 passages were two specific examples labeled (a) and (b), both passages containing identical notes differing in notated metrical groupings. Subjects' performances of passages (a) and (b) were recorded electronically, and measured for duration of each note, loudness of each

note, and timing of the onset and offset relative to preceding and subsequent notes. Performances were assigned three numerical values based on computer analysis: (a) inter-onset interval, defined as the time from the onset of the note in question to the onset of the subsequent note, (b) touch, defined as the time interval between the offset of the note in question and the onset of the subsequent note, and (c) loudness, defined as the reciprocal of the duration from the hammer starting to move in the striking of the string. According to Sloboda, results of the study provided extremely strong evidence to support the hypothesis that pianists vary their performances in response to changes in notated meter. Based on the results, Sloboda reported that notes carrying major stress, such as metric accents, were played more legato than preceding notes. These notes also were played louder than preceding and subsequent notes.

Sloboda also addressed the questions of whether these differences in performances have any real consequence for listeners, and do these differences contribute to the effective communication of metric structure? Other researchers such as Nakamura (1987) also questioned whether the expressive intentions of performers are understood by the listener. In Sloboda's study, performances of musical passages (a) and (b) were presented in random order to musically literate listeners. Listeners decided if each performance was passage (a) or passage (b), and indicated to what extent they were certain of their decision. For each performance, listeners marked one of the following responses on a response sheet: sure (a), maybe (a), sure (b), maybe (b). Results revealed substantial variations among listeners in the number of

performances correctly identified as (a) and (b), yet when listeners were divided into two groups based on music experience, Sloboda reported a higher degree of agreement between listeners. Sloboda concluded that ability to identify meter from expressive variation develops over years of practice listening to and performing music.

Development of Rhythmic Behaviors through Movement

The ability to perceive and discriminate meter is related to previous music experiences, including listening to and performing music (Sloboda, 1983). Researchers also maintain that ability to perceive and discriminate meter can be affected by the use of psychomotor experiences and body movement; however, the literature presents conflicting results regarding the efficacy of movement experiences on rhythmic perception abilities (McCoy & Ellis, 1992; Lewis, 1988; McCoy, 1986; Cheek, 1979; Sins, 1976). Thackray (1969), however, reported that rhythmic perception ability is related positively to rhythmic movement. He also reported a strong relationship between perception and performance abilities; thus, suggesting that participation in movement experiences which affects perception abilities also may affect rhythmic performance abilities. Indeed, researchers have reported that rhythmic performance abilities are subject to improvement through movement training (DeYarman, 1972; Boyle, 1970; Wight, 1937); however, there is again a lack of consensus concerning the efficacy of movement training on performance abilities (Douglass, 1977).

Rhythmic Perception Ability and Movement Experiences

Fardig (1966) utilized kinesthetic rhythmic activities in order to examine the relationship between rhythmic movement and variables which included personality characteristics, creativity response, self-concept expression, rhythmic discrimination ability, and interest in music. Ten classes of third grade students were randomly assigned to a control or experimental group. Experimental treatment consisted of nine weeks of daily rhythmic movements to music, planned in accordance with Dalcroze eurhythmic practices: the control treatment was devoid of rhythmic movement activities. Fardig reported no significant differences between groups on measures of rhythmic discrimination; however, significant differences existed on measures of creativity and interest in music, with results favoring the control group.

Sins (1976) examined the effect of a learning sequence utilizing movement on the abilities of middle school students to learn selected musical concepts, including meter discrimination. Control and experimental groups each were comprised of two classes of sixth grade students. A pretest consisting of taped musical examples and multiple choice questions was administered to both groups. For six weeks, students in the experimental group participated in movement activities based on relevant music concepts, after which the pretest was administered as a posttest. Sins reported significant differences in students' abilities to recognize complete melodies and distinguish ostinato and sequences, with differences favoring the experimental group. No significant differences, however, existed between the groups in the concept areas of melodic contour and meter discrimination.

Cheek (1979) stated that movement-based instruction is recognized as one of the most appropriate ways of developing children's creativity, independence, aesthetic sensitivity, problem-solving skills, and listening skills. Hypothesizing a relationship between psychomotor experiences and the formation of self-concept, Cheek investigated the effects of psychomotor experiences on students' perceptions of selected musical elements, including pitch and meter discrimination, identification of intervals, modes, and tonal center, and formation of self-concept. Classes of fourth-grade students received 15 weeks of music instruction based on identical teaching philosophy, objectives, and materials; however, students in the study's experimental group participated in systematic psychomotor experiences that included creative movement, body rhythms, and hand gestures.

Cheek hypothesized that children who receive systematic psychomotor experiences as an integral part of learning music concepts, elements, and skills will attain higher levels of music achievement, and demonstrate greater improvement in self-concept than students who do not receive psychomotor experiences. Students' scores on Colwell's Music Achievement Test (Test I and II) and the Piers-Harris Children's Self-Concept Scale (Piers, 1969) revealed that systematic psychomotor experiences had a significant impact on students' learning of certain music elements such as music reading, meter discrimination, and rhythm response. Gains in measures of self-concept also were significantly greater for students in the experimental group; therefore, Cheek concluded that psychomotor experiences should assume a vital role in the elementary music curriculum.

To determine the effects of movement as a rehearsal technique on choral performance, meter discrimination abilities, and attitudes of students toward participation in a choral ensemble, McCoy (1986) incorporated movement into high school choral ensemble rehearsals. Students from one advanced and one less advanced ensemble comprised an experimental group which participated in nine weeks of movement activities designed to emphasize the beat and/or subdivisions of the pulse, to increase awareness of metrical groupings, and to reinforce concepts of dynamics and phrasing. Two ensembles, one advanced and one less advanced, comprised a control group which participated in traditional choral rehearsals. Scores on a choral performance rating scale, researcher-designed attitude rating scale, and the meter discrimination subtest of Colwell's Music Achievement Test served as subjects' posttest scores. Results revealed significant differences between the less advanced ensembles: rating scale scores of tempo, dynamics and tone control favored the control group. Supporting the findings of Fardig and Sins, McCoy reported no significant differences in meter discrimination abilities between the two advanced choral ensembles or the two less advanced ensembles despite differences in rehearsal procedure.

According to Lewis, movement-based instruction is promoted by music educators as a particularly appropriate method for increasing young children's music perceptions, despite a lack of substantiating empirical support from researchers. Lewis (1988), therefore, investigated the effect of movement-based instruction on select listening skill achievements of general music students. Specifically, she examined the relationship between psychomotor activities reflecting common practices in elementary

general music classrooms and achievement on selected listening tasks involving melodic direction, meter, rhythm patterns, dynamics, and tempo. Students were pretested using standardized and researcher-constructed tests in melodic direction, meter, rhythm patterns, dynamics, and tempo. Intact classes of first and third grade students were randomly assigned to a control or experimental group, with all students receiving 12 thirty-minute music lessons using an activity-oriented approach which included playing accompaniments, singing, listening, improvising, and analyzing. The experimental treatment included the addition of movement-based instructional activities such as conducting, body ostinati, dance, and eurhythmics. Significant posttest differences between students occurred only in the areas of dynamics, with experimental group students in both grades scoring significantly higher, and melodic direction, with experimental students in the third grade scoring higher. Lewis concluded that movement-based instruction was not robust across the listening skills examined; therefore, her hypothesis did not receive strong support. She also suggested that the movement-based instructional treatment was not of sufficient length and intensity to have produced a significant impact on learning.

McCoy and Ellis (1992) conducted a study (a) to determine if short-term instruction could produce significant improvement in meter discrimination abilities of college nonmusicians, and (b) to examine the effectiveness of three instructional strategies designed to improve meter perception abilities. Students in six intact classes were administered a researcher-constructed *Meter Discrimination Test*, and were assigned to one of three treatment groups. Students in one group received a traditional

approach found in music appreciation texts, for which beat and meter concepts were defined and listening examples provided. Students in a comparison group listened to music examples that had been altered by the addition of a "click track" which highlighted beats and meter. Students in a third group responded to beat groupings of recorded music with large muscle movements. Treatment for all students consisted of one 45 minute class period, after which students again took the *Meter Discrimination Test.* McCoy and Ellis reported significant differences among the three groups, with the movement group recording the highest mean score. Based on the results, McCoy and Ellis concluded that movement was the most effective instructional approach for developing meter discrimination abilities.

Rhythmic Performance Ability and Movement Experiences

Examining the effect of movement experiences on rhythmic abilities, Wight (1937) sought to determine if rhythmic ability can be increased with movement training, and if a relationship existed between rhythmic ability and overall motor movement ability. Subjects were selected from a home for disabled children and were divided into two matched groups which were determined by scores from a motor coordination test, as well as measures of strength, age, and IQ. A rhythm test, requiring subjects to reproduce electronically-produced rhythm patterns, served as both the pretest and posttest.

Subjects in the experimental group participated in two months of rhythmic movement activities including conducting, tapping sticks and feet, marching, folk dancing, and tap dancing: all activities were adapted to meet students' physical

limitations. Results of the posttest revealed an 18% gain achieved by the experimental group on measures of rhythmic performance, compared to the 2.3% gain achieved by the control group. Based on the results, Wight concluded that rhythmic ability is related to motor coordination, and that rhythmic ability can improve as a result of movement training. According to Wight, if rhythmic ability is a component in motor coordination and is subject to improvement, then a carefully planned program of rhythmic movement activities should begin for students at the earliest possible age.

Boyle (1970) investigated the effect of prescribed rhythmic movements on the abilities of junior high band students to sight-read music by comparing the effectiveness of an instructional method employing body movement for teaching rhythm reading with a traditional method. Boyle hypothesized that an approach to music reading, which includes tapping the foot to mark the beat and clapping rhythm patterns, aids instrumentalists in reading and performing rhythm patterns. In this study, the "Rhythm Imagery" portion of the Music Aptitude Profile and a modified version of the Watkins-Farnum Performance Scale (WFPS) served as pretests. Students performed the WFPS on a single pitch, playing just the rhythm patterns. Bands in the experimental group participated in beat tapping and rhythm clapping activities thirty minutes per week for the purpose of helping students to become aware of the underlying beat. Results of the WFPS posttest revealed that students who participated in rhythmic movements performed significantly better than students who did not. Performance differences remained significant when scores were adjusted for students' rhythm aptitudes, intelligence, and sight-reading abilities. Based on these

results, Boyle concluded that rhythm training sessions are an effective method of instruction, specifically recommending the inclusion of foot tapping and hand clapping.

Based on a review of the literature, Douglass (1977) stated that there is an important connection between rhythm and kinesthetic motor response; therefore, she examined the efficacy of rhythmic movement training in teaching rhythm. Douglass sought to determine whether children who received instruction in rhythmic movement attained higher levels of music achievement than those who received traditional classroom music instruction. Students in two fourth-grade classes were administered Gordon's Music Aptitude Profile and Froseth's Physical Response to Rhythm in Music as pretests. For a period of 28 weeks, both classes received music instruction which included recorder performance instruction. Eurhythmic activities were incorporated into lessons of the experimental group: students learned and practiced rhythm patterns using some form of movement. Control group lessons were conducted with children remaining in their seats. At the conclusion of the treatment period, students were tested on measures of aural perception of rhythm, physical response to rhythm in music, ability to sight-read rhythms, and rhythmic accuracy in instrumental performance. Results of analyses revealed that rhythmic performance ability and sight-reading ability were significantly related to music aptitude; however, no significant differences existed between the two groups on any of the four criterion variables. Contrary to the findings of Boyle, Douglass reported that rhythmic movement did not significantly affect students' aural perceptions of rhythms, physical responses to rhythms, abilities to sight-read rhythms, and rhythmic accuracy in performances.

Factors Affecting Beginning Instrumental Music Performance

Numerous researchers have examined the relationship between music achievement of beginning instrumental music students and variables such as music aptitude, academic achievement, parental involvement, music background, and socio-economic status. Fewer researchers, however, have attempted to distinguish between music achievement as measured by a written test, and actual instrumental performance achievement. Bailey (1975), for example, did distinguish between achievement as measured by MAT and adjudicator ratings of students' performance abilities, reporting a positive relationship between performance skills and one or more years of piano lessons. In a longitudinal comparison of music achievement and music aptitude tests, Young (1976) also discovered that piano study had a slightly positive relationship to sixth grade beginning band students' performance ratings.

Zdzinski (1992), in his investigation of music achievement of instrumental music students, concluded that performance achievement as measured by the Watkins-Farnum Performance Scale is related strongly to music aptitude as measured by the Music Aptitude Profile. Zdzinski reported no significant effect of gender on performance achievement of instrumental music students in grades six through eight. Klinedinst (1991) also identified music aptitude as a valid predictor of success in beginning instrumental music, but concluded that scholastic ability and academic achievement have the strongest relationship with beginning instrumental music students' performance achievements. Academic achievement also was reported by Hufstader (1974) as an important predictor of success for instrumental music students.

Education Through Movement: Building the Foundation

Education Through Movement: Building the Foundation is a program developed by Phyllis S. Weikart as a result of teaching movement to individuals ranging from preschool age to adults. According to Weikart, contemporary technology, including television and video games, partially is responsible for elementary school children's motor development not keeping pace with their cognitive development and chronological age. She stated that the result of today's contemporary lifestyle points to children's (a) lack of awareness of what their bodies can do, (b) diminished control of arms, legs, and fingers, (c) need to develop gross and fine-motor abilities, (d) evident fatigue after brief periods of activity, and (e) need to attain physical fitness (Weikart & Carlton, 1995). Weikart stated that *Education Through Movement* addresses these issues by "developing and refining each learner's full body-potential in a way that leads to needed understanding and application--true ownership--of movement concepts" (p. 6). Building the child's movement foundation, essential in its own right for physical development as well as for supporting concept development in other curricular areas, is the basis of the program, and the reason for the educational approach. According to Weikart, the fundamental abilities stressed in *Education Through Movement* may be regarded as underlying students' performances in all curriculum areas, including music.

As the primary author of the book, Foundations in Elementary Education: Movement (Weikart & Carlton, 1995), Weikart stated that *Education Through Movement* uses a conceptual learning approach that has a broad movement base.

> The guiding principles and sequencing involved in *education through movement* are determined by knowledge of child development, established motor development principles, and our many years of practical experience with learners of all ages (p. 3).

There are five majors goals of the *Education Through Movement* program (p. 3):

1. To engage learners in the key experiences in movement, which are designed to develop the kinesthetic intelligence and address fundamental lifelong motor needs.

2. To promote active learning experiences supporting all areas of learning.

3. To *draw* from learners' existing capabilities.

4. To facilitate learners in *developing* new abilities and awareness and in *constructing* their own knowledge.

5. To create within learners a personal understanding of movement concepts and the ability to use and incorporate these concepts.

The first goal involves engaging learners in nine key movement experiences proposed by Weikart, key experiences which are developmentally sequenced to assist students in learning fundamental movement abilities which may be regarded as underlying students' performances in all curriculum areas. These key movement experiences, described below, are divided by Weikart into three broad categories: (a) engaging the learner, (b) enabling the learner, and (c) extending the learner.

Engaging the Learner. According to Weikart, when children are engaged in learning, "it means that they are paying attention to what is happening and thus able to thoughtfully respond to questions and requests for actions as well as describe their own ideas and actions" (Weikart & Carlton, 1995, p. 57). When engaged in these key movement experiences, students are building their movement foundations.

Acting Upon Movement Directions
A child's ability to respond to directions presented visually, verbally, and with hands-on guidance. Gives information about the child's ability to attend and concentrate.

Within the movement key experience which involves students responding to directions presented visually, verbally, and with hands-on guidance, Weikart has proposed "Stages of Movement" which range sequentially from simple to complex in motor-development order. These Stages of Movement, described in Appendix A, represent the stages through which learners proceed in building their motor foundation.

Describing Movement
Children's ability to plan, to talk about what they are doing, to recall, and to use the Learner SAY & DO method (uses one action to match each single word). Gives information about thinking abilities and language connected to action.

According to Weikart, language is the essential bridge to reaching ownership of movement concepts. Because children, as well as adults, find it challenging to think, speak, and move at the same time, she has proposed a Four-Step Language Process (Figure 1) to aid in the combination of action, thought, and language (p. 83).

Step 1: SAY:	students use simple descriptive language for the movement to be performed.
Step 2: SAY & DO:	children match movement with the language of Step 1 when they are ready.
Step 3: WHISPER & DO:	like Say & Do except that the words are whispered instead of said aloud.
Step 4: THINK & DO:	students *think* the words instead of saying or whispering while the movement continues.

Figure 1. Four-Step Language Process

Enabling the Learner. According to Weikart, teachers can "enable children for lifelong learning and enjoyment by initiating and supporting their development in the four broad areas of movement" (Weikart & Carlton, 1995, p. 87). Weikart maintained that observable outcomes of these key movement experiences include children's increased comfort with movement, and an improved awareness of the body, space, language, and time concepts related to each area of movement.

> ***Moving in Nonlocomotor Ways***
> *The child's comfort with anchored movement in personal space. Gives information about the child's body, language, space and time awareness of nonlocomotor movement.*

Nonlocomotor movement is movement that always has one part of the body anchored to the floor, and is performed in one's own space without completely transferring body weight (Weikart & Carlton, 1995). The nonlocomotor movement menu proposed by Weikart includes bend, twist, swing, push, curl, rise, straighten, turn, rock, pull, stretch, and fall. According to Weikart, nonlocomotor movements usually are easier for children to perform because the body is anchored in some way, and they require less strength, balance, and coordination than locomotor movements.

> ***Moving in Locomotor Ways***
> *The child's comfort with nonanchored movement in personal and general space. Gives information about the child's body, language, space, and time awareness of locomotor movement.*

Locomotor movement is movement that does not have a body part anchored to the floor, the movement menu including walk, jump, run, hop, leap, slide, gallop, and skip. Weikart maintained that, in addition to performing locomotor movements,

students must develop space awareness--understanding the "where" of movement such as around and under, and the "how" of movement such as fast or slow.

> ***Moving in Integrated Ways***
> *Designed for students in grade 2 and older learners. Gives increased information about students' coordination and basic timing.*

Integrated movement involves combining purposeful movement of different areas of the body and/or combining locomotor and nonlocomotor movement. According to Weikart, moving in integrated ways understandably is more complex than the previous two key movement experiences (Weikart & Carlton, 1995). Weikart stated that certain terms are used to describe components of integrated movement, terms which are useful in explaining the simplicity or complexity of a particular integrated movement. Weikart also proposed a developmental movement sequence to explain how integrated movement can follow a progression from simple to more complex (Appendix B).

> ***Moving with Objects***
> *The child's comfort with nonlocomotor and locomotor movement combined with objects. Gives information about the use of hand-held objects, such as rhythm instruments, bean bags, or scares, and about manipulating objects by throwing, kicking, dribbling, striking, or catching.*

According to Weikart, objects can be combined with nonlocomotor, locomotor, and integrated movements. This key experience includes all of the throwing, kicking, dribbling, and catching that characterize sports or games, and also includes movement with any hand-held object such as a music instruments.

Extending the Learner. Weikart maintained that the three key movement experiences under the category of Extending the Learner "build on children's emerging

abilities, awareness, and knowledge of movement concepts, challenging them to begin to figure things out for themselves" (Weikart & Carlton, 1995, p. 145). According to Weikart, these key experiences extend children creatively and rhythmically, and can be observed by the following observable outcomes.

> ***Expressing Creativity in Movement***
> *Children's ability to extend movement by incorporating their own ideas through problem solving and representing. Gives information about the child's ability to make independent decisions.*

Weikart suggested that creative movement means taking something familiar and changing it in some way; therefore, if students "possess a wide range of movement abilities, feel supported, and are intrinsically motivated, then they can start with what they know and understand and use it creatively" (p. 146). According to Weikart, children who express creativity in movement are those who use their own movement ideas, make decisions about movement, and solve movement problems: they are comfortable with representation and creative expression.

> ***Feeling and Expressing Steady Beat***
> *A child's ability to independently feel, express, and keep steady beat to rhymes, songs, and recorded or live music in nonlocomotor and locomotor ways. Gives information about child's basic timing.*

Weikart stated that this movement key experience is fundamental to both movement and music, and is one of the important prerequisites for early success in education. According to Weikart, "basic timing prepares the student to function throughout the curriculum; it affects motor skills, sports skills, musical performance, speech-flow, reading comprehension, performance of timed tasks, and organizations of one's time" (p. 155). Weikart also maintained that feeling and expressing steady beat

is one of the most primitive, yet the most overlooked, foundational ability. According to Weikart, children develop basic timing in two stages: (a) beat awareness which involves being able to move to their own internal steady beat, match a steady beat that is spoken verbally or modeled visually by others, and perform locomotor and nonlocomotor movements to that steady beat, and (b) beat competence which involves being able to *independently* identify, express, and keep the steady beat using nonlocomotor and locomotor movements (Weikart & Carlton, 1995). Weikart stated that a student who has achieved beat awareness, and then moved on to achieve beat competence, has developed basic timing.

Weikart described steady beat as the "consistent, repetitive pulse that lies within every rhyme, song, or musical selection," (p. 155); yet she distinguished between the organizational steady beat and the groupings of two beats or three beats, the first of which coincides with the organizational beat. Adopting the "microbeat" and "macrobeat" terminology of music theorist Edwin Gordon, Weikart referred to beats grouped in twos or threes as microbeats, and the organizational beat as the macrobeat. She stated that students need a variety of experiences using nonlocomotor movement with macrobeat to feel the organization of rhymes, songs, and recordings, as well as experiences using locomotor movement with microbeat. Although she acknowledged that learners progress at their own rate, and children's motor development depends not only on age but maturation and experience, Weikart has proposed approximate guidelines concerning movement and developing basic timing (Appendix C).

Moving in Sequences to a Common Beat
The child's ability to sequence movement in steady beat alone and with others. Gives information about the child's coordination.

Whereas the key experience *Feeling and Expressing Steady Beat* uses single movements, this key experience works with sequences of movements beginning with a pattern of two movements (Weikart, 1996). Sequences of movements are performed with a steady beat, a sequence referring to two or more different movements joined together. Weikart stated that the ease or difficulty with which students can perform various kinds of sequenced movements is important to know when working with students' beat coordination. According to Weikart, children can be assisted in developing beat coordination by introducing them to timed movements of increasing complexity, a complexity sequence which she organized into six Levels of Beat Coordination (Appendix D). Weikart stated that, of the six Levels of Beat Coordination, Levels I through IV are appropriate for children up through first grade. Levels V and VI are attainable for students in the second grade and above, provided they are developmentally ready for the more complex coordination involved in these last two levels.

Organized dance is an extension of the key movement experience *Moving in Sequences to a Common Beat*, and is an integral component of *Education Through Movement.* In the book, Teaching Movement and Dance (Weikart, 1989), Weikart defined organized dance as a "rhythmic movement sequence performed to music" (p. 71). The incorporation of organized, international folk dance is a hallmark of the *Education Through Movement* program, engaging students in rhythmic movement to

music in duple meter and triple meter. As with all other movement activities, Weikart has offered a method or sequence for introducing folk dance to students by level of movement difficulty. According to Weikart (1989), students should be exposed to an introductory sequence of organized movements prior to participating in folk dance. Therefore, she stated that students must have opportunities to practice locomotor and nonlocomotor movement sequences in different combinations, in different directions, and to a variety of music selections before being introduced to folk dance.

Active Learning Approach

Central to *Education Through Movement: Building the Foundation* is the facilitative role of the teacher, and the teacher/learner partnership. Weikart stated that the teacher's role in *Education Through Movement* is not to be a director of children's activities, or a dispenser of information. Rather, the teacher (a) introduces ideas and recognizes opportunities to support and extend ideas initiated by children, (b) encourages children to explore these ideas through purposeful movement, and (c) helps children to reflect on what they have done to bring the purposeful movement to a level of verbalization (Weikart & Carlton, 1995). The Active Learning Approach, as developed in the *Education Through Movement* program, is based on the following strategies.

1. *Initiation by Teacher and Student.* An active learning approach changes students from passive receivers of information as is found in a teacher-directed approach to learning, to active constructors of their own knowledge in which learning is initiated by the student and the teacher.

2. *Exploration of Purposeful Movement.* Learners try out movements germane to the specific concept in their own timing and in their own

space. Purposeful movements are planned ahead, and student are given opportunities to explore and work with movement concepts which leads to true understanding and ability to apply those concepts to all curricular areas.

3. *Choices and Planning by Students.* Learners find ways to express the concept through movement and then are encouraged to become the

   leader when sharing. Students take on ownership of the task and its solutions.

4. *Language Listened to and Supplied.* Throughout a movement activity, there is much verbal interaction. Conversations occur among students and between the teacher and students. Supplying language helps student to transfer learning, and to make associations from existing knowledge to new knowledge.

5. *Facilitation and Reflection.* Student learning is facilitated by questions which encourage them to reflect on their experience, draw conclusions from it, and think about other ways they might have proceeded. This reflection also helps the teacher to evaluate the level of students' understanding.

6. *Support from Teachers and Peers.* A positive, supportive classroom means realizing that teachers and students are on the educational journey together: each person brings something valid to the journey. A supportive environment is essential if teachers are to help students construct new knowledge and develop new skills by building on their existing capabilities.

The Teaching Model

The three-part Teaching Model (Figure 2) was developed as part of the *Education Through Movement* program. According to Weikart, educators employing the Teaching Model have found that using the model's three components–SEPARATE, SIMPLIFY, FACILITATE–can lead to an increased sense of responsibility in learners, and a decreased need to reteach concepts (Weikart & Carlton, 1995, p. 31).

SEPARATE:	Demonstrate *or* Tell *or* Use hands-on guidance
SIMPLIFY:	Begin with what is easy or manageable to learn
FACILITATE:	Engage learners through action, thought, and language

Figure 2. Education Through Movement Teaching Model

The SEPARATE component involves presenting information by using only one mode of presentation at a time, allowing children to focus on a single message presented in one of the following three modes (Weikart & Carlton, p. 31).

1. By *demonstration*, which means that the student must visually process in order to respond.
2. By *verbal (spoken) directions*, which means that the student must aurally process in order to respond.
3. By *hands-on guidance*, which means that the student must use tactile processing in order to respond.

Weikart stated that use of the SEPARATE strategy captures a learner's attention and leads to greater success in learning. In addition, each learning modality of the student is strengthened in the process.

The SIMPLIFY component involves beginning with that which is manageable to learn, so that all children can become engaged immediately in the active learning process and experience success (Weikart & Carlton, 1995). Weikart maintained that the SIMPLIFY component serves an important role in the teacher's selection of developmentally-appropriate activities based on curriculum concepts: teachers first must consider children's present capabilities. In her discussion of this component of the Teaching Model, Weikart provided guidelines for use of the SIMPLIFY strategy.

According to Weikart, these guidelines help teachers judge how easy or difficult a movement task is for children, and select activities that are developmentally appropriate (Appendix E).

The FACILITATE component, or strategy, of the Teaching Model "concerns all the ways that teachers engage children through action, thought, and language as they support them in developing awareness and skills and constructing their own knowledge" (Weikart & Carlton, p. 40). Weikart discussed the many opportunities available to teachers for facilitating students' learning: (a) encouraging and supporting children in initiating their own ideas and experiences, (b) giving children time to explore movement concepts on their own, and apply existing understanding and skills to a movement task, (c) providing time for children to work alone, with partners, or in small groups, planning and making choices about how they will solve problems, (d) supplying language, so that children accurately can label what they are doing, (e) asking children to plan what they are going to do, describe what they are doing, and reflect on what they did, and (f) asking children questions that provoke thought. Weikart suggested that providing a safe, interactive environment is the most important of all the ways that teachers can facilitate the learning process.

Research on Movement-based Instruction developed by Weikart

Although the principles and goals of *Education Through Movement* are being realized by numerous educators in preschool, elementary, physical education, and music classes, throughout the country, there is limited empirical research investing the effects of the program on students. In a study focusing on rhythmic achievement,

High (1987) examined the effects of rhythmic training developed by Weikart on beat competency performance skills of kindergarten children. Subjects in the experimental group received 14 weeks of rhythmic movement training using the Weikart approach: the control group participated in traditional rhythmic training, defined as speaking/singing rhythmic patterns and playing musical instruments. Weikart's Rhythmic Competency Analysis Test (1989) was used as a posttest measure: the results favored the experimental group. High concluded that rhythmic movement instruction developed by Weikart was effective for developing beat competency skills in kindergarten children.

Massette (1995), a music educator, reported using an instructional approach proposed by Weikart, in combination with simple folk dancing, in a casual manner over a two-year period. According to Massette, only 10% of the general music students could walk to the steady beat of music prior to implementation of the rhythmic movement element of Weikart's approach in her general music classes. Massette reported that, after the two year implementation period, 60% of the girls and 50% of the boys could walk, for more than 16 consecutive paces, to the steady beat of music never before used in the music class. Massette concluded that even casual implementation of Weikart's methods and materials for remediation in rhythmic movement produced positive results.

Price (1996) adopted Weikart's methods to investigate the effect of folk dance movement instruction on rhythmic and pitch perception abilities of students in grades three, four, and five. Two classes from each grade level were matched according to

scores on the Colwell Music Achievement Test, Part I, as well as results on a rhythmic movement test designed by the researcher. For nine weeks, classes designated as the experimental group received only folk dance instruction once a week in place of the general music class. The control classes received "regular" music instruction which involved singing, playing percussion instruments, and studying basic music theory: no dance-related movement was incorporated into the classes. All classes were taught by the same music teacher. Price reported that results of the Music Achievement Test meter recognition subtest and rhythmic movement test favored the folk dance approach over the traditional method of general music class. No significant differences were found between groups on measures of pitch perception, both groups improving equally. The researcher stated that higher scores demonstrated by the experimental group may be attributed to increased social and physical involvement, which may have developed a more positive attitude and increase in students' desires to learn. According to Price, this supports Weikart's findings that teenage students felt better about themselves when they improved their rhythmic and dance abilities after participating in her classes. Price also reported fewer discipline problems with students involved in the folk dance.

Summary

Musicians employ many different musically expressive devices for the purpose of establishing metric structure in music performance. Primarily through the use of electronic measuring instruments, researchers have discovered that performers use variations in dynamic level, duration, and articulation to accent metrically important beats. Few researchers, however, have addressed the question of whether performers'

employment of these musically expressive devices serves to communicate metric structure to listeners. Fewer researchers have examined beginning instrumental music students' abilities to communicate metric structure, and the types of music instruction that contribute to this ability. Numerous researchers have investigated the efficacy of movement-based instruction on students' rhythmic performance abilities; however, the lack of adequate movement treatment periods and rationale for movement activities included in the treatments have produced disparity in results. Movement activities included in movement-based instruction developed by Weikart are based on child and motor development principles, and are designed to build students' movement and learning foundations, as well as to support development in other curricular areas. Researchers generally support the use of movement-based instruction, developed by Weikart, for developing students' rhythmic behaviors; therefore, participation in movement-based instruction developed by Weikart may be effective for developing instrumental music students' rhythmic performance abilities.

Restatement of Purpose

The principal purpose of the current study was to investigate the effects of participation and nonparticipation in movement-based instruction, developed by Weikart, on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Secondary purposes of the study were to examine (a) the effect of rhythmic aptitude, (b) the effect of differences in notated meter, and (c) the interactive effects of movement-based instruction background and level of and rhythmic aptitude

on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Students' abilities to communicate metric structure were determined by an adjudication procedure whereby experienced instrumental music teachers, serving as judges, were required to discriminate aurally the meter of rhythm patterns performed by students. Judges indicated the extent to which students communicated duple and triple metric structure when reading and performing rhythm patterns using their music instruments.

Null Hypotheses

The following null hypotheses served as the principal research objectives of the current study. An alpha level of .05 was set for statistical analyses.

1. Three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction will not significantly affect beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments.

2. Three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction will not significantly affect beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments.

The following null hypotheses served as the secondary research objectives of the current study. An alpha level of .05 was set for statistical analyses.

1. Level of rhythmic aptitude will not significantly affect beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments.

2. Level of rhythmic aptitude will not significantly affect beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments.

3. Differences in notated meter will not significantly affect beginning instrumental music students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments.

4. Participation in movement-based instruction developed by Weikart and level of rhythmic aptitude will not interactively affect beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments.

5. Participation in movement-based instruction developed by Weikart and level of rhythmic aptitude will not interactively affect beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments.

CHAPTER III

PROCEDURES

The principal purpose of the current study was to investigate the effects of participation and nonparticipation in movement-based instruction, developed by Weikart, on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Secondary purposes of the study were to examine (a) the effect of rhythmic aptitude, (b) the effect of differences in notated meter, and (c) the interactive effects of movement-based instruction background and level if rhythmic aptitude on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments.

To control for possible confounding effects of variables identified in the research literature as contaminates, data describing students' piano experiences, dance experiences, and parents' music backgrounds were collected and examined. Music aptitude and music achievement also were identified as variables related to music performance; therefore, students' rhythmic aptitude and rhythm reading scores, as measured by standardized tests, served as covariates in the analysis of students' performance scores. Furthermore, because experienced music teachers served as judges of subjects' abilities to communicate duple and triple meter, homogeneity of variance across teachers' meter discrimination skills was established.

Subjects

To compare the meter performance abilities of students who had and had not participated in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction, the researcher needed to determine the availability of subjects for movement and comparison groups prior to conducting the study. To secure subjects for the movement group, teachers trained by Weikart and actively implementing principles of the *Education Through Movement: Building the Foundation* program with their students were identified. This procedure was accomplished by consulting with Weikart, who identified teachers meeting this criterion and produced for the researcher a list of teachers across diverse geographical locations in the United States: sites included schools in California, Washington, Colorado, Texas, Massachusetts, Florida, Michigan, and Georgia. All teachers identified by Weikart were Endorsed Trainers in the *Education Through Movement* program, the title indicating that the teacher successfully completed the three-year certification program established by Weikart. To maintain certification, Endorsed Trainers also verified continued implementation of the principles of *Education Through Movement* through the recertification process required by Weikart. Based on information provided by Weikart, 13 Endorsed Trainers involved in the *Education Through Movement* program were contacted to determine the availability of their students as subjects.

Initial contact with the Endorsed Trainers consisted of a letter of introduction sent to each teacher explaining the purpose of the research study, and outlining the procedure of the study in relation to his or her participation, as well as that of the

students. To help trainers determine the appropriateness of participation by their students in the research study, the letter also outlined criteria for students to serve as subjects for the movement group. These criteria, the minimum requirements students must satisfy to be included in the movement group, were based upon a review of the literature, principles of motor development, and communications with Weikart: students in the movement group must have received movement-based instruction, developed by Weikart, from an Endorsed Trainer on a weekly basis for a minimum of three years prior to beginning instrumental music instruction during the current school year. Subjects in the movement group, therefore, were specified as beginning instrumental music students who, for a minimum of three years prior to beginning instrumental music instruction, participated in weekly classes taught by an Endorsed Trainer actively implementing principles of Weikart's *Education Through Movement: Building the Foundation* program. Subjects receiving fewer than three years of movement-based instruction from an Endorsed Trainer were excluded from the study.

A second letter was sent to each Endorsed Trainer to reconfirm the purposes and procedures of the study, and to prompt responses from trainers regarding the feasibility of their participation. Additionally, the second letter outlined the need to test all beginning instrumental music students in their schools, including beginning instrumental music students who had not received movement-based instruction from an Endorsed Trainer. The procedure for the current study served to investigate the effects of participation and non-participation in movement-based instruction, developed by Weikart, on meter performance abilities by including beginning instrumental music

students who had not participated in movement-based instruction developed by Weikart. Subjects in the comparison group, therefore, were specified as beginning instrumental music students who had not participated in movement-based instruction developed by Weikart, but who had participated in the same beginning instrumental music programs as students in the movement-based instruction group.

Of the 13 Endorsed Trainers contacted by the researcher, three music teachers whose students met the criteria agreed to participate in and facilitate the study in their school district. These elementary music teachers, whose cooperation was critical to securing beginning instrumental music students for the movement and comparison groups, were employed in schools in Colorado, Massachusetts, and Washington. Cooperation of the band director and school administrators at each site also was necessary; therefore, the trainers served as the liaison between the researcher, and the band director and principals of each school by securing their permission for and cooperation in conducting the study. The researcher also corresponded with the band director in each school to ensure student availability and feasibility of the research procedure. A letter of explanation requesting parental permission for students to participate in the study was sent to each band director, who then distributed copies of the letter and permission form to the beginning instrumental music students. Permission forms signed by parents signified agreement for their children to participate in the study.

A total of 177 beginning instrumental music students from the three aforementioned states participated in meter performance testing conducted for the

current study. Complete data, however, were obtained from only 155 students. Students from all three test sites were combined according to movement-based instruction background for the purpose of forming a movement group and a comparison group. Students whose backgrounds included movement-based instruction, and who met the criteria previously outlined, served as subjects for the movement group (n = 77). Students whose backgrounds did not include movement-based instruction served as subjects for the comparison group (n = 78).

Colorado. Subjects from Colorado (n = 59) were beginning instrumental music students in the sixth grade who attended one middle school comprised of students who, collectively, had attended five different elementary schools across the school district. The Endorsed Trainer at this site was the elementary music teacher at one of the five elementary schools; therefore, students who attended that particular elementary school (n = 28) participated in movement-based music instruction, developed by Weikart, on a weekly basis for at least three years prior to beginning instrumental music instruction. All other subjects (n = 31) had not received elementary music instruction from an Endorsed Trainer, and, therefore, had not participated in movement-based instruction developed by Weikart.

Massachusetts. Subjects from Massachusetts (n = 24) were beginning instrumental music students in the fourth grade, all of whom received instrumental music instruction from the same band director. Students attending one of two different elementary schools served as subjects at this test site. An Endorsed Trainer was the elementary music teacher for students attending School A (n = 8); therefore, students

participated in movement-based instruction, developed by Weikart, on a weekly basis for at least three years prior to beginning instrumental music instruction. Students attending School B (n = 16) had not received their elementary music instruction from an Endorsed Trainer, and, therefore, had not participated in movement-based instruction developed by Weikart.

Washington. Subjects from Washington (n = 72) were beginning instrumental music students in the fifth grade, all of whom received instrumental music instruction from the same band director. Students attending one of two different elementary schools served as subjects for this study. An Endorsed Trainer was the elementary music teacher for students attending School C (n = 41); therefore, students participated in movement-based instruction, developed by Weikart, on a weekly basis for at least three years prior to beginning instrumental music instruction. Students attending School D (n = 31) had not received their elementary music instruction from an Endorsed Trainer, and, therefore, had not participated in movement-based instruction.

Students' participation in movement-based instruction taught by an Endorsed Trainer implementing principles of *Education Through Movement* was exclusively the result of their attending elementary schools in which Endorsed Trainers served as general music teachers. According to information gathered from individuals at each site, schools in which Endorsed Trainers were employed were representative of all other elementary schools in the respective school district with regard to students' cultural and socio-economic backgrounds, as well as academic, athletic, and musical opportunities. Elementary schools belonging to the respective school districts visited

by the researcher differed only by the presence or absence of an Endorsed Trainer and movement-based music instruction. Students' attendance at particular elementary schools within the school districts was based solely on the location of their homes within a district. Table 1 presents a profile of subjects from all three sites by state of residence, grade level, and movement-based instruction background.

Table 1
Subject Profile by State, Grade, and Movement-Based Instruction Background

	Movement Group n = 77	Comparison Group n = 78	Total n=155
Colorado (grade 5)	28	31	59
Massachusetts (grade 4)	8	16	24
Washington (grade 6)	41	31	72

Judges

In this study, subjects' abilities to communicate metric structure were determined by an adjudication procedure whereby judges were required to discriminate aurally duple and triple meter in rhythm patterns performed by students. Three instrumental music teachers, with a mean of 12 years teaching experience, served as judges for the current study. Sloboda (1983) maintained that ability to aurally identify meter develops over years of practice listening to and performing music. Therefore, the researcher of this study sought to secure judges whose teaching and performance

backgrounds were comprehensive, as well as extensive. In addition to private instrumental music instruction at the beginning through college level, the judges' combined teaching experiences included elementary through senior high school instrumental music instruction, pre-school through senior high school general music instruction, and elementary through senior high school vocal music instruction. Judges' collective instrumental music performance experiences included performance of brass, woodwind, percussion, and stringed instruments.

Materials

Student Questionnaire

A *Student Questionnaire* (Appendix F) was constructed by the researcher for the purpose of obtaining qualitative information about each subject. Subjects' responses to items on the questionnaire provided data regarding variables which a review of the literature revealed may affect music performance: (a) piano experience, (b) dance experience, (c) academic performance, and (d) parents' music backgrounds (Zdzinski, 1992; Klinedinst, 1991; Young, 1976; Bailey, 1975). Included as part the questionnaire was an item designed to reveal subjects' movement-based instruction backgrounds. This item required subjects to indicate whether the Endorsed Trainer teaching music in an elementary school at the respective test site had been their elementary music teacher, thereby, indicating whether their background included movement-based instruction.

Students of three different Endorsed Trainers served as subjects for this study; therefore, three different versions of the *Student Questionnaire* were constructed. Each

version presented the name of only one Endorsed Trainer, whom subjects at each respective test site did or did not identify as their elementary music teacher. Also included on the questionnaire were items regarding subjects' ages, grade levels, instruments currently played, and additional movement experiences.

Meter Performance Instrument

A *Meter Performance Instrument* (Appendix G) was designed by the researcher to evaluate subjects' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. An analysis of several widely recognized beginning instrumental method books (Pearson, 1993; Feldstein & O'Reilly, 1988; Anzalone, 1983; Pearson, 1982) revealed that the durations comprising the majority of rhythm patterns contained in these beginning method books included whole note, dotted-half note, half note, dotted-quarter note, quarter note, and eighth note. Constructed by the researcher, the *Meter Performance Instrument* (*MPI*) consisted of seven rhythm patterns comprised solely of the durations listed above. The rhythm patterns were notated in either simple duple or simple triple meter, and all seven rhythm patterns were 12 beats in duration (quarter note = 1 beat). Five of the seven patterns included on the *MPI* were unique; however, the remaining two patterns contained identical durations in identical order. One pattern, Pattern D (Figure 3), was notated in duple meter; one pattern, Pattern T (Figure 4), was notated in triple meter.

Figure 3. *Pattern D*

Figure 4. *Pattern T*

The findings of Bolton (1894) and Woodrow (1909) were accommodated in the construction of Pattern D and Pattern T; both researchers reported that sound durations affect a listener's perception of grouping. To control for judges' perceptions of grouping and identifications of meter based solely on differences in duration of sounds resulting from differences inherent in the rhythmic notation, the first two measures of Pattern D and Pattern T each began with a notated quarter note. In addition, Pattern D and Pattern T were constructed so that the longest notated duration, the dotted-quarter note, was on the first beat of a measure in both rhythm patterns. The purpose for including Pattern D and Pattern T as part of the *Meter Performance Instrument* was to present to performers two identical lines of rhythm, notated once in duple meter and once in triple meter.

By varying the order in which the seven rhythm patterns were presented, three different forms of the *Meter Performance Instrument* were created. Placement of Pattern D and Pattern T was altered on each form of the *MPI* to control for performance variability due to serial effect. However, to ensure consistency among Form A, Form B, and Form C of the *Meter Performance Instrument*, Pattern D was

preceded always by a pattern notated in triple meter: Pattern T was preceded always by a pattern notated in duple meter. In addition, each form of the *Meter Performance Instrument* was designed so that subjects read and performed a pattern in both duple meter and triple meter before performing Pattern D or Pattern T.

A copy of the *Meter Performance Instrument* was sent to each band director prior to the main study to determine the extent of subjects' experiences reading and performing the selected durations. The directors were requested to review the rhythm patterns included on the *Meter Performance Instrument*, and provide information regarding the length of time their beginning instrumental music students had been reading and performing durations comprising the *MPI*. Specifically, the band directors were requested to identify any durations with which their students were unfamiliar. Band directors did not identify any note value comprising the *MPI* as unfamiliar to their students; therefore, the rhythm patterns which constituted the *Meter Performance Instrument* were considered appropriate.

Performance Assessment Instrument

A review of the literature revealed that researchers investigating the communication of rhythm information generally employed electronic measuring instruments to determine the extent to which the metric structure had been communicated (Drake & Palmer, 1993; Windsor, 1993; Gabrielsson, Bengtsson, & Gabrielsson, 1983). Gabrielsson (1985), however, stated that music performance is for the purpose of affecting the listener; therefore, music performance must be examined in relation to what the listener experiences. In a study investigating the

communication of meter, Sloboda (1983) examined rhythm performance in relation to listeners. In his study, the communication of metric structure was determined by the degree to which listeners accurately identified the meter of the performance; therefore, the performance assessment procedure developed by Sloboda was adapted for the current study.

Based on Sloboda's procedures, and patterned after the listener response sheet described by Sloboda, the researcher for the current study developed a *Performance Assessment Instrument* (Appendix H) to be utilized by the judges when assessing subjects' performances of Pattern D and Pattern T. The *Performance Assessment Instrument* contained one row of responses for each separate performance of Pattern D and Pattern T, each row containing five response columns: "Sure D," "Maybe D," "Maybe T," "Sure T," and "Uncertain." The five response options allowed judges to identify each performance as being played in duple or triple meter, and the extent to which the performer communicated the meter. The column headed "Uncertain" was provided to discourage guessing, reducing the chance scores and enhancing reliability (Boyle & Radocy, 1987). The *Performance Assessment Instrument* contained the following written instructions based on those described by Sloboda (1983).

> After listening to each performance, fill in the announced pattern identification number, and decide whether you think the performance to be in duple meter (D) or triple meter (T). If you are sure it was in duple meter, circle the response "Sure D." If you are not sure, but think that it was duple, then circle "Maybe D." If you are not sure, but think that it was in triple meter, circle the response "Maybe T." If you are sure it was in triple meter, circle "Sure T." If no confident judgement can be made concerning the meter, circle "Uncertain." You MUST choose one of these five options for each performance.

Judges' qualitative responses to each performance were assigned a numerical value ranging from 0 to 2. For example, a response was scored as 2 if a judge circled "Sure" for the meter matching the notated meter of the rhythm pattern being performed: a response of "Maybe" matching the notated meter was scored as 1. If a judge responded "Sure" or "Maybe" for a meter that was not the notated meter, or responded "Uncertain," the response was scored as 0, indicating the judge's inability to associate the notated meter with the subject's performance. Judges' scores for individual performers were combined, each performer receiving three scores: (a) a score for Pattern D, ranging from 0 to 6 points, (b) a score for Pattern T, ranging from 0 to 6 points, and (c) an, overall, composite score, ranging from 0 to 12 points.

Music Achievement Test

In this study, subjects' abilities to communicate duple and triple metric structure were determined by the extent to which experienced instrumental music teachers, serving as judges, could identify the meters of the rhythm patterns being performed. To account for the factor of judges' abilities to perceive and identify meter, and to establish increased interrater reliability, the "Meter Discrimination" subtest of Colwell's (1969) Music Achievement Test (MAT), Test 1, was administered to each judge, and scored prior to conducting the main study. The "Meter Discrimination" subtest required judges to classify 15 musical items as moving in two or three; an "in doubt" response also was provided for each item. Test 1 of the Music Achievement Test has a reported reliability of .88 (Colwell, 1969). Each of the three judges obtained the

maximum score (15 of 15), establishing homogeneity of variance across the experienced music teachers' meter discrimination skills

The "Auditory-Visual Discrimination" rhythm subtest of Colwell's Music Achievement Test, Test 2, also was utilized for the purpose of determining subjects' abilities to read rhythm notation. The researcher administered the subtest to subjects at all three sites as part of the on-site research procedure. Music reading scores, as measured by the MAT, served as a covariate to adjust for differences in subjects' meter performance scores due to differences in subjects' music reading skills. The rhythm portion of the "Auditory-Visual Discrimination" subtest has a reported reliability of .80 (Colwell, 1969).

Music Aptitude Profile

Music aptitude, defined by Gordon as an individual's potential to learn, is positively related to music achievement and music performance (Zdzinski, 1992; Gordon, 1995). Specifically, rhythmic aptitude as measured by the "Rhythm Imagery" test of the Musical Aptitude Profile (Gordon, 1988) is linearly related to rhythm performance; a higher measure of rhythmic aptitude is indicative of a greater degree of rhythmic performance ability (Douglass, 1977; Boyle, 1970). A review of the literature suggests that students' meter performance abilities are affected by their rhythmic aptitudes; therefore, the "Rhythm Imagery" test of Gordon's Music Aptitude Profile was administered to subjects by the band director or Endorsed Trainer at each site prior to the arrival of the researcher. Subjects' rhythmic aptitude scores served as

a covariate to adjust for differences in subjects' meter performance scores due to differences in subjects' rhythmic aptitudes.

The "Rhythm Imagery" test of the MAP is comprised of two separate subtests. The Tempo subtest, which consists of paired musical questions and musical answers, required students to judge whether the musical answer was the same tempo as the question. The Meter subtest required students to decide if the meter of the musical answer was different from the meter of the question. Subjects' scores on both the Tempo and Meter subtests were converted to standard scores according to standardization procedures outlined by Gordon, and combined to produce subjects' composite standardized rhythmic aptitude scores. Gordon reported the reliability of the "Rhythm Imagery" test of MAP as ranging from .82 (fourth grade) to .91 (eleventh grade) (Boyle & Radocy, 1987).

Pilot Study

In the current study, rating subjects' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments required assigning a specific score to each performance as a judgement of ability. According to Boyle and Radocy (1987), when judgement calls are the basis for scoring, interrater reliability becomes important. A pilot study, therefore, was conducted to establish interrater reliability, or the extent of agreement among judges, prior to conducting the formal research study. First-year, sixth grade instrumental music students (n = 26) from a middle school in Guilford County, North Carolina served as subjects for the pilot study. No attempt was made to determine students' identities, rhythmic aptitudes,

music reading abilities, academic achievement, or parents' music backgrounds because the purpose of the pilot study was to establish interrater reliability, not to compare subjects' abilities to communicate metric structure.

In cooperation with the instrumental music teacher, the researcher conducted the meter performance testing in the school during the month of April, 1996. Students were tested individually during their regularly scheduled sixth-grade band class. Pilot testing facilities included a room for audio taping students' performances: pilot testing materials and equipment included copies of the three forms of the *Meter Performance Instrument*, a metronome, a JVC, RX318BK Stereo Receiver with a TDW709 double cassette deck, and three Maxell XLII 90 minute high bias cassette tapes.

The performance testing procedure designed by the researcher involved a two-step process to which all students adhered. The first step involved students' practice of the *Meter Performance Instrument* to control for differences in sight-reading abilities. Students randomly selected a copy of one of the three forms of the *Meter Performance Instrument* as they entered the practice area located directly outside of the testing room. Students then were given time to practice reading the rhythm patterns on the *MPI* prior to recording their performances of Pattern D and Pattern T. The lack of facilities and of teacher supervision prohibited the use of a separate room in which students could practice the patterns using their instruments. The second step of the process involved students individually entering the testing room wherein students' performances of the rhythm patterns were tape-recorded.

Students entered the testing room, placed the *Meter Performance Instrument* on the music stand provided, and were presented with the option of standing or sitting to perform. The chair and music stand provided for students were positioned so that students performed directly into the microphone. The recording equipment was arranged by the researcher for optimum accessibility, and prohibited students from viewing the researcher's operation of the equipment. After indicating their preference for sitting or standing to perform, students were asked to identify which form of the *Meter Performance Instrument* they possessed. Prior to their performance of the *MPI*, a metronome sounded a suggested tempo of 80 beats per minute. Students then were requested to perform the seven rhythm patterns notated on the *Meter Performance Instrument* in order, but to pause before performing each pattern to allow the researcher to announce the "pattern identification number" of the rhythm pattern. Initially, the researcher suggested the pitch on which students should perform the rhythm patterns; however, while conducting the performance testing, the researcher determined that students experienced greater comfort when permitted to choose the performance pitch.

As described above, a unique pattern identification number was stated aloud by the researcher before students' performances of each rhythm pattern, creating for the subject the impression that each pattern was being tape-recorded and assessed. However, only students' performances of Pattern D and Pattern T were tape-recorded by the researcher, and their identification numbers recorded as a means of associating the performance with a notated meter. Performances were recorded on one of three

cassette tapes: tapes were exchanged between every performance of Pattern D and Pattern T to ensure that judges experienced a random order of meters and performers.

To ensure maximum efficiency of the performance testing procedure, a rotation system was established whereby three students were seated in the practice area located outside of the testing room while one student was taping in the testing room. When a student completed the performance testing and exited the testing room, he or she returned to the band rehearsal in progress, and the student who had been in the practice area the greatest length of time entered the testing room. In an order predetermined by the band director, another student then was excused from the band rehearsal and entered the practice area to begin the performance testing procedure.

Duplicate tapes were made of the three cassette tapes used to record student performances, and a copy of all performances given to each judge. An interrater reliability estimate of .82 was determined by comparing the scores assigned by each judge to each of the 52 performances (n = 26 x 2) using Cronbach's coefficient alpha (Boyle & Radocy, 1987).

Procedure for the Main Study

Test materials for the "Rhythm Imagery" test of the MAP were sent to the three Endorsed Trainers serving as facilitators for the research study in their schools. Materials included an original copy of the "Rhythm Imagery" test of the MAP, a photocopy of the administration procedure as presented in the manual, and standardized answer sheets. Permission to photocopy the administration procedure for the "Rhythm Imagery" test of the MAP was obtained by the researcher from G.I.A.

Publications, Inc (via telephone 2/11/96). The rhythmic aptitude testing was conducted in schools at each site by resident teachers prior to the arrival of the researcher. The test was administered to subjects in Colorado by the band director during their regularly scheduled band classes. Likewise, the band director in both elementary schools in Massachusetts administered the aptitude test to subjects during their respective band rehearsals. In Washington, subjects attending one elementary school were administered the rhythmic aptitude test by the Endorsed Trainer during their regularly scheduled general music classes. Subjects attending the other elementary school were administered the test by the band director during their regularly scheduled band rehearsals.

Administration of the "Aural-Visual Discrimination" rhythm subtest of the Music Achievement Test, and tape-recording of subjects' performances of Pattern D and Pattern T was conducted by the researcher at the three sites during the month of May, 1996. Differences in school facilities and teachers' schedules among sites necessitated only minor adjustments in the conditions under which the researcher conducted the testing. The actual performance testing procedure was consistent among sites, and remained similar to that established in the pilot study. Subjects agreeing to participate in the performance testing procedure of the main study randomly chose one of the three forms of the *Meter Performance Instrument*, and were allotted time to practice reading and performing the rhythm patterns using their music instruments. Subjects also completed the *Student Questionnaire* during the practice time, presenting the questionnaire to the researcher upon entering the testing room. This procedure

allowed the researcher to assess the completeness of the questionnaire, and to gather necessary information from the subject in the event that the questionnaire was not complete.

Subjects were recorded individually by the researcher, subjects choosing the pitch on which to perform the *Meter Performance Instrument*. Because subjects had practiced the rhythm patterns several times at a tempo of their choosing prior to entering the testing room, the researcher did not employ the metronome to impose a suggested tempo. Subjects again identified their copy of the *Meter Performance Instrument* as Form A, Form B, or Form C, and performed the seven rhythm patterns in order, pausing before each pattern to allow the researcher to announce a pattern identification number. The performance identification numbers assigned to a subject's performances of Pattern D and Pattern T were recorded directly on the subject's *Student Questionnaire*. In the event that a subject hesitated while performing Pattern D or Pattern T, the researcher simply repeated the pattern identification number and recorded the complete performance before exchanging the cassette tape. A greater number of subjects participated in the study than served in the pilot study; therefore, subjects' performances were recorded on one of seven cassette tapes which were exchanged between every performance of Pattern D and Pattern T.

Site Descriptions and Testing Procedures

Colorado. The first site visited by the researcher was a middle school located near the Colorado Springs area of Colorado. Part of a large school district, the middle school was comprised of students who, collectively, had attended five different

elementary schools across the school district. The Endorsed Trainer was the elementary music teacher at one of the five elementary schools; therefore, students who attended that particular elementary school participated in movement-based music instruction, developed by Weikart, on a weekly basis for at least three years prior to beginning instrumental music instruction. Due to the large number of beginning instrumental music students in the middle school, the students were divided into two separate band classes, each rehearsing with the same band director on a daily basis. Again, because of the large number of beginning band students, the band director had conducted rhythmic aptitude testing only for those band students who had the Endorsed Trainer as their elementary music teacher, and for an equal number of students who had not. The band director reported that he purposely selected an equal number of students demonstrating high, medium, and low music abilities to serve as subjects for the comparison group. A total of 62 students participated in the performance testing; however, complete data were obtained from only 59 students: 28 subjects in the movement group, and 31 subjects in the comparison group.

Testing occurred over a two-day period, and was conducted during subjects' regularly scheduled band rehearsals. All testing was conducted in a large rehearsal room adjacent to the band room. On the first day of testing, all subjects involved in the study were administered the MAT subtest prior to beginning the performance portion of the testing procedure. Subjects also completed the *Student Questionnaire* prior to the performance testing. As occurred in the performance testing procedure of the pilot study, a rotation was established whereby several students individually

practiced reading and performing the randomly chosen forms of the *Meter Performance Instrument* using their music instruments. An instrument storage room within the rehearsal room served as the testing room, wherein subjects entered individually to be recorded by the researcher. When a subject completed the taping portion of the testing procedure, he or she returned to the regular band rehearsal, and the subject experiencing the most practice time entered the testing room. A new subject then entered the practice area to begin the performance testing procedure. The assistant band director conducted the regular band rehearsal for those students not involved in the research study, while the senior band director supervised the questionnaire completion, subjects' practice of the *MPI*, and the rotation of subjects throughout the performance testing procedure. The performance testing was conducted on the second day of testing using the same procedure. However, to ensure the largest possible sample, available subjects were tested at times other than their regularly scheduled band classes throughout the second day.

Massachusetts. The second site visited by the researcher was comprised of two small elementary schools located in a rural area of south central Massachusetts. Both elementary schools were part of the same school district, enrollment in both schools consisted of students of the same socio-economic level and cultural backgrounds. Fourth grade students from both schools who participated in the beginning instrumental music program were taught by the same band director: each student experienced a weekly small group lesson and weekly band rehearsal. An Endorsed Trainer had been elementary music teacher for subjects attending School A; therefore,

subjects had participated in movement-based instruction, developed by Weikart, on a weekly basis for at least three years prior to beginning instrumental music instruction. Students attending School B had not received their elementary music instruction from an Endorsed Trainer, and, therefore, served as subjects for the comparison group. A total of 28 students were tested; however, complete data were obtained from only 24 students: 8 subjects in the movement group, and 16 subjects in the comparison group.

Testing occurred over a two-day period: one day was spent in each of the two elementary schools. With the cooperation of the band director and classroom teachers, subjects in both schools were excused from their regular classrooms in small groups of five to seven. Subjects participated in the same performance testing procedure established at the first site; however, the MAT was administered to each small group after all subjects in that group had completed the performance testing procedure. The taping of subjects' performances was conducted in the music room in School A: taping was conducted in the principal's office in School B. In each elementary school, the band director arranged for the availability of subjects and supervised the questionnaire completion, subjects' practice of the MPI, and the rotation of subjects throughout the performance testing procedure.

Washington. The third site visited by the researcher was comprised of two large elementary schools located near the Seattle area of Washington. Both elementary schools were part of the same school district, and were attended by students of various socio-economic levels and cultural backgrounds. Fifth grade students from both schools who participated in the beginning instrumental music

program were taught by the same band director, all students participating in daily band rehearsals. An Endorsed Trainer was the elementary music teacher for subjects attending School C; therefore, subjects participated in movement-based instruction, developed by Weikart, on a weekly basis for at least three years prior to beginning instrumental music instruction. Subjects attending School D had not received their elementary music instruction from an Endorsed Trainer, and, therefore, served as subjects for the comparison group. A total of 83 students participated in the performance testing; however, complete data were obtained from only 72 students: 41 subjects in the movement group, and 31 subjects in the comparison group.

Testing occurred over a two-day period in accordance with the band director's schedule; beginning band classes rehearsed in the morning at School C and in the afternoon at School D. The MAT was administered to all subjects on the first day of testing during their regularly scheduled band classes. The performance testing procedure remained similar to that established at the previous two sites, the assistance of the classroom music teacher and band director making it possible for subjects to rotate out of band rehearsal to a supervised practice room before individually entering the testing room. Subjects received and completed the *Student Questionnaire* while in the practice room; however, because these subjects did not receive traditional letter grades (i.e., "A" and "B" letter grades), the questionnaire format regarding academic performance was not appropriate. Subjects familiar with the traditional letter grading system were instructed to circle the letter grade they thought comparable to the academic performance mark they received in their system of grading, or to simply

comment about their academic performance. To ensure the largest possible sample, available students again were tested during times other than their regularly scheduled band classes throughout the second day.

Scoring Procedure

Duplicate tapes were made of the seven cassette tapes on which students' performances of Pattern D and Pattern T were recorded, and copies of all taped-recorded performances were given to each of the three judges. Judges listened to 155 performances of Pattern D and 155 performances of Pattern T, and utilized the *Performance Assessment Instrument* to record the extent to which they could identify subjects' performances as communicating duple or triple meter. Judges' responses then were compared to the notated meter of the rhythm pattern, and assigned a numerical value based on the extent of agreement in the manner explained previously. Each subject received three meter performance scores: (a) a score for Pattern D, ranging from 0 to 6 points, (b) a score for Pattern T, ranging from 0 to 6 points, and (c) an overall, composite score, ranging from 0 to 12 points. Subjects' three meter performance scores were transferred to their individual *Student Information Records* (Appendix I). Interrater reliability for the main study was determined by comparing judges' responses to each of the 310 performances (n = 155 x 2) using Cronbach's coefficient alpha (Boyle & Radocy, 1987).

Rhythmic aptitude and ability to read rhythm notation were determined by subjects' scores on the "Rhythm Imagery" test of the Music Aptitude Profile and the "Aural-Visual Discrimination" rhythm subtest of the Music Achievement Test

respectively. Both tests were hand scored by the researcher according to the standardized scoring procedure outlined in the respective manuals. Subjects' scores on both the Tempo and Meter subtests were converted to standard scores according to the standardization procedures outlined by Gordon, and combined to produce subjects' composite standardized rhythmic aptitude scores. Using subjects' standardized rhythmic aptitude scores and Gordon's suggested groupings by percentile rankings, subjects were categorized as demonstrating high rhythmic aptitude (75th percentile and higher), medium rhythmic aptitude (26th to 74th percentile), and low rhythmic aptitude (25th percentile and below) for the purpose of data analysis. Subjects' MAT scores, standardized MAP scores, and rhythmic aptitude groupings also were transferred to their individual *Student Information Records.*

For the purpose of data analysis, qualitative data gathered from subjects' *Student Questionnaires*, including piano experience, dance experience, aptitude grouping, parents' music backgrounds, and movement-based instruction background were quantified. Information regarding state of residence, age, and instrument currently played was used only for further identification of subjects. The numerical data were entered on subjects' *Student Information Records* according to the coding system presented in Table 2. A three-digit student identification number also was recorded on subjects' *Student Information Records* to ensure a unique line of data for each of the 155 subjects.

Table 2
Quantitative Coding System for Student Questionnaire Data

State of Residence		*Piano Experience*		*Instrument Currently Played*	
11	Colorado	41	yes	20	clarinet
12	Massachusetts	42	no	21	flute
13	Washington			22	oboe
				23	bassoon
				24	saxophone
Movement-Based Instruction Background		*Dance Experience*		25	trumpet
				26	horn
				27	trombone
31	yes	51	yes	28	baritone/tuba
32	no	52	no	29	percussion

Rhythmic Aptitude Group		*Parents Play Instrument*		*Parents Teach Music*	
1	Low	0	0 parents play	0	0 parents teach
2	Medium	1	1 parent plays	1	1 parent teaches
3	High	2	2 parents play	2	2 parents teach

Analysis of Data

The *Student Information Records* served as the researcher's record of each subject's meter performance scores which included a score for Pattern D, a score for Pattern T, and a composite score. Subjects' MAT scores, MAP scores, and quantified descriptive data also were recorded on subjects' individual *Student Information Records.* Using data from subjects' *Student Information Records*, data files were established using the Digital Equipment Corporation (DEC) VAX cluster. Descriptive data, standardized test scores, and meter performance data, collapsed across the three testing sites by movement-based instruction background, were analyzed using the

Minitab statistical package and Statistics Package for Social Sciences (1990) descriptive and inferential statistical packages. An alpha level was set at .05 for statistical analyses.

Descriptive Analysis of Dependent Variables

Subjects' Pattern D scores and Pattern T scores served as measures of the dependent variables for the current study, and formed part of the statistical analysis necessary to test the null hypotheses. According to Glass and Hopkins (1984), many statistical methods, including *t* tests and analyses of variance, assume that population distributions, such as distributions of subjects' Pattern D and Pattern T scores, follow the normal distribution curve. Glass and Hopkins also stated, however, that violation of this assumption of normality has almost no practical consequences when using a *t* test. Likewise, non-normality has negligible consequences with respect to an ANOVA unless a population distribution is highly skewed. The Minitab statistical package, therefore, was used to examine the distribution of subjects' Pattern D scores, and distribution of subjects' Pattern T scores, to determine their appropriateness as dependent variables in further analyses.

Collapsed across movement-based instruction background, subjects' Pattern D scores were analyzed to determine measures of central tendency including the mean and median, as well as the range of scores. Pattern D scores also were analyzed to determine the distribution of scores, and to ensure that the assumption of normality had not been violated. Collapsed across movement-based instruction background,

subjects' Pattern T scores were subjected to the same analyses to determine indicators of central tendency and variability.

Analysis of measures of the dependent variables revealed a slightly positively skewed distribution of subjects' Pattern D scores. Subjects' Pattern T scores, however, were highly skewed; therefore, the assumption of normality was violated. Analysis also revealed, that, although there was variability among subjects' Pattern T scores, the majority of subjects demonstrated lack of abilities to communicate triple metric structure when performing rhythm pattern using their music instruments. Due to lack of abilities among subjects to communicate triple metric structure, and the highly skewed distribution of scores, subjects' Pattern T scores were not subjected to further analysis in the current study, with the exception of a paired-difference *t* test comparing subjects' Pattern D and Pattern T scores.

Analysis of Qualitative Data

To control for differences in subjects' abilities to communicate metric structure when reading and performing rhythm patterns due to variables revealed in the literature as contaminates, the researcher examined the relationship between subjects' Pattern D scores and their piano experiences, dance experiences, and parents' music backgrounds. Data obtained from the *Student Questionnaires* revealed that 36 subjects had at least one year of formal piano training, 38 subjects had at least one year of formal dance training, 7 subjects had one parent who taught music, 42 subjects had one parent who played an instrument, and 16 subjects had two parents, each of whom played an instrument (Table 3).

Table 3
Qualitative Data by Movement-Based Instruction Background

	Movement Group n = 77	Comparison Group n = 78	Total n=155
Piano lessons (at least 1 year)	18	18	36
Dance lessons (at least 1 year)	25	13	38
High rhythmic aptitude	32	23	55
Middle rhythmic aptitude	44	48	92
Low rhythmic aptitude	1	7	8
One parent is a music teacher	4	3	7
Both parents are music teachers	0	0	0
One parent plays an instrument	22	20	42
Both parents play an instrument	9	7	16

Piano experience. Researchers identified a strong, positive relationship between formal piano training and music performance (Bailey, 1975; Young, 1976); therefore, the effect of piano training on subjects' abilities to communicate metric structure was examined. A *t* test was used to determine if the mean score of persons who received a special treatment, i.e., piano training, differed significantly from the mean score of persons who did not (Glass & Hopkins, 1984). Meter performance data, therefore, were collapsed across movement-based instruction background, and a *t* test used to determine the significant difference between Pattern D scores of subjects

with at least one year of formal piano training (n = 36) and subjects with no piano experience (n = 119).

Dance experience. The researcher also sought to determine if differences in subjects' abilities to communicate metric structure were related to formal dance training other than that received as a result of participating in movement-based instruction developed by Weikart. Performance data were collapsed across movement-based instruction background, and a *t* test used to determine the significant difference between Pattern D scores of subjects with at least one year of formal dance training (n = 38) and subjects with no dance experience (n = 117).

Parents' music backgrounds. To determine the effects of parents' music backgrounds on subjects' abilities to communicate metric structure, a *t* test was run on subjects' Pattern D scores, data collapsed across movement-based instruction background, to compare performance abilities of subjects with 0 parents (n = 148) and 1 parent (n = 7) who were music teachers. No subject reported having 2 parents who taught music. Effects of parents' music backgrounds on subjects' meter performance abilities also were determined by using a one-factor ANOVA, designed to determine if significant differences exist between mean scores of three or more independent groups (Glass & Hopkins, 1984). Pattern D scores of subjects with 0 parents (n = 96), 1 parent (n = 43), and 2 parents (n = 16) who played a music instrument were compared to determine if mean Pattern D scores of the three groups differed significantly.

Academic performance. A review of the literature revealed that academic performance is related strongly to music performance (Hufstader, 1974; Klinedinst, 1991); therefore, the *Student Questionnaire* previously described was designed to obtain information regarding subjects' academic performances. Data were collected for the purpose of examining the effect of academic performance on subjects' abilities to communicate metric structure. As discussed previously in this chapter, limitations of the *Student Questionnaire* format prohibited many subjects from reliably reporting their academic performance; therefore, academic performance was not considered in any analyses in the current study.

Main Research Question Analysis

The principal purpose of this study was to investigate the effects of participation and non-participation in movement-based instruction developed by Weikart on subjects' abilities to communicate metric structure when performing rhythm patterns using their music instruments. One null hypothesis stated that three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction will have no significant effect on beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments. This null hypothesis was tested using an analysis of covariance (ANCOVA) to statistically equate the movement and comparison groups on characteristics on which they differ, characteristics or variables assumed to be linearly related to the dependent variable (Glass & Hopkins, 1984).

Researchers investigating variables affecting the performances of beginning instrumental music students suggested that music aptitude, as measured by MAP, and music achievement, as measured by MAT, both are linearly related to music performance (Klinedinst, 1991; Zdzinski, 1992). Therefore, to equate statistically the movement and comparison groups on measures of rhythmic aptitude and music reading in the analysis of meter performance abilities, subjects' MAP scores and MAT scores served as covariates. The effects of movement-based instruction developed by Weikart on subjects' abilities to communicate duple metric structure, therefore, were examined with the covariates adjusting for differences in subjects' rhythmic aptitudes and music reading abilities.

Secondary Research Questions Analyses

Rhythmic aptitude. A secondary purpose of the study was to examine the effect of rhythmic aptitude on subjects' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments. Using subjects' standardized rhythmic aptitude scores and Gordon's suggested groupings by percentile rankings, subjects were categorized as demonstrating a high level of rhythmic aptitude, a medium level of rhythmic aptitude, or a low level of rhythmic aptitude. The null hypothesis regarding the effect of rhythmic aptitude on ability to communicate duple metric structure was tested using a one-factor ANOVA. Pattern D scores of subjects demonstrating high aptitude, medium aptitude, and low aptitude were collapsed across movement-based instruction background, and compared to determine if significant differences existed between mean Pattern D scores of the three aptitude groupings. In

addition, the researcher used an independent samples *t* test to determine if mean standardized rhythmic aptitude scores differed significantly between subjects in the movement group and the comparison group.

Meter. A further purpose of this study was to test the null hypothesis that differences in notated meter will have no significant effect on beginning instrumental music students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments. The null hypothesis was tested using a paired-difference *t* test designed to compare the mean scores of a single group of individuals who are assessed at two different times (Jaeger, 1986). Subjects' Pattern D scores were compared to their Pattern T scores, data collapsed across movement-based instruction background, to determine if significant differences existed between subjects' abilities to communicate duple metric structure and triple metric structure.

Movement-Based Instruction Background and Rhythmic Aptitude. The current research study also was designed to determine if participation in movement-based instruction developed by Weikart and rhythmic aptitude interactively affect students' abilities to communicate metric structure when reading and performing rhythm patterns using their instruments. Specifically, the researcher sought to examine the interactive effects of participation and non-participation in movement-based instruction developed by Weikart and high, medium, and low levels of rhythmic aptitude on subjects' abilities to communicate metric structure.

Subjects' Pattern D scores were subjected to a 2 (movement-based instruction background) by 3 (level of rhythmic aptitude) analysis of variance, with movement-

based instruction and level of rhythmic aptitude serving as the main effects. A 2 X 3 ANOVA procedure employs a multiple comparison technique (Glass & Hopkins, 1984); therefore, the mean Pattern D scores for subjects of each possible combination of rhythmic aptitude level and movement-based instruction background were compared with the mean Pattern D scores for subjects of every other possible combination of rhythmic aptitude level and movement-based instruction background. Subjects' MAT scores did not serve as a covariate because of the relationship between music aptitude and music achievement. According to Pedhauzer (1973), when two variables are correlated, no justification exists to control for one variable while studying the effect of the other.

CHAPTER IV

RESULTS

The principal purpose of the current study was to investigate the effects of participation and nonparticipation in movement-based instruction, developed by Phyllis S. Weikart, on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Secondary purposes of the study were to examine (a) the effect of rhythmic aptitude, (b) the effect of differences in notated meter, and (c) the interactive effects of movement-based instruction background and level of rhythmic aptitude on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments.

Beginning instrumental music students attending schools located in Colorado, Massachusetts, and Washington served as subjects for the current study. Students (n = 155) from all three sites were combined according to movement-based instruction background to form a movement group and a comparison group. Subjects in the movement group (n = 77) were beginning instrumental music students who, for a minimum of three years prior to beginning instrumental music instruction, participated in weekly music education classes taught by an Endorsed Trainer implementing principles of Weikart's *Education Through Movement: Building the Foundation* program. The comparison group (n = 82) was comprised of beginning instrumental

music students who had not participated in movement-based instruction developed by Weikart, but who had participated in the same beginning instrumental music programs as students in the movement group.

Subjects were administered the "Rhythm Imagery" test of the Musical Aptitude Profile (Gordon, 1988) and the "Aural-Visual Discrimination" rhythm subtest of the Music Achievement Test (Colwell, 1969). Subjects also completed a researcher-constructed *Student Questionnaire* from which information regarding subjects' piano experiences, dance experiences, parents' music backgrounds, ages, instruments currently played, academic achievement, and movement-based instruction backgrounds was gathered.

Meter performance testing was conducted by the researcher in the Colorado, Massachusetts, and Washington schools. The performance testing procedure involved subjects individually practicing and performing seven notated rhythm patterns which comprised the *Meter Performance Instrument*. The researcher tape-recorded subjects' performances of one specific rhythm pattern notated in duple meter, Pattern D, and the same pattern notated in triple meter, Pattern T. Subjects' abilities to communicate metric structure were determined by an adjudication procedure whereby three judges were required to discriminate aurally the meter of subjects' performances of Pattern D and Pattern T, and indicate the extent to which they could identify each performance as communicating duple or triple meter. Based on the numerical values assigned to judges' responses to each performance, each subject received a score for Pattern D and

a score for Pattern T, ranging from 0 to 6 points, and a composite score, ranging from 0 to 12 points.

Subjects' Pattern D and Pattern T scores served as measures of the dependent variables for the current study, and formed part of the statistical analysis necessary to test the null hypotheses. The dependent variables were analyzed to determine measures of central tendency, ranges, and distributions of scores, these analyses revealing a highly skewed distribution of subjects' Pattern T scores producing a violation of the assumption of normality. The analyses also revealed that the majority of subjects received low Pattern T scores; therefore, subjects demonstrated lack of abilities to communicate triple metric structure when performing rhythm pattern using their music instruments. Due to subjects' lack of abilities to communicate triple metric structure, and the highly skewed distribution of scores, subjects' Pattern T scores were subjected to limited analysis in the current study.

To control for differences in subjects' meter performance abilities due to variables identified in the literatures as contaminates, the researcher examined the relationship between subjects' Pattern D scores and their piano experiences, dance experiences, and parents' music backgrounds. The effects of formal piano experience and formal dance experience on subjects' abilities to communicate duple metric structure were examined using separate independent-samples *t* tests. The effect of parents' music background on subjects' meter performance abilities also was analyzed using a *t* test to compare Pattern D scores of subjects with the reported status of 0 and

1 parents who teach music. An ANOVA was employed to compare Pattern D scores of subjects with 0, 1, or 2 parents who reportedly play a music instrument.

The effect of participation in movement-based instruction developed by Weikart on subjects' abilities to communicate duple metric structure when performing rhythm patterns using their music instruments was determined by an analysis of covariance (ANCOVA). Subjects' performances of Pattern D were examined according to movement-based instruction backgrounds, with performance scores of subjects in the movement group compared to those of the comparison group. Subjects' standardized rhythmic aptitude scores and music reading scores served as covariates, based on the literature which identified aptitude and achievement as variables strongly related to music performance.

Subjects were categorized as demonstrating high, medium, or low levels of rhythmic aptitudes based on their standardized rhythmic aptitude scores, and the researcher examined the effect of level of rhythmic aptitude on their abilities to communicate duple metric structure. Collapsing groups across movement-based instruction background, subjects' Pattern D scores were analyzed by aptitude levels using a one-factor ANOVA. In addition, standardized rhythmic aptitude scores of subjects in the movement group versus the comparison group were compared using an independent-samples *t* test. A *t* test also was employed to determine the effect of differences in notated meter on subjects' meter performance abilities. A paired-difference *t* test compared subjects' Pattern D and Pattern T scores to determine if significant differences existed between subjects' abilities to communicate duple metric

structure and triple metric structure when reading and performing rhythm patterns using their music instruments.

Finally, the researcher determined if participation in movement-based instruction developed by Weikart and rhythmic aptitude interactively affected students' abilities to communicate metric structure when reading and performing rhythm patterns using their instruments. Specifically, the researcher examined the interactive effects of participation and non-participation in movement-based instruction developed by Weikart and high, medium, and low levels of rhythmic aptitude on subjects' meter performance abilities using a 2 X 3 analysis of variance.

Treatment of the data was conducted at the University of North Carolina at Greensboro employing procedures from the Minitab Statistical Package and Statistical Package for the Social Sciences (1990). An alpha level was set at .05 for statistical analyses.

Interrater Reliability for the Main Study

Students' abilities to communicate metric structure were determined by an adjudication procedure whereby the judges were required to aurally discriminate duple and triple meter in rhythmic patterns performed by students. Judges listened to taped recordings of the 310 performed rhythm patterns, and indicated the extent to which they were able to identify subjects' performances as communicating duple or triple meter. Judges' responses to each performed rhythm pattern then were compared to the notated meter of the pattern, and based on the extent of agreement, subjects' performances of Pattern D and Pattern T were assigned numerical values ranging from

0 to 2. Using the numerical values assigned to their responses, the means and standard deviations for each of the three judges' responses combined across all 310 performances were computed. An interrater reliability estimate of .74 was derived using Cronbach's coefficient alpha (Boyle and Radocy, 1987). Table 4 presents judges' mean scores, standard deviations, and Cronbach's coefficient alpha reliability estimate.

Table 4
Judges' Means, Standard Deviations, and Cronbach's Coefficient Alpha Reliability Estimate

Judge	Number of Patterns	Mean	*SD*	Cronbach's Coefficient of Reliability
Judge 1	310	.848	.949	.74
Judge 2	310	.722	.889	
Judge 3	310	.627	.761	

Descriptive Analysis of Dependent Variables

Subjects' performances of a rhythm pattern notated in duple meter, Pattern D, and the same rhythm pattern notated in triple meter, Pattern T, constituted the primary focus of the current study. Subjects' Pattern D scores and Pattern T scores served as measures of the dependent variables in the current study, and formed part of the statistical analysis necessary to test the null hypotheses.

Duple meter. Examination of subjects' Pattern D scores revealed a mean of 3.75, a standard deviation of 1.83, and a median of 4, as presented in Table 5.

Table 5
Mean, Standard Deviation, Median, and Range of Dependent Variables

Dependent Variable	n	Mean	*SD*	Median	Range
Pattern D	155	3.75	1.83	4	6
Pattern T	155	.63	.88	0	4

Scores assigned to subjects' performances of Pattern D ranged from the minimum performance score of 0 to the maximum performance score of 6, the maximum score signifying that a subject communicated the metric structure of Pattern D to the extent that all three judges responded "Sure D." The mean of 3.75, revealed that, on average, the subjects' performances of the rhythm pattern notated in duple meter elicited the response of "Maybe D" from the judges. Figure 5 presents the frequency distribution of subjects' Pattern D scores. The graph reveals a slightly negatively skewed distribution, with 100 subjects receiving a Pattern D score greater than the mean of 3.75, and 55 receiving a score of 3 or less.

Triple meter. Results of analysis of subjects' performances of Pattern T are presented in Table 5, as well as in Figure 6, revealing that scores ranged from the minimum performance score of 0 to only a score of 4. The mean Pattern T score of .63, and standard deviation of .88, indicates that subjects did not demonstrate abilities to communicate triple metric structure when performing rhythm patterns using

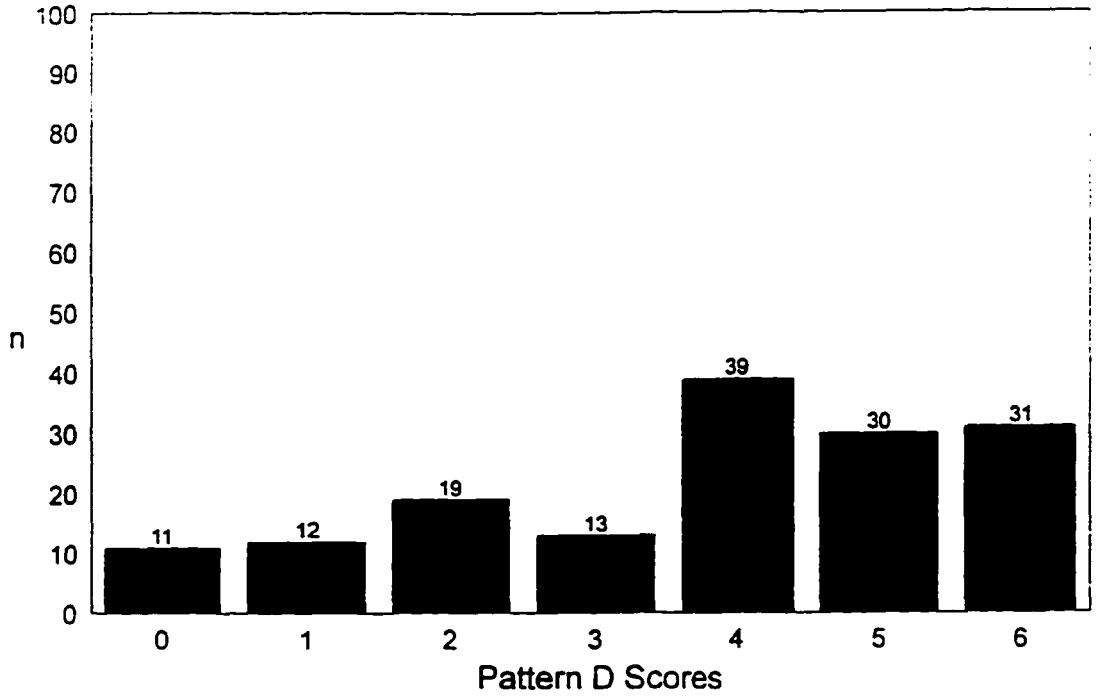

Figure 5. Distribution of Subjects' Pattern D Scores (n = 155)

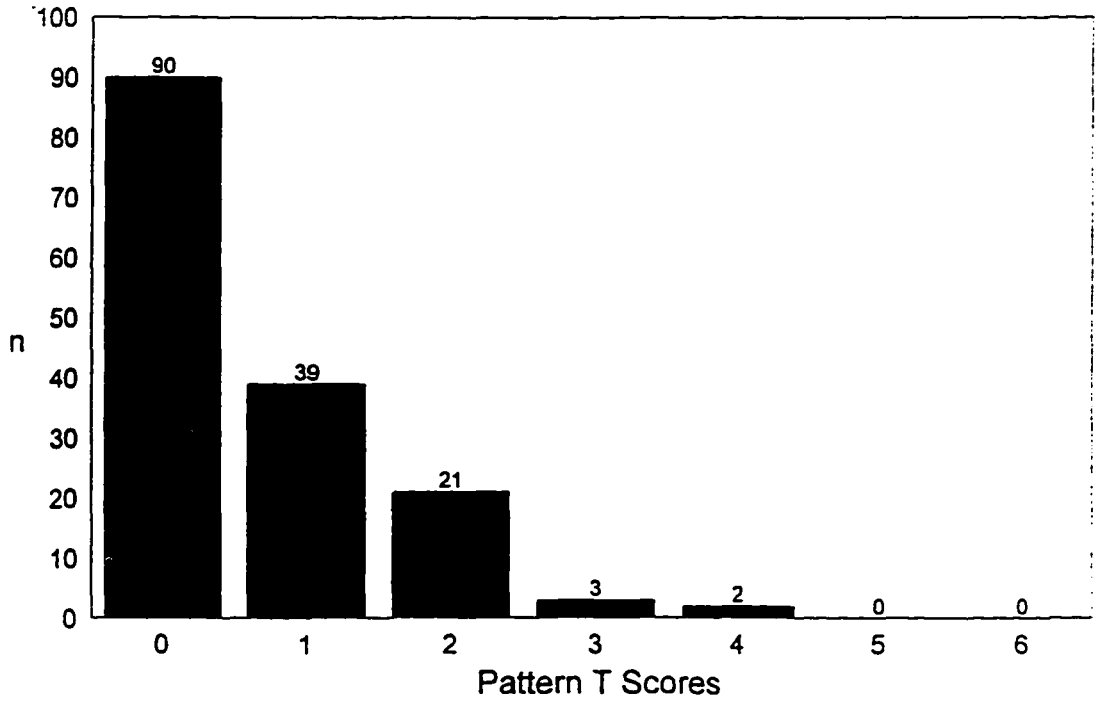

Figure 6. Distribution of Subjects' Pattern T Scores (n = 155)

their instruments. The low mean Pattern T score indicates that the judges, when listening to taped recordings of the performed rhythm patterns, were unable to identify the meter of subjects' performances of Pattern T. Also resulting in the low mean were subjects' performances of Pattern T to which judges responded "Maybe D" or "Sure D," the responses indicating that students communicated duple meter rather than the notated triple meter. The graph presented in Figure 6 clearly reveals the extremely positively skewed distribution of subjects' Pattern T scores, the distribution violating the assumption of normality essential for further analysis.

As illustrated by Figure 6, 129 of the 155 performances of Pattern T were assigned a score of only 0 or 1, revealing little variability among subjects' abilities to communicate triple metric structure. Regardless of rhythmic aptitude and movement-based instruction background, the majority of subjects (83%) demonstrated minimal abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments. Due to subjects' lack of abilities to communicate triple metric structure, and the highly skewed distribution of scores, subjects' Pattern T scores were subjected to limited analysis in the current study.

Analysis of Qualitative Variables

Data obtained from the *Student Questionnaires* provided information regarding subjects' piano experiences, dance experiences, parents' music backgrounds, and movement-based instruction backgrounds. Piano experience, dance experience, and parents' music backgrounds were variables most often identified in the literature as contaminates; therefore, to control for differences in subjects' meter performance

abilities due to these variables, the researcher examined the relationship between subjects' performances of Pattern D and their piano experiences, dance experiences, and parents' music backgrounds.

Piano experience. Meter performance data were collapsed across movement-based instruction background, and a *t* test run between Pattern D scores of subjects with at least one year of formal piano training (n = 36) and subjects with no piano experience (n = 119). Results of the *t* test revealed that subjects with at least one year of formal piano training demonstrated significantly greater abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments ($p < .05$). As presented in Table 6, the mean Pattern D score of 4.64 for subjects with piano experience was statistically greater than that of 3.48, the mean Pattern D score for subjects with no piano experience.

Table 6
Pattern D scores: t test Examining Effect of Piano Experience

Pattern	Piano Experience		No Piano Experience			
	Mean	*SD*	Mean	*SD*	*t* value	*p*
	n = 36		n = 119			
Pattern D scores	4.64	1.42	3.48	1.86	3.44	.001*

* $p < .05$

Based on results of the *t* test, the researcher determined the need to account for differences in piano experience between subjects in the movement group and comparison group. The frequency distribution presented in Chapter III (Table 3),

however, revealed that an equal number of subjects with piano experience comprised each group (n = 18), internally controlling for possible confounding effects due to piano experience. Piano experience, therefore, was not considered in further analyses.

Dance experience. Meter performance data were collapsed across movement-based instruction background, and a *t* test used to compare Pattern D scores of subjects with at least one year of formal dance training (n = 38) and subjects with no dance experience (n = 117). Results of the *t* test revealed that formal dance training, beyond that gained as a result of participating in movement-based instruction developed by Weikart, did not significantly affect subjects' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments ($p > .05$). The mean Pattern D score was 4.24 for subjects with dance experience: subjects with no dance experience received a mean Pattern D score of 3.58 (Table 7). Although approaching statistical significance, the means were not statistically different in accordance with the .05 alpha level set for analysis in the current study.

Table 7
Pattern D scores: t test Examining Effect of Dance Experience

	Dance Experience		No Dance Experience			
	Mean	*SD*	Mean	*SD*	*t* value	*p*
	n = 38		n = 117			
Pattern D scores	4.24	1.46	3.58	1.91	1.91	.058

Parents' music backgrounds. The effects of parents who teach music and parents who play music instruments on subjects' abilities to communicate duple metric structure were examined. A *t* test run on subjects' Pattern D scores, collapsed across movement-based instruction background, compared the meter performance abilities of subjects with 0 parents (n = 148) and 1 parent (n = 7) who were music teachers: no subject reported having two parents who taught music. Results of the analysis revealed no significant effect of parents who teach music on subjects' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments ($p > .05$). The difference between the mean Pattern D scores of 3.70 for subjects with 0 parents who teach music and 4.71 for subjects with 1 parents who teaches music was not statistically significant at the .05 level (Table 8).

Table 8
Pattern D scores: t test Examining Effect of Parents Who Teach Music

	0 Parents Teach Music		1 Parent Teaches Music			
	Mean	*SD*	Mean	*SD*	*t* value	*p*
	n = 148		n = 7			
Pattern D scores	3.70	1.85	4.71	1.11	1.43	.154

An ANOVA also was run on subjects' Pattern D scores, collapsed across movement-based instruction background, to compare meter performance abilities of subjects with 0 parents (n = 97), 1 parent (n = 42), or 2 parents (n = 16) who play a music instrument. Results of the analysis revealed no significant effect of parents who

play music instruments on subjects' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments ($p > .05$), the variable accounting for only .3% of variability in subjects' Pattern D scores ($R^2 = .003$). The mean Pattern D score of 3.79 for subjects with 0 parents who play an instrument, the mean Pattern D score of 3.60 for subjects with 1 parent who plays an instrument, and the mean Pattern D score of 3.88 for subjects with 2 parents who play instruments were not statistically different at the .05 level (Table 9).

Table 9
Analysis of Variance of Pattern D scores by Parent(s) Play Instruments

Source of Variance	Sum of Squares	*df*	Mean Square	*F*	*p*
Main Effects					
Parents Play	1.442	2	.721	.212	.809
Explained	1.442	2	.721	.212	.809
Residual	515.745	152	3.393		
Total	517.187	154	3.358		

Summary. Analyses of qualitative variables examined in the current study revealed that piano experience affected subjects' abilities to communicate duple metric when reading and performing rhythm patterns using their music instruments ($p < .05$). Differences in piano experience between the movement group and comparison group, however, were controlled for internally. Results of the analyses revealed that dance experience and parents' music background did not significantly affect subjects' performance abilities ($p > .05$). Therefore, data gathered from the

Student Questionnaires regarding subjects' piano experiences, dance experiences, and parents' music backgrounds were not considered during further analyses.

Main Study Data Analyses

Principal Purpose Data Analysis

The principal purpose of this study was to investigate the effect of movement-based instruction, developed by Weikart, on subjects' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Subjects' performances of a rhythm pattern notated once in duple meter, Pattern D, and once in triple meter, Pattern T, were the primary focus of the current study, with subjects' Pattern D and Pattern T scores serving as measures of the dependent variables. Analysis of these scores revealed a highly skewed distribution of subjects' Pattern T scores, as well as subjects' lack of abilities to communicate triple metric structure. Due to lack of subjects' abilities, and the violation of assumption of normality, subjects' Pattern T scores were eliminated from the primary hypotheses testing.

Movement-based instruction. The effect of movement-based instruction developed by Weikart on subjects' abilities to communicate duple metric structure was determined using an analysis of covariance (ANCOVA), with subjects' Pattern D scores serving as the dependent variable. Researchers investigating variables affecting the performance of beginning instrumental music students reported that music aptitude and music achievement both are related to music performance; therefore, subjects'

standardized rhythmic aptitude scores (MAP) and music reading scores (MAT) served as covariates. Results of the ANCOVA revealed that participation in movement-based instruction developed by Weikart did not significantly affect subjects' abilities to communicate duple metric structure when accounting for subjects' rhythmic aptitudes and music reading skills (F = 1.844; df = 3, 151; $p > .05$) (Table 10).

Table 10
Analysis of Covariance of Pattern D scores by Movement-based Instruction Background Adjusting for Rhythmic Aptitude and Music Reading Skill

Source of Variation	Sum of Squares	*df*	Mean Square	*F*	*p*
Covariates	58.579	2	29.290	9.665	.000
MAP	.001	1	.001	.000	.987
MAT	49.489	1	49.489	16.330	.000
Main Effects					
Movement	1.001	1	1.001	.330	.566
Explained	59.580	3	19.860	6.553	.000
Residual	457.607	151	3.031		
Total	517.187	154	3.358		

The adjusted mean Pattern D score of 3.75 for subjects in the movement group was not statistically different from the adjusted mean Pattern D score of 3.74 for the comparison group, results of the ANCOVA revealing that participation in movement-based instruction developed by Weikart did not significantly contribute to subjects' abilities to communicate duple metric structure. Therefore, the null hypothesis which stated that three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction will not significantly affect

beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments was retained.

Secondary Purpose Data Analyses

Secondary purposes of the study were to examine (a) the effect of rhythmic aptitude, (b) the effect of differences in notated meter, and (c) the interactive effects of movement-based instruction background and level of rhythmic aptitude on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Subjects' Pattern D and Pattern T scores served as measures of their abilities to communicate duple and triple metric structure, respectively. However, due to the highly skewed distribution of Pattern T scores, and to subjects' lack of abilities to communicate triple metric structure, subjects' Pattern T scores were subjected to limited analysis in the testing of the secondary hypotheses.

Effect of Rhythmic Aptitude

Using subjects' standardized rhythmic aptitude scores and Gordon's suggested groupings by percentile rankings, subjects were categorized as demonstrating high, medium, or low levels of rhythmic aptitude. The null hypothesis regarding effect of level of rhythmic aptitude on subjects' abilities to communicate duple metric structure, regardless of movement-based instruction background, was tested using a one-factor ANOVA. Results of the ANOVA revealed that level of rhythmic aptitude did not

significantly affect subjects' abilities to communicate duple metric structure when performing rhythm patterns using their music instruments ($F = 1.844$; $df = 2, 152$; $p > .05$) (Table 11). The variable accounted for only 2% of variability in subjects' duple meter pattern scores ($R^2 = .024$).

Table 11
Analysis of Variance of Pattern D scores by Level of Rhythmic Aptitude

Source of Variance	Sum of Squares	*df*	Mean Square	*F*	*p*
Main Effects					
Level of Aptitude	12.252	2	6.126	1.844	.162
Explained	12.252	2	6.126	1.844	.162
Resid	504.935	152	3.322		
Total	517.187	154	3.358		

The ANOVA revealed that the mean Pattern D score of 4.13 for subjects with high rhythmic aptitude, the mean Pattern D score of 3.54 for subjects with medium rhythmic aptitude, and the mean Pattern D score of 3.50 for subjects with low rhythmic aptitude were not statistically different at the .05 level. Results revealed that rhythmic aptitude did not significantly contribute to subjects' abilities to communicate duple metric structure; therefore, the null hypothesis regarding the effect of rhythmic aptitude on students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments was retained.

In addition, the researcher used an independent-samples *t* test to determine if standardized rhythmic aptitude scores differed significantly based on subjects'

movement-based instruction backgrounds. Results of the *t* test, presented in Table 12, revealed that the mean aptitude score of 105.26 for subjects in the movement group was significantly higher than the mean aptitude score of 97.99 for the comparison group ($p < .05$).

Table 12
t test Examining Rhythmic Aptitude Scores by Movement-Based Instruction Background

	n	Mean	*SD*	*t* value	*df*	*p*
Movement Group	77	105.26	12.11	3.33	153	.001*
Comparison Group	78	97.99	14.88			

*$p < .05$

Effect of Meter

An additional purpose of this study was to test the null hypothesis stating that differences in notated meter will not significantly affect beginning instrumental music students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments. To determine the effect of differences in notated meter on subjects' meter performance abilities, subjects' performances of Pattern D and performances of Pattern T were compared using a paired-difference *t* test, collapsing data across movement-based instruction background. Results of the paired-difference *t* test revealed significant differences between the mean Pattern D score of 3.75 and the mean Pattern T score of .63, subjects demonstrating significantly greater abilities to communicate duple metric structure then triple metric structure

($t = 3.33$; $df = 153$; $p < .05$). Based on results of the paired-difference t test, presented in Table 13, the null hypothesis was rejected.

Table 13
Paired-Difference t test Examining Pattern D scores and Pattern T scores

	Mean	*SD*	Mean Diff	*SD*	*t* value	*df*	*p*
Pattern D scores	3.748	1.83	3.12	1.98	19.56	154	.001*
Pattern T scores	.632	.883					

*$p < .05$

Interactive Effects of Movement-Based Instruction Background and Rhythmic Aptitude

The current research study also was designed to determine if movement-based instruction developed by Weikart and level of rhythmic aptitude interactively affect students' abilities to communicate metric structure when reading and performing rhythm patterns using their instruments. Specifically, the researcher examined the interactive effects of participation or nonparticipation in movement-based instruction developed by Weikart, and high, medium, and low levels of rhythmic aptitude on subjects' abilities to communicate metric structure. Subjects' duple meter pattern scores were subjected to a 2 (movement-based instruction background) by 3 (rhythmic aptitude) analysis of variance, with movement-based instruction background and levels of rhythmic aptitude serving as the main effects. Table 14 presents the mean Pattern D score for subjects in groups of every combination of rhythmic aptitude level and movement-based instruction background.

Table 14
Mean Pattern D scores by Movement-Based Instruction Background and Level of Rhythmic Aptitude

	Low Aptitude	Medium Aptitude	High Aptitude
Movement Group	6.00	3.48	4.06
Comparison Group	3.14	3.60	4.22

The multiple comparison procedure comparing the mean Pattern D score for subjects in groups of every combination of rhythmic aptitude level and movement-based instruction background, with the mean Pattern D score for subjects in groups of every other combination, revealed no significant differences between the mean scores of any groups ($p > .05$). Table 15 presents the results of 2 X 3 analysis of variance, indicating that participation in movement-based instruction developed by Weikart did not significantly contribute to meter communication abilities of subjects specifically demonstrating low, medium, or high levels of rhythmic aptitude. Therefore, the null hypothesis stating that participation in movement-based instruction developed by Weikart and level of rhythmic aptitude will not interactively affect beginning instrumental music students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments was retained.

Summary

Analysis of subjects' performances of Pattern D and Pattern T revealed that participation in movement-based instruction developed by Weikart did not significantly

Table 15
2 x 3 Analysis of Variance of Pattern D scores by Movement-based Instruction Background and Rhythmic Aptitude

Source of Variance	*df*	Sum of Squares	Mean Square	*F*	*p*
Main Effects	3	12.418	4.129	1.241	.297
Aptitude	2	12.414	6.207	1.861	.159
Movement	1	.166	.166	.050	.824
2-Way Interactions					
Mvt Aptitude	2	7.668	3.834	1.149	.320
Explained	5	20.085	4.017	1.204	.310
Residual	149	497.102	3.336		
Total	154	517.187	3.358		

affect beginning instrumental music students' abilities to communicate metric structure when reading and performing using their music instruments. Level of rhythmic aptitude also did not significantly affect subjects' meter performance abilities, these results contrary to previous researchers' findings of a positive effect of music aptitude on music performance. Subjects' performances of Pattern D and Pattern T were affected by differences in notated meter, with subjects demonstrating greater abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments. Judges' responses to subjects' performances of Pattern T revealed that, regardless of movement-based instruction background, subjects failed to communicate triple metric structure to the level acceptable for valid treatment in the study. When accounting for movement-based instruction background and level of rhythmic aptitude in the analyses of subjects' performance scores, no significant

interactive effects on subjects' performances of rhythm patterns notated in duple and triple meter were revealed. Overall, results of the analyses revealed that three years of participation in movement-based instruction developed by Weikart did not contribute to subjects' meter performance abilities.

CHAPTER V

SUMMARY AND CONCLUSIONS

The principal purpose of the current study was to investigate the effects of participation and nonparticipation in movement-based instruction, developed by Phyllis S. Weikart, on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Secondary purposes of the study were to examine (a) the effect of rhythmic aptitude, (b) the effect of differences in notated meter, and (c) the interactive effects of movement-based instruction background and level of rhythmic aptitude on beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments.

Hypotheses

The following null hypotheses served as the principal research objectives.

1. Three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction will not significantly affect beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments.

2. Three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction will not significantly affect beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments.

The following null hypotheses served as the secondary research objectives.

1. Level of rhythmic aptitude will not significantly affect beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments.

2. Level of rhythmic aptitude will not significantly affect beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments.

3. Differences in notated meter will not significantly affect beginning instrumental music students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments.

4. Participation in movement-based instruction developed by Weikart and level of rhythmic aptitude will not interactively affect beginning instrumental music students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments.

5. Participation in movement-based instruction developed by Weikart and level of rhythmic aptitude will not interactively affect beginning instrumental music students' abilities to communicate triple metric structure when reading and performing rhythm patterns using their music instruments.

Summary

Beginning instrumental music students attending schools located in Colorado, Massachusetts, and Washington served as subjects for the current study. Students (n = 155) from all three sites were combined according to movement-based instruction background to form a movement group and a comparison group. Subjects in the movement group (n = 77) were beginning instrumental music students who, for a minimum of three years prior to beginning instrumental music instruction, participated

in weekly general music classes taught by an Endorsed Trainer implementing principles of Weikart's *Education Through Movement: Building the Foundation* program. The comparison group (n = 82) was comprised of beginning instrumental music students who had not participated in movement-based instruction developed by Weikart, but who had participated in the same beginning instrumental music programs as students in the movement-based instruction group.

Subjects were administered the "Rhythm Imagery" test of the Musical Aptitude Profile (Gordon, 1988) and the "Aural-Visual Discrimination" rhythm subtest of the Music Achievement Test (Colwell, 1969). Subjects also completed a researcher-constructed *Student Questionnaire* from which information regarding subjects' piano experiences, dance experiences, parents' music backgrounds, ages, instruments currently played, academic achievements, and movement-based instruction backgrounds was gathered.

Meter performance testing was conducted by the researcher in the Colorado, Massachusetts, and Washington schools. The performance testing procedure involved subjects individually practicing and performing seven notated rhythm patterns which comprised the *Meter Performance Instrument*. The researcher tape-recorded subjects' performances of one specific rhythm pattern notated in duple meter, Pattern D, and the same pattern notated in triple meter, Pattern T. Subjects' abilities to communicate metric structure were determined by an adjudication procedure whereby three judges were required to discriminate aurally the meter of subjects' performances of Pattern D and Pattern T, and indicate the extent to which they could identify each performance

as communicating duple or triple meter. Based on the numerical values assigned to judges' responses to each performance, each subject received a score for Pattern D and a score for Pattern T, ranging from 0 to 6 points, and a composite score, ranging from 0 to 12 points.

The mean score for subjects' performances of Pattern D was 3.75: the mean score for performances of Pattern T was .63. The distribution of subjects' Pattern D scores was slightly negatively skewed; however, the distribution of Pattern T scores was extremely positively skewed, with 83% of subjects receiving a Pattern T score of 0 or 1. Due to the highly skewed distribution of scores and resultant violation of assumption of normality, and subjects' lack of abilities to communicate triple metric structure, analysis of subjects' Pattern T scores in the current study was limited.

Analysis of qualitative variables identified in the literature as contaminates revealed that piano experience was related to subjects' abilities to communicate duple metric structure when performing rhythm patterns using their music instruments ($p < .05$). However, the movement and comparison groups contained an equal number of subjects with at least one year of formal piano training; therefore, differences in piano experiences between groups were controlled for internally. Dance experience and parents' music backgrounds did not significantly affect subjects' performance abilities ($p > .05$); therefore, data gathered from the *Student Questionnaires* were not considered in further analyses.

The primary null hypothesis was tested using an analysis of covariance (ANCOVA), with subjects' MAP and MAT scores serving as covariates. Movement-

based instruction backgrounds did not significantly affect subjects' performances of Pattern D ($p > .05$); therefore the null hypothesis regarding the effect of participation in movement-based instruction developed by Weikart on students' abilities to communicate duple metric structure when reading and performing rhythm patterns using their music instruments was retained. As determined by an analysis of variance (ANOVA), rhythmic aptitude also did not significantly affect subjects' abilities to communicate duple metric structure ($p > .05$); therefore, the null hypothesis regarding the effect of level of rhythmic aptitude on students' meter performance abilities also was retained. Subjects' standardized rhythmic aptitude scores were compared using a *t* test, results revealing that subjects in the movement group scored significantly higher on the measure of rhythmic aptitude than subjects in the comparison group ($p < .05$).

Subjects' performances of Pattern D and Pattern T were compared using a paired-difference *t* test, results revealing a significant difference between subjects' abilities to communicate duple metric structure and triple metric structure ($p < .05$). The mean Pattern D score of 3.75, compared to the mean Pattern T score of .63, revealed that subjects demonstrated greater abilities to communicate duple metric structure. The null hypothesis regarding the effect of differences in notated meter on students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments, therefore, was rejected. However, the null hypothesis related to the interactive effects of movement-based instruction background and level of rhythmic aptitude on students' abilities to communicate duple

metric structure was retained, as determined by a 2 (movement-based instruction background) by 3 (rhythmic aptitude grouping) analysis of variance ($p > .05$).

Conclusions

Main Research Purpose

Music educators have advocated the natural relationship between music and movement in the development of students' rhythmic behaviors; however, research findings do not uniformly support the efficacy of movement-based instruction in the development of rhythmic performance abilities. Wight (1937) and Boyle (1970) concluded that rhythmic performance abilities are subject to improvement through movement training. Douglass (1977), however, reported no significant effects of rhythmic movement training on subjects' rhythmic perception abilities, physical responses to rhythm, sight-reading abilities, or rhythmic performances. The principal purpose of the current study was to investigate the effects of participation and nonparticipation in movement-based instruction, developed by Weikart, on beginning instrumental music students' rhythmic performance. Specifically, the researcher examined students' abilities to communicate duple and triple metric structure when reading and performing rhythm patterns using their music instruments. Results of the study revealed no significant effect of movement-based instruction on students' performance abilities; the researcher, thereby, concluded that three years of participation in movement-based instruction developed by Weikart did not significantly affect students' abilities to communicate metric structure when performing rhythm patterns using their music instruments. Although this study satisfies the primary

research objective, the results supported the need for additional research regarding the lack of significant differences between performances of students in the movement group and students in the comparison group. The following discussion reflects the researcher's further consideration of the results.

Confirmed by the Endorsed Trainers involved in the current study, students serving as subjects for the movement group had participated in "purposeful movement activities" based on principles proposed in Weikart's' *Education Through Movement* program. Endorsed Trainers at each of the three testing sites visited by the researcher reported that students, while in their elementary music classes, had experienced moving and responding to music in duple and triple meter, dancing and singing in duple and triple meter, and aurally recognizing and identifying music as duple or triple meter. All students in the movement group received this instruction from an Endorsed Trainer on a weekly basis for a minimum of three years prior to the current study. These same students, however, demonstrated no significant differences in their abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments as compared to students who had not received movement-based instruction developed by Weikart.

According to the skill-learning sequence proposed by Gordon (1986), the skill of reading and performing music notation in duple and triple meter comprised of familiar rhythm patterns is one of the most advanced skills students can exhibit. As discussed in Chapter I, Gordon's skill-learning sequence was designed to develop awareness of, and sensitivity to metric structure by engaging students in (a) perceiving

and performing music without notation in duple and triple meter including singing, chanting, and moving rhythmically to what is heard, (b) associating the labels of duple and triple with music which is heard and performed without notation, (c) recognizing and identifying duple and triple meter in familiar music, and (d) reading and writing music in duple and triple meter comprised of familiar rhythm patterns. As presented in the skill-learning sequence, only after students can perceive and perform music in duple and triple meter without notation should the notation of familiar rhythm patterns in duple and triple meter be introduced. Traditional beginning band classes, however, generally focus on the immediate development of students' abilities to read and perform notation in duple and triple meter. In addition, the concepts of meter and meter signature typically are presented in a theoretical and mathematical framework, which Gordon maintained should be introduced only after all lower level skills are developed.

Students serving as subjects for the current study received traditional instructional approaches to beginning instrumental music: no students participated in movement-based instruction developed by Weikart taught by an Endorsed Trainer as part of their beginning instrumental music instruction. Students, whose elementary general music classes included movement-based instruction developed by Weikart, participated in activities which involved responding and purposefully moving to music in duple and triple meter, as well as singing, chanting, and dancing in duple and triple meter. These same students then participated in traditional beginning band classes which emphasized the reading of music notation, and an understanding of meter and

meter signature not developed through purposeful movement. This transition from the elementary music classroom and Endorsed Trainer to a beginning instrumental music program and traditional band director, therefore, may have resulted in students "skipping" levels of the skill-learning sequence as proposed by Gordon. Students may have progressed from moving and responding to music in duple and triple meter to reading and performing music notation in duple and triple meter, without adequate development of intermediate performance skills for which the foundation had been developed in the elementary music classroom.

According to Gordon's skill-learning sequence, students initially must develop intermediate skills of performing rhythm patterns and familiar songs in duple and triple meter without notation before notation is introduced. As mentioned previously, developing students' abilities to read notation typically is the first objective within the traditional beginning band program; therefore, the lack of adequate experiences performing music in duple and triple meter without reading notation may have denied students in the movement group the opportunity to transfer their movement experiences in duple and triple to the symbolic notation. Of major consideration is the possibility that students who had participated in movement-based music instruction possessed the abilities to move and perform in duple and triple meter; however, due to lack of pre-notation experiences performing music in duple and triple using their music instruments, they failed to transfer the feeling of duple and triple to the symbolic notation. Additionally, the possibility exists that students developed movement and performance abilities as a result of their elementary music instruction; however, this

same music instruction did not develop students' abilities to transfer purposeful movement experiences in duple and triple meter to symbolic music notation through music reading activities. The researcher of this study, therefore, hypothesized that the connection between purposeful movement in duple and triple meter and the production and communication of duple and triple metric structure when reading and performing rhythm patterns using their music instruments had not been realized by students in the movement group. Thus, participation in movement-based instruction developed by Weikart did not significantly affect these students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments.

The current study was limited to investigating the effect of participation in movement-based instruction developed by Weikart on the skill of reading and performing music in duple and triple meter, which is a high level skill in Gordon's skill-learning sequence. Researchers (Massette, 1995; High, 1987), however, have found that even casual implementation of Weikart's methods and materials for developing lower level rhythmic skills produced positive results. In particular, Price (1996) reported that results from the meter recognition subtest of the Music Achievement Test (Colwell, 1969) favored the Weikart approach over a traditional general music class instructional approach. Recognizing and identifying meter is a skill level identified in Gordon's skill-learning sequence; therefore, findings by Price suggest that participation in movement-based instruction developed by Weikart positively affects students' development of skills which Gordon identified as prerequisites for reading and performing music notation. Further research, therefore, is

needed to examine the transfer of students' "purposeful movement experiences" in duple and triple meter to meter performance skills across all levels of Gordon's skill-learning sequence. Specifically, such research may provide a better understanding of the effects of movement-based instruction developed by Weikart on the development of students' meter perception and performance abilities.

Secondary Research Purposes

Rhythmic Aptitude. A secondary purpose of the current study was to examine the effect of level of rhythmic aptitude on students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments. Based on their standardized rhythmic aptitude scores, subjects were classified as high aptitude, medium aptitude, or low aptitude, and their Pattern D scores analyzed. No significant differences in subjects' Pattern D scores were found between students demonstrating low, medium, or high levels of rhythmic aptitude; therefore, the researcher concluded that aptitude did not affect subjects' abilities to communicate metric structure when performing rhythm patterns. This finding does not support previous research in which strong, positive effects of musical aptitude on music performance were found (Klinedinst, 1991; Zdzinksi, 1992).

Although level of rhythmic aptitude was not found to affect students' meter performance abilities, differences were found in the proportion of students in the movement group categorized as demonstrating high or low aptitudes, and the proportion of students in the comparison group categorized as demonstrating high or low aptitudes. Table 2 (Chapter III) indicates that of the 77 students in the movement

group, 32 students or 42% demonstrated high aptitude: only 23 students, or 29% of the 78 students comprising the comparison group demonstrated high aptitude. Conversely, only 1 student in the movement group was categorized as low aptitude: 7 students in the comparison group were categorized as low aptitude. Although not related directly to a research question posed in the current the study, the difference in proportions, as well as the significant difference in mean standardized rhythm aptitude scores between the movement group (mean = 105) and comparison group (mean = 97), did warrant further attention by the researcher.

According to Weikart, the basis of the *Education Through Movement: Building the Foundation* program, and the reason for the educational approach, is to build the child's physical movement foundation, essential in its own right for physical development as well as for supporting concept development in other curricular areas (Weikart and Carlton, 1995). The fundamental abilities stressed in *Education Through Movement*: *Building the Foundation* are contained in nine key movement experiences which provide a framework for developing each child's potential in the physical, cognitive, social, and artistic areas of living (Weikart, 1996). Aptitude is defined as the measure of a child's potential to learn (Gordon, 1989); therefore, musical aptitude is a measure of each child's potential in one specific artistic area, namely music. As stated by Weikart, *Education Through Movement* provides a framework for developing each child's potential; therefore, students who receive instruction from a teacher actively implementing principles of *Education Through Movement* participate in

activities designed to develop their artistic potential, as well as their physical, cognitive, and social potential.

Students in the movement-based instruction group received three years of movement-based instruction taught by an Endorsed Trainer actively implementing the principles of *Education Through Movement*. These students participated in activities designed to develop their potential; therefore, students' increased rhythmic aptitudes (their increased potential to learn about and demonstrate rhythmic behaviors) may be a reflection of their participation in movement-based instruction developed by Weikart. Students' participation in movement-based instruction taught by an Endorsed Trainer implementing the principles of *Education Through Movement* was exclusively the result of attending elementary schools in which Endorsed Trainers served as general music teachers (i.e., students attended schools according to school system location policies, and teachers were assigned to schools for reasons other than Endorsed Trainer qualifications). According to information gathered from individuals at each site, schools in which Endorsed Trainers were employed were representative of all other elementary schools in the respective school district with regard to students' cultural and socio-economic backgrounds, as well as academic, athletic, and music opportunities. Elementary schools belonging to the respective school districts visited by the researcher differed only by the presence or absence of an Endorsed Trainer and movement-based music instruction. Students' attendance at particular elementary schools within the school districts was based solely on the location of their homes within a district.

Examining the possible relationship between movement-based instruction developed by Weikart and increased rhythmic aptitude was not within the scope of the current study. A positive relationship, however, would support the incorporation of the principles of *Education Through Movement: Building the Foundation* into the preschool and elementary classroom as a means of developing students' rhythmic abilities. Further research, however, is necessary to determine the extent to which participation in movement-based instruction designed to develop each child's potential contributed to the high level of rhythmic aptitudes demonstrated by students in the movement group.

Meter. Successful musical performance depends on communication of rhythmic information to a listener (Cone, 1968). This rhythmic information necessarily includes metric structure, which a performer must communicate by performing accented and unaccented beats so that regularly recurring groupings of these beats are detectable by the listener (Jones, 1993). Clarke and Windsor (1992) stated that it does not matter how these metric accents and groupings are established, but only that they are established in a musical performance.

Results of the current study indicate that beginning instrumental music students failed to establish and communicate triple metric structure, and communicated duple metric structure with only limited success. Students' mean Pattern D score of 3.75 out of 6 possible points indicates that students' performances of Pattern D averaged a response of "Maybe Duple." Judges' responses to students' performances suggest that students did communicate duple metric structure, but not of a magnitude that the

judges were certain of delineating the meter being performed. The extremely low mean score of .63 for subjects' performances of Pattern T revealed that students did not communicate triple metric structure to the extent that judges could identify the meter of the performances. The communication of rhythmic information, including metric structure, is identified in the literature as one criterion of a successful musical performance. Therefore, based on this criterion, only a small minority of the students' 310 performances of a rhythm pattern, which served as the focus of this study, were "successful musical performances."

Students serving as subjects for the current study failed to communicate triple metric structure when reading and performing rhythm patterns using their music instruments. All students, however, had experience with reading and performing music in triple meter prior to participating in the study. Also, students in the movement group had experienced triple meter through purposeful movement activities such as international folk dance. Further evidence of students' experiences with triple meter was obtained during the researcher's visit to one particular test site. During the course of the two-day visit, the researcher observed the Endorsed Trainer's elementary classroom music students dancing to music in triple meter, as well as performing music in triple meter, without notation, on Orff instruments. The researcher noted that these students in the elementary music classes were able to perform music in triple meter without the aid of the Endorsed Trainer, demonstrating their abilities to independently feel, perform, and communicate triple metric structure.

Students in the movement group, who received elementary music instruction from the Endorsed Trainer referenced in the discussion above, also had experienced triple meter through the same purposeful movement and performance activities for the three years immediately preceding their beginning instrumental music instruction. Beginning instrumental music students were selected as subjects for this study specifically because of the close proximity between their movement-based general music instruction and traditional instrumental music instruction. Students of the other two Endorsed Trainers involved in the study also experienced triple meter through similar purposeful movement experiences; therefore, students' lack of abilities to communicate triple metric structure when reading and performing rhythm patterns cannot be attributed simply to lack of adequate "triple meter" music experiences. Rather, the researcher again concluded students' lack of abilities to communicate triple metric structure when using their music instruments reflects their failure to transfer purposeful movement experiences in triple meter to symbolic notation in triple meter.

Interactive Effects. Finally, the research was designed to investigate the interactive effects of rhythmic aptitude and movement-based instruction background on students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments. Results of the analysis revealed no significant differences in students' abilities to communicate duple metric structure when considering both students' level of rhythmic aptitudes and movement-based instruction backgrounds. Thus, the researcher concluded that students in the movement and comparison groups possessing high, medium, or low level of rhythmic

aptitude demonstrated similar abilities to communicate metric structure when reading and performing rhythm patterns using their music instrument.

Summary of Results and Conclusions

Movement-based instruction. Three years of participation in movement-based instruction, developed by Weikart, prior to beginning instrumental music instruction did not significantly affect students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments ($p > .05$). Students serving as subjects for the movement group had experienced duple and triple metric structure through purposeful movement activities, including moving and responding to music in duple and triple meter, dancing and singing in duple and triple meter, and recognizing and identifying music as duple or triple meter. However, these students did not necessarily experience reading and performing music notation in duple and triple meter as part of their elementary music instruction. These same students then participated in traditional beginning band classes which emphasized the reading of music notation, and an understanding of meter and meter signature not developed through purposeful movement. This transition from the elementary music classroom with an Endorsed Trainer to a traditional beginning instrumental music program, therefore, may have resulted in students' failure to transfer their movement experiences in duple and triple to the symbolic notation of the rhythm patterns. The researcher of this study, therefore, hypothesized that the connection between purposeful movement in duple and triple meter and the production and communication of duple and triple

metric structure when reading and performing rhythm patterns had not been realized by students in the movement group.

Rhythmic aptitude. Level of rhythmic aptitude did not significantly affect students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments ($p > .05$). Although contrary to previous research findings, students categorized as demonstrating high, medium, or low levels of rhythmic aptitude demonstrated similar meter performance abilities. Students in the movement and comparison groups, however, did differ significantly on measures of standardized rhythmic aptitude ($p < .05$), with results favoring students who participated in movement-based instruction developed by Weikart.

According to Weikart, the fundamental abilities stressed in *Education Through Movement: Building the Foundation* program provide a framework for developing each child's potential in the physical, cognitive, social, and artistic areas of living. Students in the movement group received three years of movement-based instruction taught by an Endorsed Trainer implementing the principles of *Education Through Movement.* These students participated in activities designed to develop their artistic and physical potential; therefore, students' increased rhythmic aptitudes, i.e., their increased potential to learn about and demonstrate rhythmic behaviors, may be a reflection of their participation in movement-based instruction founded on principles of Weikart's *Education Through Movement.*

Meter. Differences in notated meters did affect students' meter performance abilities, with students demonstrating a significantly greater ability to communicate

duple metric structure than triple metric structure when performing rhythm patterns using their music instruments ($p < .05$). The mean Pattern D score of 3.75 revealed that students communicated duple metric structure with limited success, whereas the very low mean Pattern T score of .63 indicated that students failed to establish and communicate triple metric structure. The communication of metric structure is identified in the literature as one criterion of a successful musical performance. Therefore, based on this criterion, a minority of the students' 310 performances of a rhythm pattern serving as the focus of this study were "successful musical performances."

Interactive effects. There were no significant interactive effects of participation in movement-based instruction developed by Weikart and level of rhythmic aptitude on students' abilities to communicate metric structure when reading and performing rhythm patterns using their music instruments ($p > .05$). Thus, the researcher concluded that the abilities of students possessing high, medium, or low levels of rhythmic aptitudes to communicate metric structure when reading and performing rhythm patterns using their music instruments were not significantly affected by movement-based instruction background.

Recommendations for Future Research

The published empirical research on performers' abilities to communicate the metric structure of music is minimal: no published research on the abilities of beginning instrumental music students to communicate metric structure when performing using their music instruments exists. Beginning instrumental music

students served as subjects for the current study, and, of practical concern to instrumental music educators, are these students' demonstrated lack of abilities to communicate triple metric structure when playing their music instruments. The metric grouping of one accented beat followed by two unaccented beats is basic in music performance, and the communication of this metric information essential for successful music performance. Therefore, within judges' responses to students' performances of a rhythm pattern notated in triple meter lies an implied failure of students to produce successful music performances. Due to the lack of research investigating beginning instrumental music students' abilities to perform and communicate metric structure, further research is needed to confirm the findings of the current study.

Additional research also must be conducted to determine factors which account for beginning instrumental music students' abilities to communicate duple and triple metric structure when reading and performing music notation. Results of the current research indicate that subjects for this study communicated the metric structure of rhythm patterns with minimal success; therefore, the addition of a melodic element to the rhythm patterns may produce information regarding the role of melody in students' meter performance abilities. In this study, subjects' abilities to communicate metric structure were evaluated by their performances of rhythm patterns using their music instruments. These performances involved not only the reading of rhythm notation, but the physical demands necessary to play a music instrument such as breath support, embouchure formation, tone production, and hand position. Therefore, research investigating students' meter performance abilities when students chant or sing notated

rhythm patterns may reveal that the physical demands of instrumental performance influence students' communication of metric structure. Finally, longitudinal research studies may reveal the role of musical maturation and instrumental music performance experience on students' meter performance abilities, as well as reveal long-term effects of movement-based music instruction on those performance abilities.

Further research is needed to examine the effect of movement-based instruction developed by Weikart on the development of students' meter performance abilities across all skill levels of Gordon's skill-learning sequence. The current study was limited to examining the effect of movement-based instruction on students' abilities to read and perform music in duple and triple meter comprised of familiar rhythm patterns, a high level skill in the learning sequence. Although results of the current study revealed no significant effects of movement-based instruction developed by Weikart on subjects' meter performance abilities, a study by Price (1996) revealed that folk dance movement instruction developed by Weikart positively affected students' meter recognition abilities. Results of Price's study indicate that participation in movement-based instruction developed by Weikart positively affects students' perception of metric structure; therefore, additional research examining students' abilities across all skill levels of the learning sequence is needed to provide a better understanding of the effect of movement-based instruction developed by Weikart on the development of students' meter performance abilities.

Finally, students in the movement group demonstrated significantly greater rhythmic aptitudes as measured by MAP than students in the comparison group.

Students' increased potential to learn about and demonstrate rhythmic behaviors may be a reflection of their participation in movement-based instruction founded on principles of Weikart's *Education Through Movement.* A positive relationship between movement-based instruction developed by Weikart and increased rhythmic aptitude would support the incorporation of the principles of *Education Through Movement: Building the Foundation* into the preschool and elementary classroom as a means of developing students' rhythmic abilities. Further research, however, is necessary to determine the extent to which participation in movement-based instruction designed to develop each child's potential contributed to the high level of rhythmic aptitudes demonstrated by students in the movement group.

In conclusion, research examining factors which account for beginning instrumental students' abilities to communicate duple and triple metric structure, as well as research examining the effect of movement-based instruction developed by Weikart on students' meter performance abilities, should be considered essential by instrumental music educators. This study, in which students representing three beginning instrumental music programs across the country participated, revealed that traditional beginning instrumental instructional approaches did not develop the abilities of these students, at a beginning level of instrument performance, to communicate metric structure when performing rhythmic notation. Therefore, the efficacy of approaches to music education including Weikart's *Education Through Movement* must continue to be examined. Additional studies examining the effects of movement-based instruction developed by Weikart on students' rhythmic behaviors should include larger

samples of students randomly selected from representative music programs implementing movement-based instruction developed by Weikart. Of greatest consequence for music educators may be the potential positive relationship between rhythmic aptitude and participation in movement-based instruction developed by Weikart. Aptitude is a measure of a child's potential to learn; therefore, the role of *Education Through Movement* in developing and increasing each child's potential to learn rhythmic skills and behaviors must continue to be examined.

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APPENDIX A

STAGES OF MOVEMENT
KEY EXPERIENCE: *ACTING UPON MOVEMENT DIRECTIONS*

STAGES OF MOVEMENT
(Weikart & Carlton, 1995, p. 74)

Stage 1: SINGLE SYMMETRICAL MOVEMENTS: corresponding body parts do single movement ending in the same place and pause for learner response.

Stage 2: SINGLE ALTERNATING MOVEMENTS: one body part moves, learners respond: corresponding body part does identical movement, learners respond.

Stage 3: SINGLE ASYMMETRICAL MOVEMENTS: corresponding body parts do different movement at the same time and pause for learner response.

Stage 4: SINGLE ALTERNATING ASYMMETRICAL MOVEMENTS: one body part moves, learners respond; corresponding body part moves to different location, learners respond. When body parts begin from different positions, there is "correctness" by placement of body parts, not by right/left or mirroring or reversal.

Stage 5: SEQUENCED SYMMETRICAL MOVEMENTS: two Stage 1 movements are sequenced before learners respond.

Stage 6: RIGHT/LEFT IDENTIFICATION (AURAL PROCESSING) AND MIRRORING (VISUAL PROCESSING): learners respond to leader's verbal directions for right or left, and learners use mirror image of side leader is using as they face leader.

Stage 7: RIGHT/LEFT REVERSAL (VISUAL PROCESSING): learners use what looks like reverse of side leader is using as they face leader.

APPENDIX B

INTEGRATED MOVEMENT SEQUENCE PROGRESSING FROM SIMPLE TO COMPLEX
KEY EXPERIENCE: *MOVING IN INTEGRATED WAYS*

INTEGRATED MOVEMENT SEQUENCE
(Weikart & Carlton, 1995, pp. 128-130)

1. Single recurring movements that repeat over and over in the same way in both the arms and legs (e.g., arms flap and heels bounce).

2. Single alternating movements in the legs (e.g., jogging) with single recurring movements in both arms (e.g., pushing).

3. Single alternating movements in the arms and legs, using same-side integration (ipsilateral movement--right arm and right leg). Contralateral movement (right arm and left leg) is more difficult.

4. Sequenced recurring movements of both legs, with single recurring movements of the arms (e.g., feet going apart and together while both hands shake in front of the body).

5. Sequenced recurring movements of both arms and legs (e.g., heels go out and in while bent arms go up and down). Arms working in the same plane as the legs is easier than arms working in a different plane (e.g., feet going apart, together sideward while arms straighten and bend in front of the body).

6. Sequenced alternating movements of the legs with single recurring movements of the arms (e.g,. legs do KICK, STEP, KICK, STEP while arms PUSH, PUSH, PUSH, PUSH).

7. Sequenced alternating movements of the legs with sequenced recurring movements of the arms (e.g., legs do HEEL, STEP, HEEL, STEP while both arms do UP, DOWN, UP, DOWN).

8. Sequenced alternating movements of the legs with sequenced alternating movements of the arms (e.g., legs do UP, STEP, UP, STEP while each arm follows the plane of the leg in going up and down). Arm and leg on the same side working together (ipsilateral movement) is easier than arm and leg on opposite sides working together (contralateral movement). It would be even more difficult for arms to work in a different plane than the legs are moving in.

APPENDIX C

GUIDELINES FOR DEVELOPING BASIC TIMING KEY EXPERIENCE: *FEELING AND EXPRESSING STEADY BEAT*

GUIDELINES FOR DEVELOPING BASIC TIMING
(Weikart & Carlton, 1995, p. 183)

Grade	Timing
Preschool and K	Nonlocomotor movement in macrobeat Locomotor movement in microbeat
Grade 1	Nonlocomotor movement in macrobeat and microbeat Locomotor movement in microbeat
Grade 2	Nonlocomotor movement in macrobeat and microbeat Locomotor movement in microbeat and macrobeat
Grade 3	Extending timing to all learning areas, which includes singing and moving, performing accurate rhythm patterns, and integrating movement sequences from a solid foundation in steady beat.

APPENDIX D

LEVELS OF BEAT COORDINATION
KEY EXPERIENCE: *MOVING IN SEQUENCES TO A COMMON BEAT*

LEVELS OF BEAT COORDINATION
(Weikart & Carlton, 1995, pp. 190-201)

Level I: SINGLE MOVEMENT: students use the same single movement in repetition, using both sides of the body simultaneously.

Level II: SINGLE ALTERNATING MOVEMENTS: students perform a single movement on one side of the body and then repeat the same movement with the corresponding body part. This single-alternating-movement pattern continues.

Level III: SEQUENCED MOVEMENTS: students combine two single movements into a two-movement sequence. They move two corresponding body parts to one location and then move them to a different location.

Level IV: SEQUENCED MOVEMENTS COMBINED: both sides of the body perform four movements--two sequences of two movements, each, or one side of the body at time performs two sequences of two movement, repeating the sequence at least four times before the other side begins.

Level V: SEQUENCED ALTERNATING MOVEMENTS: students perform a two-movement sequence on one side of the body before repeating the same sequence on the other side of the body. The side that is inactive must hold still until the opposite side completes the sequence once.

Level VI: SEQUENCED ALTERNATING MOVEMENTS COMBINED: students complete a four-movement sequence on one side of the body before repeating the same four-movement sequence on the other side.

APPENDIX E

GUIDELINES FOR SIMPLIFYING AND JUDGING DIFFICULTY OF MOVEMENT TASKS

GUIDELINES FOR SIMPLIFYING AND JUDGING DIFFICULTY OF MOVEMENT TASKS
(Weikart & Carlton, 1995, pp. 35-38)

1. Static movement (movement that pauses) is simpler to follow than dynamic movement (continuous movement).

2. Movements that have endpoints against the body are easier to perceive than movements with endpoints away from the body.

3. Movement of the upper body generally are easier to perform than the weight-bearing movements of the lower body.

4. Trunk movement is easier than limb movement, which is easier than finger or toe movement.

5. Gross-motor movements are easier than fine-motor movements.

6. Nonlocomotor movement (movement with the body anchored, without weight transfer) is generally easier to coordinate than locomotor movements (movement with the body not anchored, with foot patterns and weight transfer). Integrating (combining) nonlocomotor and locomotor movement is the most difficult of all.

7. Movement without an object is easier than movement with an object.

8. Symmetrical movement (the same movement done by corresponding body parts) is easier than asymmetrical movement (different movements done by corresponding body parts).

9. Two hands, arms, or legs doing nonlocomotor movements at the same time is easier than one side moving alone.

10. Nonlocomotor movement of two sides of the body together, or of one side alone, is easier than alternating nonlocomotor movement.

11. In locomotor movement, alternating is the easiest, followed by two sides moving together, followed by one side moving alone.

12. Single movements are easier than sequenced movements.

13. Personal space (the area immediately around a person) is easier to manage than general space (the total movement area that is available).

14. Performing movement alone without a specified external beat is easier than performing movement alone with a specified external beat. Movement performed alone, according to one's own timing, is easier than movement synchronized with a partner or group.

15. Performing nonlocomotor movement to a slower beat is generally easier than performing nonlocomotor movement to a faster beat.

16. Locomotor movement is usually more successful when performed to a beat that is close to one's internal timing rather than to a beat that is faster or slower than one's internal timing.

APPENDIX F

STUDENT QUESTIONNAIRE

STUDENT QUESTIONNAIRE

Please read each question and statement carefully.
Circle YES or NO to indicate if the statement does or does not describe you. Also, fill in the blank for each statement which requires a response.
** All of your answers will be confidential **

Name _____ Grade _____

Instrument _____ Age _____

1.	I have taken piano lessons for at least one year.	YES	NO
2.	I am taking piano lessons this year.	YES	NO
3.	One of my parents is a music teacher.	YES	NO
4.	Both of my parents are music teachers.	YES	NO
5.	My mother plays a musical instrument.	YES	NO
6.	My father plays a musical instrument.	YES	NO
7.	I have taken dance lessons for at least one year.	YES	NO
8.	I am taking dance lessons this year.	YES	NO

Please list any classes/activities in which you have performed movements to music that were led by a teacher.

_____

9. (Endorsed Trainer) was my elementary music teacher. YES NO

If question #9 was YES, circle each grade in which she was your teacher.
Kindergarten 1st 2nd 3rd 4th 5th

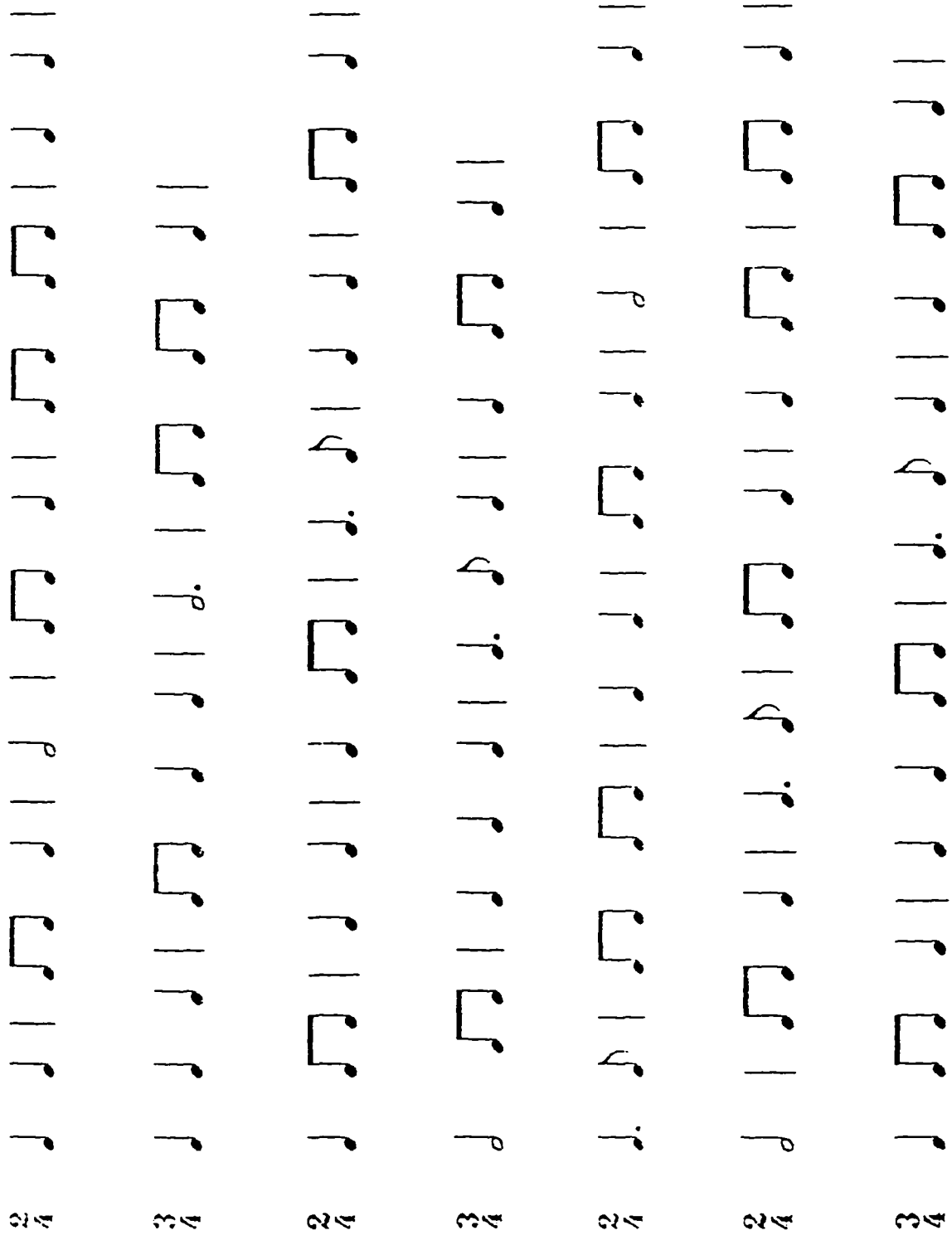
10. The grades on my report card this year for ALL classes are mostly (circle one):
[A] [A and B] [B] [B and C] [C] [C and lower]

APPENDIX G

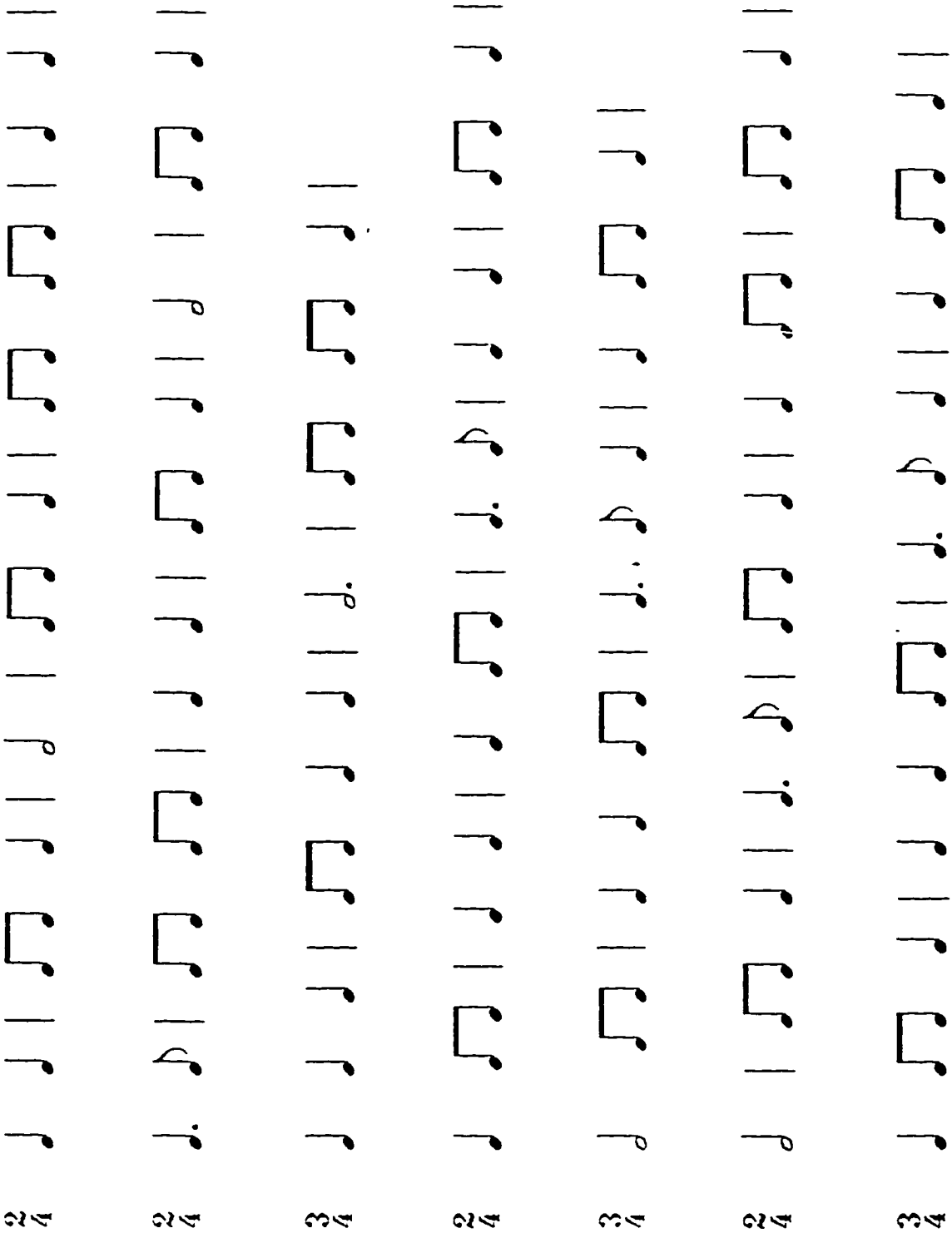
METER PERFORMANCE INSTRUMENT

Form A
Form B
Form C

Form A



Form B



Form C

APPENDIX H

PERFORMANCE ASSESSMENT INSTRUMENT

PERFORMANCE ASSESSMENT INSTRUMENT

Please read the following directions carefully.

After listening to each performance, fill in the announced pattern identification number, and decide whether you think the performance to be in duple meter (D) or triple meter (T). If you are sure it was in duple meter, circle the response "Sure D." If you are not sure, but think it was in duple, then circle "Maybe D." If you are not sure, but think it was in triple meter, circle the response "Maybe T." If you are sure it was in triple meter, circle the response "Sure T." If no confident judgement can be made regarding the meter, circle "Uncertain." You MUST choose one of these five options for each performance.

Performance Identification Number					
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain
________	Maybe D	Sure D	Maybe T	Sure T	Uncertain

APPENDIX I

STUDENT INFORMATION RECORD

STUDENT INFORMATION RECORD

Student Name _____

School _____

Movement Group YES NO Subject # _____

DUPLE METER		TRIPLE METER	
Judge #1	_____	Judge #1	_____
Judge #2	_____	Judge #2	_____
Judge #3	_____	Judge #3	_____
TOTAL	_____	TOTAL	_____

Composite Score _____

MAP Score _____ H M L

MAT Score _____

DATA

student #	inst	piano	MAT	MAP	%%	mvt	D	T
_____	_____	_____	_____	_____	_____	___	___	___

comp	state	teach	p-inst	dance
_____	_____	_____	_____	_____