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A COMPARATIVE STUDY OF THE RHYTHM APTITUDE,
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Carla S. Larzelere

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of the requirements for the

MASTER OF
MUSIC

degree in

MUSIC EDUCATION

Cynthia Taggart
Major Professor's Signature

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**A COMPARATIVE STUDY OF THE RHYTHM APTITUDE, PERSONAL TEMPO,
AND MOTOR PROFICIENCY OF FIRST AND THIRD-GRADE STUDENTS**

By

Carla Scharton Larzelere

A THESIS

**Submitted to
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ABSTRACT

A COMPARATIVE STUDY OF THE RHYTHM APTITUDE, PERSONAL TEMPO, AND MOTOR PROFICIENCY OF FIRST AND THIRD-GRADE STUDENTS

By

Carla Scharton Larzelere

The purpose of this study was to examine the relationships between children's developmental rhythm aptitude, motor-proficiency, and personal tempo. The problems guiding this research were as follows: (1) Is there a relationship between children's developmental rhythm aptitudes and their motor-proficiencies? (2) Is there a relationship between children's developmental rhythm aptitudes and their personal tempos? (3) Which of the following variables has the strongest relationship to developmental rhythm aptitude: personal tempo or motor proficiency? (4) Do the personal tempos of first-grade students differ from those of third-grade students? Subjects (n=80) were from three intact third-grade classes, and two intact first-grade classes from a high-income, suburban school district in Michigan. In a seven-week testing period, subjects were administered the rhythm subtest of Gordon's *Primary Measures of Music Audiation*, the Short Form of the *Bruininks-Oseretsky Test of Motor Proficiency (BOT-2)*, and three personal tempo measurements using Walter's procedure for measuring personal tempo. Correlations were calculated between the variables. A weak, negative correlation was found between personal tempo and rhythm aptitude for all subjects combined. A low weak correlation was also found between personal tempo and motor ability, for all subjects combined. At each grade level, no significant correlations were found. The average personal tempo measurements of first-grade students were found to be faster than the average personal tempo measurements of third-grade students.

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CHAPTER ONE

Literature Review

Specialists in the fields of philosophy, psychology, movement and music have remarked on the interdependency of rhythm and movement for thousands of years. In fact, one has difficulty defining one without referring to the other. In the words of Plato, rhythm is "order in movement" (Thurmond 1983, p.37). For Seashore (1938), a prominent music psychologist from early in the 20th century, rhythm is "one of the foundation structures in all motor skills" (p.139). Cratty (1986), an expert in motor development, believes that rhythm is the essence of life itself, as evidenced by the prominent roles of music and dance in all cultures of the world. Certainly rhythm and movement are intrinsically linked.

Given the attention to the relationship between rhythm and movement, it is not surprising that a large body of research exists in which researchers have examined the role of movement in music instruction (Crumpler, 1983; Ferguson, 2005; Joseph, 1982; Rohwer, 1998; Shiobara, 1994). Additionally, the widespread use of movement and music in both music education curricula and physical education curricula is a natural outgrowth of the relationships among rhythm, movement, and music. Although much attention has been given to the relationship between rhythm and movement, relatively little work has been done in the area of motor development and its relationship to rhythm skills. Smaller still is the amount of research concerning the phenomenon of personal tempo, which is an observed factor in both musical and movement performance. The term personal tempo refers to a preferred tempo that is unique to each individual, and can be described as the rate at which someone pats a consistent beat for a short period of time. Past research has determined the existence of more intra-individual consistency for

personal tempo than inter-individual consistency (Rimoldi, 1951; Smoll, 1974). Of the research that has been conducted separately in the areas of rhythm aptitude, motor proficiency, and personal tempo, compelling links have been observed (Alward, 2001; Baer, 1987; Nelson, 1990; Walters, 1983). For example, personal tempo and rhythm aptitude stabilize around age nine (Walters, 1983; Gordon, 2000). Motor proficiency improves as students mature and tends to level off in the late elementary years as well (Gallahue, 1995). Given the similarities in the developmental patterns of rhythm aptitude, personal tempo, and motor proficiency, it is conceivable that one or more of these areas of study could be a contributor to student achievement in the other areas. If, for example, personal tempo is found to relate to a child's rhythm aptitude, then personal tempo could serve as an important factor for teachers to consider when accounting for individual student needs and differences in the classroom. For instance, a child with a fast personal tempo may have difficulty performing steady beat on a drum to a particularly slow song. Additionally, a child with a slow personal tempo may have difficulty marching in time to a fast chant. When a teacher has additional information about a child's tendencies, the teacher can adjust instruction accordingly to improve that child's understanding and performance. The need exists for research examining the relationships among rhythm, motor development, and personal tempo.

Rhythm Aptitude

Music aptitude is defined as "a measure of our potential to learn music" (Gordon, 2000, p. 135). Music aptitude is not the same as music achievement. Gordon explains that, whereas music aptitude measures a child's potential to learn music, music achievement measures what has already been learned. Gordon describes music aptitude as innate; that is, music aptitude is present in everyone to a certain degree at birth.

However, music aptitude is also developmental; it is strongest at birth and then fluctuates, depending upon environmental influences, as children mature, eventually stabilizing at the age of nine. After the age of nine, while a student's music potential will remain unchanged, his or her music achievement may increase. However, according to Gordon, a student's musical achievement will not surpass his or her level of music aptitude as determined by the age of nine. Early environmental influences, combined with innate potential, affect a child's eventual potential for music learning. Due to the potential for gains in musical aptitude from birth to age nine, a strong musical environment is needed in the formative years to ensure optimal music achievement throughout life.

Developmental music aptitude can be divided into two types: tonal music aptitude and rhythm music aptitude. Whereas tonal music aptitude refers to a student's potential to learn melody and harmony, Gordon describes rhythm aptitude as, “the flow and coordination of movement in audiation” (Gordon, 2000, p.32). As tonal and rhythm aptitudes are discreet constructs, it is possible and likely that a child's tonal aptitude will differ from his or her rhythm aptitude.

Music aptitude test scores are valuable tools for teachers to use in adapting their instruction to meet the needs of individual students. Perhaps most important, music aptitude tests identify students whose needs are not being met in the classroom. For instance, a child who is still using a speaking voice while singing may be considered to have low tonal ability or be labeled "tone-deaf." However, if that child scored high on a tonal aptitude test, the teacher would then know that the child may simply be having difficulty producing a singing voice and could adapt instruction by including more vocal exploration opportunities. Valid measures of developmental music aptitude have been developed by Gordon, including the *Primary Measures of Music Audiation* and the

Intermediate Measures of Music Audiation, and are widely used by teachers and researchers to assess developmental aptitudes effectively.

Motor Development

Experts in the field of motor development agree that a general notion of motor proficiency does not exist (Gallaher, 1995; Wickstrom, 1983). Individuals possess varying abilities for performing selected motor skills, and, though the developmental sequence is generally predictable, the rate at which each child progresses varies among individuals. Motor development is viewed as the continued changes over time in specific motor behaviors (Wickstrom, 1983). Motor development specialists also agree that children learn fundamental motor patterns in the first five years of life. The elementary school years provide opportunities for children to refine their skills, rather than acquire new ones (Wickstrom, 1983; Gallahue 1995). Early movement experiences are believed to be beneficial to children and can result in a child developing a higher level of motor skill than is normally expected for his or her age.

Rhythm Aptitude and Motor Development

The developmental aspects of rhythm aptitude and motor development have parallels. Developmental periods for both occur between the ages of birth and nine years, and early experiences are recommended by specialists in both the fields of music education and motor development to facilitate optimal development. Separate intelligences within each area have been identified, and educators are encouraged to attend to individual student differences in their instruction strategies in both domains.

Specialists in both fields allude to the need for further research in order to develop knowledge and improve instruction. Gallahue (1995) suggests looking at motor development through a wider lens, one that looks at a variety of factors in motor

development. "The study of motor development must be viewed from the perspective of the totality of humankind. It must encompass both the biological and environmental aspects of cognitive and affective behavior that impact on motor development and it must look across various age periods of development" (p. 5). It is conceivable that rhythm aptitude may be considered a biological aspect of behavior, which affects motor development, but lack of combined research leaves this to speculation.

Cratty (1986) notes that there is a detrimental absence of literature in motor development pertaining to rhythm and its effect on movement instruction. "Most books purporting to cover the topic of motor development either ignore the subject of rhythm entirely or pay only superficial heed to this most important quality imbedded in the unfolding movement behavior of children" (Cratty p. 257). Evidently the subject of rhythm as it relates to motor development is an area that has been neglected in research, and making more information available to educators would benefit the fields of both music and movement instruction. The more information educators have about their students' abilities, the better understanding they have of their performance, whether in the music classroom or the gym. If a physical education teacher knew that a student with high rhythm aptitude would be able to anticipate the next jump better during a jump roping lesson than a student with low rhythm aptitude, then that teacher would know which child would be best suited to demonstrate the skill for the rest of the class.

Seashore (1938) asserts that rhythm is an underlying factor of motor skills. "Rhythm is a dominant factor in the organization and facilitation of control...rhythm is one of the foundation structures in all motor skills" (Seashore, p. 148). If one agrees that rhythm creates a foundation for motor behavior, then certainly one would want as much information as possible to discover whether a child's motor behavior is not only affected

by his or her rhythm aptitude, but, conversely, if a child's rhythm aptitude may somehow be affected by his or her motor proficiency.

Gardner's (1985) theory of multiple intelligences identifies music and movement as separate intelligences: however it is possible that one intelligence may influence another. Gardner suggests that the use of bodily-kinesthetic experiences can lead to improved creativity in all of the intelligences. Music and movement are often combined in music classrooms, but the extent to which teachers can open up creative opportunities for our students through movement remains unexplored. Given the similarities between the developmental aspects of motor development and rhythm aptitude, as well as the established need for research in both fields by known specialists, further research examining the relationship between rhythm aptitude and motor development is necessary to develop a broader understanding of individual students' musical development as well as motor development.

Research on Rhythm Aptitude and Motor Development

As previously discussed, the relationship between rhythm and movement has been explored by theorists and researchers for many years. Carl Orff (1935), Emile Jacques-Dalcroze (1921), Rudolph von Laban (1975), and Edwin Gordon (1983; 2000) all attested to the importance of movement in music education. The more specific relationship between rhythm aptitude and motor development, however, has not been studied extensively. Researchers have examined rhythm achievement as it pertains to motor development and results remain largely inconclusive. Whereas Brand (1976) found a high positive correlation between motor movement and rhythmic capacity in 5-year olds, Ray (1985), who continued Brand's research, found that there was not a high positive correlation between motor skills and rhythmic ability in 7-year olds. Studies investigating

the relationship between rhythm aptitude and motor development are sparse, but some researchers have examined the relationship between rhythm aptitude and selected motor skills. In a study comparing secondary-school athletes (who would potentially demonstrate a high level of motor proficiency) and musicians, Smith (1993) found no significant differences between the stabilized rhythm music aptitude scores of musicians and those of varsity and junior varsity athletes. Hunter examined the relationships among rhythm music aptitude, jumping skill, rhythm achievement, and chronological age of 3- to 5-year old children, and found no evidence of significant relationships between any of the variables (Hunter, 1993). Although past studies have reported mixed evidence of a relationship between rhythm and motor skills, these studies have been limited in scope. The proposed study intends to fill the evident void in the research literature by investigating the relationship between developmental rhythm aptitude and various components of motor development.

Personal Tempo

Personal tempo is a phenomenon that has been observed by psychologists, music educators, as well as movement educators throughout the last century. When Seashore (1938) declared rhythm as primarily a projection of personality by stating, "The rhythm is what I am," (Seashore, p. 139) it is likely that he was referring to personal tempo. Driver asserts that "each one of us possesses his own individual rhythm, expressive of temperament, character, and environment" (Driver, 1936, p. 4). Personal tempo is not found exclusively in music tasks; rather it has also been found to be of great importance in the field of motor development. Cratty (1986) and Broer (1966) attribute personal tempo to the habitual tendencies of people to move at a certain rate that is consistent over time; yet these tendencies vary among individuals. Leonard (1978) goes so far as to

suggest that, "it is the inner pulse that is stable and persistent at the most fundamental level; the unitary identity that explodes out into the world as a multiplicity of identifying characteristics" (p. 63). Gardner characterizes the body as an outward reflection of one's inner-self and acknowledges that the body is "the vessel of the individual sense of self, of his most personal feelings and aspirations, as well as that entity to which others respond in a special way because of their uniquely human qualities" (Gardner, 1985, p.235). As an identifying characteristic of individuals, personal tempo is regarded as one of many factors contributing towards students' learning potential in music and movement (Broer, 1973; Cratty, 1986; Dalcroze, 1921; Leonard, 1978; Nelson, 1991; Walters, 1983). The importance of personal tempo in the music classroom remains largely unexplored, and yet it may have important implications for music educators. For instance, music teachers might need to adjust methods for teaching rhythms and songs by including various tempos so as to accommodate the varying personal tempos of their students. Additionally, teachers might need to be aware of their own personal tendencies with regard to tempo so that students are given a balanced repertoire of songs and activities to meet their own needs.

Research on Personal Tempo

Personal tempo has been studied by experts in the field of perceptual and psychomotor skills throughout the twentieth century. Frischeisen-Kohler (1932) conducted extensive research on twins, in an effort to determine whether intra-individual consistency and inter-individual variability existed in subjects' preferred tempos. Not only did Frischeisen-Kohler affirm the existence of personal tempo in individuals, but, in addition she reported evidence of an inherited disposition rather than environmental influence contributing towards subjects' preferred tempos (Frischeisen-Kohler, 1932).

Rimoldi's (1951) study of temporal patterns resulted in the identification of a personal tempo factor; however, Rimoldi's findings indicate that task-specific personal tempos exist in each individual, rather than a general personal tempo, as was reported by Frischeisen-Kohler. A series of motor rhythm studies conducted by Smoll (1975a, 1975b, 1978) resulted in the findings that (a) individuals have preferred tempo preferences for voluntary movement tasks that differ from other individuals, (b) a biological variability unique to each individual exists in tasks for which subjects select a pace for performing repetitive movement tasks, and (c) subjects with faster self-selected tempos for repetitive motor tasks performed more consistently than subjects with slower self-selected tempos (Smoll, 1975a, 1975b, 1978).

Although psychologists have examined personal tempo extensively, few have related personal tempo to musical tasks, and none have considered the personal tempos of young children. Studies by Walters (1983) and Nelson (1991) will be discussed in detail in Chapter Two, as both investigated the existence of personal tempo in children through musical tasks. Walters found that intra-individual consistency in personal tempo measurements did, in fact, exist for primary-aged children, and that, as students matured, their personal tempo measurements appeared to slow down. Nelson found that consistent personal tempo measurements existed in her first-grade subjects, and she used the students' personal tempo measurements to adjust instruction with the intent of improving synchronization ability.

Statement of Purpose

With the intent of gaining a deeper understanding of children's rhythm development and factors that may affect learning styles within the music classroom, the purpose of this study was to examine the relationships between developmental rhythm

aptitude, motor proficiency, and personal tempo.

Problems of the Study

The problems guiding this research were as follows: (1) Is there a relationship between first and third-grade student's developmental rhythm aptitudes and their motor proficiencies? (2) Is there a relationship between first and third-grade student's developmental rhythm aptitudes and their personal tempos? (3) Which of the following variables has the strongest relationship to developmental rhythm aptitude: personal tempo or motor proficiency? (4) Do the personal tempos of first-grade students differ from those of third-grade students?

Modifying instruction to meet the needs of individual students and adapting instruction to the different learning styles of students are ways in which teachers can improve instruction (Green, 1999.) However, in order for these changes to be made, more information is needed regarding individual students' abilities and tendencies. Bluestine describes our role as music educators as a responsibility to each child, "All children have a right to learn music; and we must become aware of their individual musical strengths and weaknesses in order to meet their individual musical needs "(Bluestine, 2000, p.23). Once a teacher knows that a student has high or low rhythm aptitude, that teacher can alter instruction to challenge that student, or alternately, adapt instruction by giving more experiences in the area in which the student needs more help. Additionally, if meaningful correlations are found between rhythm aptitude scores and motor proficiency, educators may be able to supplement instruction in one area by using more varied experiences, including motor skills in the music classroom, or rhythm opportunities in the gym. Personal tempo may be a factor in both rhythm aptitude and motor development. Knowing a student's personal tempo could benefit a music teacher by allowing the

teacher to understand better why that child has difficulty maintaining steady beat at a tempo that is slower than their personal tempo. Past research appears to be limited in scope and population, thus restricting the potential for new knowledge in aspects of music learning. The present study may contribute to the development of a broader understanding of how students develop in music and movement.

CHAPTER TWO

Related Research

Researchers have shown interest in the relationship between rhythm and movement, though few have offered studies that are specifically related to the proposed study (Alward, 2001; Baer, 1987; Hunter, 1993; Ray, 1985; Smith, 1993; Webster, 1987). Related research for this study can be divided into two topic areas: music aptitude and motor proficiency, and personal tempo as it relates to music instruction.

Research on Music Aptitude and Motor Proficiency

To measure music aptitude and determine its relationship to motor proficiency, researchers have used both developmental and stabilized music aptitude tests, depending on the age of their subjects. To measure motor ability, researchers have used a variety of measures. Whereas some studies used standardized motor proficiency measures covering a wide range of gross and fine motor skills, other studies relied on researcher-developed rating scales and focused on a small selection of motor skills. Perhaps as a result of the variance in motor skills measured, the relationship between music aptitude and motor ability has not been consistent across research studies, ranging from low correlations ($r = .09$) (Webster, 1987) to low-moderate correlations ($r = .33$) (Baer, 1987). However, the studies performed by Alward (2001) and Baer (1987) both used standardized music aptitude tests to measure music aptitude (developmental rhythm aptitude and stabilized music aptitude, respectively) and the *Bruininks-Oseretsky Test of Motor Proficiency* (BOTMP) to measure motor ability. As the proposed study will also use BOT-2, the second edition of BOTMP, to measure motor proficiency, both studies will be discussed. The Webster study is also related to the proposed study and will be discussed for its examination of the relationship between developmental rhythm aptitude and motor

proficiency, as measured by researcher-developed rating scales.

The Alward Study. Alward investigated the relationships among rhythm music aptitude, motor proficiency and beat competency for kindergarten, second, and fourth-grade students. One hundred and forty four subjects were randomly selected to participate in the study. A cross sectional age range was chosen with the hope that a developmental sequence of beat competency would emerge. Alward chose to use *The Primary Measures of Music Audiation* (PMMA) (Gordon, 1986) to measure the developmental rhythm aptitude of kindergarten and second-grade students and *Intermediate Measures of Music Aptitude* (IMMA) (Gordon, 1987) to measure the rhythm aptitude of fourth-grade students. The Short Form of the *Bruininks-Oseretsky Test of Motor Proficiency* (BOTMP) was used to measure motor ability, and Alward revised the *Weikart Rhythmic Competency Analysis Test* (RCAT) (1998) in order to measure beat competency. Aptitude tests were administered first, during scheduled music instruction, and then half of the students from each grade completed the motor ability measure, followed by the beat competency measure. To control for order effect, the other half of each grade took the motor ability measure after taking the beat competency measure.

Alward reported a moderate correlation ($r = .56$) between motor proficiency and beat competency for kindergarten and second-grade students, and a moderately low correlation ($r = .25$) between motor ability and beat competency for fourth-grade students. A low correlation ($r = .20$ or less) between motor proficiency and rhythm aptitude was reported for all grade levels. Alward attributed the low correlation between rhythm aptitude and motor ability to compressed variability among rhythm aptitude scores for second and fourth-grade students. Alward also found that, as students mature, the roles of rhythm aptitude and motor proficiency in contributing towards beat

competency change. For kindergarten and second-grade students, motor proficiency contributed more towards beat competency than did rhythm aptitude; the reverse was true for fourth-grade students. Alward attributed these findings to maturation.

Whereas Alward examined the relationships among rhythm aptitude, motor proficiency and beat competency, the present study examines the relationships among rhythm aptitude, motor proficiency and personal tempo. Alward's findings indicated a maturation process that occurs between kindergarten and fourth-grade, resulting in improved beat competency. This study investigates the possibility of personal tempo measurements of first and third-grade students and will discuss how the measurements relate to the maturation process described by Alward. The present study has a smaller sample size than Alward's 144 students, and the sample population of the present study also is different. Because Alward attributed a low correlation between rhythm aptitude and motor proficiency to too little variability within second and fourth-grade rhythm aptitude scores, this study instead uses the PMMA to measure the rhythm aptitude of first and third-grade students, which might result in more variability. This will also enable the use of one rather than two different aptitude tests so that the scores can be meaningfully compared. PMMA has been selected by many researchers for the purpose of measuring the developmental music aptitude of children in kindergarten through third grade.

The Baer Study. Baer examined the relationships among motor proficiency, total music aptitude, and musical achievement. One hundred and thirty six middle school instrumentalists were selected to participate in the study. Subjects were administered the *Musical Aptitude Profile* (MAP), the *Bruininks-Oseretsky Test of Motor Proficiency* (BOTMP), and a performance achievement test designed by the researcher.

Baer reported a low moderate positive correlation ($r = .33$) between general motor

development and music aptitude. Gross motor skills were found to be more strongly related to music aptitude than fine motor skills ($r = .31$ for gross motor, $r = .20$ for fine motor). Baer attributes this finding to the widespread use of gross motor movement instruction in music classrooms. Music aptitude was found to be the best predictor for musical performance achievement.

Whereas Baer chose to examine the stabilized music aptitude of middle school instrumental students, the proposed study will examine the developmental rhythm aptitudes of elementary students. Instrumental students choose to take instrumental music, resulting in a select population, whereas elementary general music includes all students. Also, with the understanding that motor proficiency skills are generally attained by age six and then refined as students mature (Gallahue, 1995), one would expect the older students examined by Baer to score reasonably high on the BOTMP. In order to obtain a better understanding of student's developing motor proficiency and its relationship to developmental rhythm aptitude, this study uses a younger population. Musical performance achievement will not be considered in the proposed study.

The Webster Study. Webster (1987) studied the relationship between children's abilities to perform selected movement tasks and their developmental rhythm aptitudes. One goal of the study was to develop appropriate rating scales for each of the following movement tasks: hopping, galloping, and skipping. Forty-four first-grade students were videotaped performing the selected movement tasks. Two judges used researcher-designed rating scales to evaluate the students' performances. PMMA was used to measure students' developmental rhythm aptitude.

Webster reported low to moderate correlations among each of the movement tasks and rhythm aptitude ($r = .09$ hopping, $r = -.14$ galloping, $r = .36$ skipping). The negative

correlation between galloping and rhythm aptitude suggests an inverse relationship, yet Webster offers no discussion on this finding. The relationship between combined movement task scores and rhythm aptitude was also found to be low ($r = .16$). Webster attributes the low correlations to relatively low inter-judge reliabilities for the movement rating scales, and low reliability for PMMA in the selected sample. The highest correlation was found between skipping and rhythm aptitude ($r = .36$). Because the skipping rating scale had the lowest inter-judge reliability ($r = .52$), the moderate correlation between skipping and rhythm aptitude is interesting and may be worth investigating further through future research. Nonetheless, Webster found that, on the basis of the obtained data, it could not be concluded that a relationship between developmental rhythm aptitude and motor development existed.

Webster's study is similar to the proposed study in that it examined the relationship between motor ability and developmental rhythm aptitude. Although the sample size of Webster's study is considerably smaller than that of this study, the sample population of the studies is similar. A possible reason for the low correlations reported is Webster's use of ineffective rating scales. To increase the validity of the assessment of first and third-grade students' motor proficiency, this study uses the *Bruininks-Oseretsky Test of Motor Proficiency*, (BOT-2) rather than researcher-designed rating scales.

Summary. The aforementioned studies have examined the relationship between motor proficiency and music aptitude. Each of the studies reported low to moderate correlations; however it is possible, at least in Webster's study, that the low correlations were a result of ineffective criterion measures for the selected sample populations. The Alward, Baer, and Webster studies have informed and influenced this study in terms of appropriate criterion measures and sample population. Alward used two different rhythm

aptitude measures, making it difficult to meaningfully compare scores. Bauer reported a leveling out of scores at the top of the motor proficiency measure, probably due to the fact that middle school subjects would be expected to perform at a high level given the developmental stages of motor proficiency. Additionally, Webster reported low inter-judge reliability for her researcher-designed rating scales for motor proficiency skills. The present study makes the following adjustments in order to improve the accuracy of research findings: (1) one measure of rhythm aptitude, PMMA, will be used to test both first and third grade students, as it is considered a valid test for the age of the subjects, and (2) a published motor proficiency measure with reported validity and reliability is used in the present study to measure motor proficiency, as recommended by motor development specialists for use in research.

Research on Personal Tempo as it Relates to Music Instruction

Although the phenomenon of personal tempo has been studied extensively in the field of psychology, there is relatively little known about its role in the music classroom. On the basis of research compiled by psychologists, Walters (1983) investigated the existence of personal tempo in young children, which was the population with which the phenomenon had yet to be studied. Once he established that young children did display a personal tempo, Walters compared children's personal tempos to students' abilities to synchronize movement with music. Nelson (1990) took Walters' work a step further, by using children's personal tempo measurements as a basis for beat-competency instruction, and then evaluated synchronization abilities. Both studies examined personal tempo in primary school students, as well as the ability of those children to synchronize movement with music. Neither study examined the relationship between personal tempo and rhythm aptitude.

The Walters Study. Upon observation that the existing body of research on personal tempo was limited to adult populations, Walters (1983) set forth to determine whether the phenomenon existed in young children and to obtain personal tempo measurements for this unstudied population. Walters hypothesized that an intra-individual consistency and an inter-individual variability in personal tempo would be observed in primary-aged children; these results would corroborate the findings of previous studies examining adult populations. Another goal of Walter's study was to investigate the ability of children to synchronize movement with music played in a wide range of tempos, particularly those that were divergent from students' personal tempo.

Walters used a sample size of 96 randomly-chosen kindergarten through third-grade students. Subjects were placed in one of eight groups, according to grade and gender. In order to measure rhythm aptitude, Walters administered the rhythm sub-test of PMMA. *The Primary Measures of Kinesthetic Response to Tempo in Music* (Walters 1983) was designed by Froseth for Walters' study to measure synchronization ability. A researcher-developed test for personal tempo was administered to the young subjects to obtain four personal tempo measurements. Walters also used a short questionnaire to discover the extent of subjects' prior musical experience.

Walters discovered no significant differences between the four personal tempo measurements of the subjects, and thus concluded that his measure for personal tempo was reliable, and that intra-individual consistency did in fact exist for primary-aged children. For all subjects, the mean personal tempo was M.M. = 106.8 with a standard deviation of 29.81. These findings were parallel to those reported by past researchers (Frischeisen-Kohler, 1933; Smoll, 1975a, 1975b, 1975c, 1974; Smoll and Schutz, 1978). On the subject of synchronization, Walters found that, as music tempos diverged from a

student's personal tempo, the student experienced more difficulty synchronizing movement with music. In particular, as the music became increasingly slower than the student's personal tempo, the student's ability to synchronize movement with the music decreased. Of interest is Walters' finding that, as students matured, personal tempo measurements decreased. Walters attributed this finding to maturation.

As a forerunner in the area of personal tempo with regards to music instruction, Walters and his work have greatly influenced the present study. The personal tempo measure designed by Walters is implemented in the present study, given its high reliability in measuring primary-aged children's personal tempos. Although Walters obtained PMMA scores from his subjects, those scores were not used to examine the relationship between rhythm aptitude and personal tempo measurements. In fact, the main purpose of Walter's rhythm aptitude scores was to determine whether a correlation existed between rhythm aptitude scores and scores from a synchronization measure. Based on Walter's finding that personal tempo measurements gradually decrease with age and possibly level off, the present study examines the trend in personal tempo measurements as students mature.

The Nelson Study. Nelson (1991) undertook a study to discover whether personal tempo could explain why some students are capable of maintaining a steady beat while others are not. The first objective of Nelson's study was to determine if individual first-grade students had a consistent personal tempo. The second objective was to investigate whether students' personal tempos would affect their ability to synchronize movement with the beat at a variety of tempos.

Nelson divided 86 first-grade students randomly into either the control group or the experimental group. Both groups were administered Walters' measure for personal

tempo. Small group instruction was determined to be the most effective method for the experimental portion of the study, so within the two groups, subjects were divided into three small groups for instruction. In the experimental group, students were divided according to personal tempo measurements.

The experimental and control groups were administered *The Primary Measures of Kinesthetic Response to Tempo in Music* as a pretest. Over a twelve unit instructional period, both groups received lessons focusing on steady beat. Lessons for both groups included movement, chanting, singing, listening, and playing instruments. In the control group, all instruction was restricted to a tempo marking of M.M.=100. In the experimental group, instruction was adjusted to target the personal tempo measurements of the subjects, and then gradually expanded to include the range of tempos included in *The Primary Measures of Kinesthetic Response in Music*. A post-test followed the twelve units of instruction.

Nelson found that a consistent personal tempo existed in first-grade students. A mean personal tempo range from 48.59 to 168.17 was reported for subjects. The standard deviation was 30.75, and as compared to the within-subject, standard deviation of 14.23. Nelson's results are similar to those reported by Walters (1983). Although the scores from the synchronization pre-test to the post-test greatly improved with instruction for both groups, there was not a significant difference between the improvement of the experimental group and the improvement of the control group. Nelson also examined the scores of each sub-group within the experimental group to see if trends emerged between subjects with slow personal tempo (PT), moderate PT, and fast PT, and their ability to synchronize with movement with music. Nelson reported no significant difference in scores between the groups.

Nelson's study was a pioneer in the field of personal tempo research. In addition to successfully replicating Walters' work, Nelson took the next step by exploring whether it was possible to accommodate students' diverse needs within the music-learning environment. Whereas Nelson examined the relationship of personal tempo and music achievement through the ability of students to synchronize movement with music, this study examines personal tempo as it relates to rhythm aptitude. By using a larger sample size, and adding third-grade students to the sample population, one of the goals of the present study is to take Nelson's work a step further in order to gain a better understanding of the role of personal tempo in the music classroom. An eventual outgrowth of the present study would be to better accommodate the diverse learning styles of music students.

Summary

Many researchers have explored the effects of rhythm and movement instruction, but few have examined the topic from a developmental angle. Also, few have explored the relationship between rhythm aptitude and motor-proficiency. Alward (2001) studied the relationship of developmental rhythm aptitude to motor ability and reported a low correlation. Baer (1987) studied sixth-through ninth-grade instrumentalists and discovered a low to moderate correlation between subjects' motor proficiency and music aptitude. Webster (1987) reported a low correlation between the developmental rhythm aptitude and motor skill proficiency of first-grade students, but used ineffective rating scales to measure motor performance. In the area of personal tempo research in music, Walters' work has created a foundation for further research. Walters' development of an appropriate measure for personal tempo in young children, in addition to measurements of personal tempo for kindergarten through third-grade students, has the potential to

greatly influence music research and instruction. Additionally, Nelson's work with first-grade students and their ability to synchronize movement with music in relation to their personal tempos is a critical step in the effort to meet students' individual learning needs. Based on this review of literature, it is evident that the need exists for a study that explores the relationships among developmental rhythm aptitude, motor proficiency, and personal tempo. Also evident is the lack of research concerning personal tempo in a musical context. The present study intends to gain a deeper understanding of these factors of musical development.

CHAPTER THREE

Method

Subjects

The subjects for this study were first and third-grade students from a high income, suburban school district in Mid-Michigan. The subjects represented ethnic as well as racial diversity. Two classes of first-grade students and three classes of third-grade students participated in the study. Of the 80 subjects, 33 students were in first-grade, and 47 were in third-grade.

As part of their school's curriculum, the subjects received music instruction twice a week for 35 minutes. All music instruction took place in a separate music classroom and was led by a certified K-12 music teacher. Primary components of the music curriculum included singing, rhythmic speech, locomotor and non-locomotor movement, listening and instrument performance. Students also received physical education instruction twice a week for 35 minutes. A certified physical education teacher led physical education instruction.

Design

This study was designed to investigate the relationships between three variables: rhythm aptitude, personal tempo, and motor proficiency. At the beginning of the six week testing period, the students were administered the rhythm aptitude test (PMMA) in their general music classroom groupings, during one music period. Students then were administered individually the personal tempo (Walters' test) and motor proficiency (BOT-2) measures during their regularly scheduled music time, over a period of six weeks.

Criterion Measures and Procedure

Primary Measures of Music Audiation. The Rhythm subtest of Edwin Gordon's *Primary Measures of Music Audiation* (PMMA) (1979) was used to measure rhythm aptitude. This is a developmental music aptitude test; that is, it measures students' developing music aptitudes before their aptitudes stabilize at the age of nine. Although a tonal subtest also exists, for the purposes of this study, only the rhythm subtest was used. Various longitudinal studies examining the validity of the test during the standardization process resulted in reports of split-halves reliabilities ranging from $r = .72$ to $.86$ and test-retest reliability ranging from $r = .60$ to $.73$ for ages 5 to 8 (Gordon, 1987, p. 114). This standardized test is made up of 40 recorded test items. Each item includes a pair of two short rhythm patterns played on a Moog music synthesizer. The subject is asked to listen to the first pattern, compare it to the second, and determine whether the patterns sound the same or different. For this discrimination task, the subjects must audiate, or aurally remember, the first pattern while listening to the second. The test is unique in that it does not require literacy skills. For the targeted age group of this test, literacy skills could inhibit students' abilities to correctly answer each item, thus affecting the process validity of the measure. Students are asked to locate a picture in order to find the appropriate pair on their answer sheet, and then circle the box with two smiling faces if the patterns sound the same or the box with one smiling face and one frowning face if the patterns sound different. The test takes 20 minutes to administer. In an effort to eliminate unnecessary stress and anxiety for the students, and for logistical reasons, all 80 subjects remained in existing general classroom groupings for the administration of the rhythm aptitude test. All classes were administered PMMA at their regularly scheduled music time in the music classroom. Slates, pencils, and answer sheets, pre-labeled with subjects' name,

grade and group, were placed at each subject's assigned seat prior to the subjects entering the music room. PMMA administration procedures were followed as directed in the test manual. In addition to the researcher, the subjects' music teacher was present and served as proctor, passing out replacement pencils as necessary and monitoring student behavior and test taking to ensure academic honesty.

Test of Personal Tempo. Past methods for measuring personal tempo have ranged from asking subjects to perform familiar movements in a natural way, to selecting preferred metronome markings, and even using technical equipment to measure the performance of precise and unnatural movement tasks. Frischeisen-Kohler (1933) chose to have subjects simply tap a preferred tempo using fingers and feet. Additionally, Frischeisen-Kohler asked subjects to listen to a variety of metronome markings and remark on how comfortable the given tempo felt. Schutz and Smoll (1978) chose instead to use an apparatus that could be considered complicated and potentially upsetting if used in research with children. In addition to a handle, sighting rod, position indicator, processing circuitry, and digital printer: "the equipment included an electronic metronome, a target, and electromechanical components that transmitted voltage fluctuations"(Smoll & Schutz, 1978, p. 884). Such methods could potentially yield inaccurate responses due to apprehensive feelings on the part of the subject. For example, feeling nervous could lead a child to experience anxiety, potentially resulting in the child patting faster and rushing his or her personal tempo. Additionally, the use of unfamiliar equipment in administering the procedure could make the child feel nervous or apprehensive, which in turn could lead to yielding an inaccurate personal tempo measurement. The following procedure, which was used in the present study, was developed by Walters (1983) as a non-disturbing method for measuring a child's natural

personal tempo using familiar objects, such as a cassette recorder, microphone, and stopwatch:

1. "Begin the occasion of the measurement with pleasant conversation to relax the subject.
2. Seat the subject in a chair. Explain the presence of the equipment in view and describe generally what is to be done.
3. Have the subject assume a relaxed position with palms down on the thighs. Give the following instructions: "When I ask you to begin, pat your hands on your legs in a steady beat that feels good to you, and keep the beat going until I ask you to stop."
4. Turn on the tape recorder, give the code number for the subject, and signal the subject to begin.
5. Use a stopwatch to time the number of pats occurring in 15 seconds, and multiply by four to obtain a rough measure of personal tempo ... a more precise measurement will be taken from the tape for analysis" (Walters, p. 48).

On the advice of Rimoldi (1951), Walters refrained from using the word "speed" during the measurement session. Using that word so that the subjects know that tempo was being observed might have caused subjects to inadvertently perform tempos that were different than their natural personal tempos, thus biasing the results. If a subject demonstrated an inconsistent beat, he or she was asked to "make all of your beats alike." The present study uses the same process in order to yield consistent results.

Walter took four measurements as follows: the first two at a 5-minute interval, the third a week later, and the final measurement a week later than the third. In the interest of time, personal tempo measurements were taken three times for the present study. Instead

of testing one week apart for the third and fourth measurements, the researcher chose to wait two weeks before taking the third and final measurement. The first two measurements were taken in five-minute intervals, and the third was taken approximately two weeks later.

To determine personal tempo following the measurements, Walters proposed using the recordings of the beat movement to obtain more exact measurements using the following procedure.

1. "Listen to the first few pats to make possible a synchronization of the stopwatch operation with the pats.
2. Start the watch precisely on a pat, and stop it precisely on a pat after 10 to 14 seconds.
3. Divide the number of pats minus one by the time, and multiply by 60 to compute M.M." (p.55).

Walters tested the reliability of this technique by randomly selecting a performance from each of the following categories: slow (M.M. <80), moderate (M.M.= 80 to <110), and fast (M.M. >110), and clocking each performance three times. Walters reported that the standard deviations of the results were "infinitesimal," (p.55) and therefore the stopwatch technique was determined capable of producing reliable results.

In order to eliminate variability at the beginning and end of the measurement and to attain the most accurate results, Walters recommended using the middle 10 seconds of movement for each performance. In order to measure the personal tempo of subjects in the present study, Walter's method was replicated according to his recommendations.

Subjects were individually administered the personal tempo and motor

proficiency measures in order to lessen peer-influence and create a comfortable testing atmosphere. Administration of both measures took place in an empty room adjacent to the music room.

With parental consent, subjects were videotaped performing the personal tempo measure. With the knowledge that, in the music classroom, subjects are sometimes discouraged from audibly patting their laps, the decision was made to videotape each performance, rather than audio record as Walters suggested. If a child is asked to pat loudly, the direction might be misinterpreted, and the child might pat faster, rather than simply louder. The researcher used the videotaped segments to calculate more precise personal tempo measurements, as was indicated Walters' procedure. Additionally, the videotaped performances of several subjects were used to determine inter-judge reliability for the measure.

For the personal tempo measure, subjects were excused from their music classroom in groups of three and directed to wait for their turn in the hallway. In order to space out the first two measurements by five minutes, as indicated by Walters, the subjects alternated turns taking the first measurement, and then waited for their second turn in the hallway. Upon entering the testing room, each student was given a brief overview of the testing procedure, and the researcher explained the purpose of the video camera and stopwatch. The subject was then seated across from the researcher to begin the personal tempo measure.

Bruininks-Oseretsky Test of Motor Proficiency. Second Edition *The Bruininks-Oseretsky Test of Motor Proficiency, 2nd Edition* (BOT-2) was used to measure subjects' motor proficiency. The test was developed by Bruininks to "measure a wide array of motor skills in individuals aged 4 through 21" (Bruininks, p.1, 2005). It is an

individually administered test and comprises four motor-area composites: Fine Manual Control, Manual Coordination, Body Coordination, and Strength and Agility. The four motor-area composites are divided further into eight subtests: Fine Motor Precision, Fine Motor Integration, Manual Dexterity, Upper-Limb Coordination, Bilateral Coordination, Balance, Running Speed and Agility and Strength. The Total Motor Composite is the combined scores of all eight subtests and is a reliable measure of overall motor proficiency (Bruininks, 2005). The administration of the complete test requires 45 to 60 minutes.

A reliable Short Form of the test is also available that requires only 15 to 20 minutes to administer. The Short Form movement tasks include: drawing lines through paths – crooked, folding paper, copying a square, copying a star, transferring pennies, jumping in place – same sides synchronized, tapping feet and fingers – same sides synchronized, walking forward on a line, standing on one leg on a balance beam – eyes open, one-legged stationary hop, dropping and catching a ball – both hands, dribbling a ball – alternating hands, knee push-ups or full push-ups, sit-ups. Norms have been developed and Short Form test reliability is reported in the test manual as .82 for ages 4-7 (first grade) and .84 for ages 8-11 (third grade) (Bruininks, 2005, p.52).

According to Bruininks, the validity of the test is "based on its ability to assess the construct of motor development of proficiency" (Bruininks, 1978, p.28). Gallahue (1995), an expert in the field of motor development, recommends using the test on the basis of its motor proficiency merits. "The BOTMP has good potential for assessing the motor proficiency of children...it can be of value as a research tool" (Gallahue, 1995, p. 540). Selection of the Short Form of BOT-2 for this study was based on the measure's popularity among physical educators and specialists for its thorough assessment of motor

proficiency.

As the researcher is not a trained physical education specialist, she worked in collaboration with a certified physical therapist with experience administering and scoring the Short Form of the BOT-2. In addition to receiving training on the administration of the motor development measure, the researcher videotaped four subjects performing the BOT-2 and had the physical therapist score them. The scores from both judges were correlated to determine an inter-judge reliability.

Procedures for the motor proficiency measure were completed as specified for the Short Form version in the BOT-2 manual. Once finished, the subject returned to their classroom and summoned the next subject for testing.

Analysis

A cross sectional design was used to examine relationships among rhythm aptitude, motor proficiency, and personal tempo by grade level. Reliabilities were calculated for each criterion measure. Means and standard deviations were calculated for each of the measures divided by grade level. Then, correlations were calculated between rhythm music aptitude scores, personal tempo, and motor proficiency in order to determine the strongest predictive relationships by grade levels and with grade levels combined.

CHAPTER FOUR

Results and Interpretations

Reliabilities

Following data collection, inter-judge reliability was computed for the motor proficiency and personal tempo measures. For the BOT-2, a trained physical therapist scored four of the third-grade subjects' tests and those scores were compared to those of the researcher. Inter-judge reliability for the motor ability measure (BOT-2) was .98, showing a strong agreement between the judges. An independent judge scored seven videotaped performances of the personal tempo measure, and those scores were correlated with those of the researcher. The resulting inter-judge reliability was .99, which, again, demonstrated strong agreement between the judges. The high levels of reliability for both measures provide evidence of the validity of the criterion measures in assessing the motor ability and personal tempo of subjects in this study.

Split-halves reliability was computed for the rhythm aptitude measure (PMMA) at each grade level. After correcting for length with the Spearman Brown Prophecy Formula, reliability of the first-grade scores was .82. Reliability of the third-grade scores was .35. The low reliability for third-grade scores probably reflects the lack of variance in scores, with most subjects scoring at a high level. The observed standard deviation for the third-grade scores was much smaller than the standard deviation of 3.99 that was reported in the test manual.

Means and Standard Deviations

Means and standard deviations were calculated for PMMA Rhythm subtest scores. Means from the manual and observed means and standard deviations for both grade levels are reported in Table 1 on the following page.

Table 1 – Means and Standard Deviations for PMMA

First grade n = 33 Third grade n = 47

	Mean in Manual	Std. Deviation in Manual	Observed Mean	Observed Std. Deviation
First-grade	25.8	4.34	32.8	3.1
Third-grade	29.4	3.99	34.0	2.0

At both grade levels, the observed mean was higher than the mean reported in the test manual, and the observed standard deviation was less than the standard deviation reported in the manual, indicating a leptokurtic distribution. Without a normal distribution of scores, it is possible that the PMMA may have been an inappropriate criterion measure, particularly for the third-grade subjects in this study.

Means and standard deviations were calculated for the personal tempo measure. The observed means and observed standard deviations for both grade levels, as well as the means and standard deviations reported by Walters, are reported in Table 2 below.

Table 2 – Means and Standard Deviations for the Personal Tempo Measure

	Mean (Walters')	Std. Deviation (Walters')	Observed Mean	Observed Std. Deviation
First-grade	108.55	35.4	110.4	44.1
Third-grade	99.47	26.23	90.4	32.5

For first-grade, the observed mean was slightly higher than the reported mean, and the observed standard deviation was greater than the reported standard deviation, indicating a somewhat platykurtic distribution. For third-grade, the observed mean was lower than the reported mean, and the observed standard deviation was somewhat higher than the reported standard deviation. It is likely that the differences in means and standard

deviations at both grade levels may be due in part to Walters' decision to eliminate outlying personal tempo measurements for 18 of his 96 subjects. If a subject's personal tempo measurements did not show internal consistency, Walters chose to omit those scores from the bulk of his analysis. It is interesting that Walters chose to omit data that may have helped in understanding the existence of personal tempo within the selected age range of his subjects. In the present study, all scores were included and analyzed, resulting in some personal tempo measurements being outliers. Additionally, whereas Walters took four personal tempo measurements, the present study used only three. The above-mentioned changes made for the purposes of the present study may have affected the means and standard deviations for the personal tempo measure.

Means and standard deviations were calculated for the motor proficiency measure. Although the author of the test chose not to report means and standard deviations for the Short Form alone, the means and standard deviations for the Total Motor Composite, the total score of the complete test battery, are reported in Table 3 below. Bruininks notes, "the Short Form yields a single score of overall motor performance, akin to the Total Motor Composite on the Complete Form" (Bruininks, 2005, p.48).

Table 3 – Means and Standard Deviations for the BOT-2

	Mean in the Manual	Std. Deviation in the Manual	Observed Mean	Observed Std. Deviation
Ages 4-7 First Grade	50.1	10.0	61.1	7.2
Ages 8-11 Third grade	50.0	9.9	55.5	8.4

At both grade levels, the observed mean was higher than the reported mean in the manual, and the observed standard deviation was less than the standard deviation reported in the manual. The higher mean for first-grade students as compared to the reported mean for the age group of 4 to 7-year olds is to be expected since the 7-year olds would be at the top of the age range and would be expected to achieve at a higher level on motor proficiency tasks. The absence of a reported mean and standard deviation for the Short Form by specific grade level or age makes it difficult to accurately assess the performance of the students in the present study. Whereas the Total Motor Composite encompasses all of the eight subtests, the Short Form measures only a selection of motor tasks.

Correlations Between Variables

The Pearson Product-moment correlation was used to determine the relationships between the scores of the motor ability measure (BOT-2), personal tempo measure, and rhythm aptitude measure (PMMA), and the results are reported in Table 2 on the following page. Correlations were examined for each grade level and all subjects combined.

Table 4 – Correlations Between Variables

	Motor Proficiency and Rhythm Aptitude	Personal Tempo and Rhythm Aptitude
All subjects combined (n = 80)	.09	-.23*
First grade (n = 33)	.21	-.13
Third grade (n = 47)	.18	-.25

* correlation found to be significant at the .05 level

For all subjects (n=80), no significant correlation was found between rhythm

aptitude and motor proficiency. When all subjects were combined, low correlations were found between rhythm aptitude and personal tempo, and personal tempo and motor proficiency. The correlation between rhythm aptitude and personal tempo was $-.23$, significant at the $.05$ level. The negative correlation indicates an inverse relationship between personal tempo and rhythmic aptitude. In other words, if a subject's rhythm aptitude score was high, then his or her average personal tempo was low. Although this correlation is statistically significant, it is not very strong, and its practical significance remains in question.

Among first-grade subjects ($n=33$), no significant correlations were found between any of the variables. A possible reason for not finding anything significant among the first-grade subjects is the small sample size. With a larger number of subjects, it is possible that the findings may have reached statistical significance.

Among third-grade subjects ($n=47$), no significant correlations were found between any of the variables. Although no significant correlations were reported, the correlations were approaching significance, which may be an indication that a larger sample size may have produced statistically significant results. That these results approached significance is particularly interesting in light of the low reliabilities of the Rhythm subtest of PMMA with this grade level. If the test had been a more reliable measure for the selected sample, it is possible that meaningful correlations might have been found.

Rhythm aptitude was found to have a stronger correlation with personal tempo than motor proficiency in third-grade subjects, and all subjects combined. For first-grade subjects, a slightly stronger correlation was found between rhythm aptitude and motor proficiency, than rhythm aptitude and personal tempo although the correlation was not

significant.

Personal Tempo and Maturation

Personal tempo measurements were averaged at both grade levels in order to determine whether maturation had an effect on overall personal tempo measurements. The average for third-grade personal tempo measurements was 89.51. The average for first-grade personal tempo measurements was 110.44. This finding is consistent with and supports Walters' results (Walters, 1983), which demonstrated that as grade level increased, the mean personal tempo measurement decreased. Whereas Walters' differences between grade levels were not statistically significant, for this study, a T-test was performed and the results indicated that the difference between first-grade personal tempo measurements and third-grade personal tempo measurements was statistically significant at the .05 level. It may be concluded that as students mature, their personal tempo slows down.

Discussion

The lack of significant results at each grade level may be attributed to several factors. The relatively small sample size in each grade may have contributed towards non-significant results. When the overall sample size increased (by combining grades), the correlations were strengthened. Increasing the number of subjects may have produced statistically significant findings.

PMMA was found to be inappropriate for the third-grade subjects in this study. The low reliability of the test with this sample indicates that a more advanced test of rhythm aptitude, such as the *Intermediate Measures of Music Audiation* may have been better suited to these third-grade students. The means of the first-grade students also were higher than those reported in the test manual. Therefore, it is possible that using IMMA

with both grade levels may have increased the overall reliability of the rhythm aptitude criterion measure. It is probable that the low reliability of the rhythm aptitude criterion measure in this sample contributed to the low correlations between rhythm aptitude and the other variables. Without a normal distribution of scores, it was difficult statistically to examine the relationships between rhythm aptitude and motor proficiency and between rhythm aptitude and personal tempo.

Personal tempo measurements were taken three times in the present study, as compared to four times in Walter's study. Although time restraints necessitated the change for the present study, it is possible that the elimination of a measurement resulted in a less valid measurement and contributed to the lack of meaningful results.

CHAPTER FIVE

Conclusions and Recommendation

Purpose

With the intent of gaining a deeper understanding of children's rhythm development and factors that may affect learning styles within the music classroom, the purpose of this study was to examine the relationships between developmental rhythm aptitude, motor-proficiency, and personal tempo.

Problems

The problems guiding this research were as follows: (1) Is there a relationship between children's developmental rhythm aptitudes and their motor proficiencies? (2) Is there a relationship between children's developmental rhythm aptitudes and their personal tempos? (3) Which of the following variables has the strongest relationship to developmental rhythm aptitude: personal tempo or motor proficiency? (4) Do the personal tempos of first-grade students differ from those of third-grade students?

Summary

The subjects in this study were first and third-grade students ($n = 80$) from a high income, suburban school district. During music class, the researcher administered the *Rhythm* subtest of Gordon's PMMA to measure rhythm aptitude. Walter's personal tempo measure was administered to students individually, and measurements were taken three times: the first two spaced by five minutes, and the third taken approximately two weeks later. To test motor proficiency, the BOT-2 Short Form was administered to students individually, within the six-week testing period.

An independent, qualified physical therapist scored four BOT-2 Short Form tests, and the reliability between those scores and the researcher's was high. For the PMMA,

reliability of the first-grade scores was .82, reliability of the third-grade scores was .35. An independent, qualified rater scored several personal tempo recordings and the inter-judge reliability was high. Rhythm aptitude scores, motor proficiency scores and personal tempo measurements were correlated and no significant relationship was found between rhythm aptitude and motor proficiency for first and third-grade subjects alone, or combined. This may be due to a small sample size of subjects, or poor reliability of the rhythm aptitude measure at the third-grade level.

For all subjects ($n=80$), a negative correlation was found between rhythm aptitude and personal tempo. Subjects with a high rhythm aptitude tended to have a slower personal tempo. This might provide music educators with an increased understanding of individual differences in the music classroom and suggests the need for music educators to explore various tempos in music activities to accommodate the different learning styles of students. A low correlation was found between personal tempo and motor proficiency for all subjects.

A significant difference was found between the average personal tempo measurements of first-grade subjects and third-grade subjects. In the older subjects, the average personal tempo was slower than the average personal tempo measurements of first-grade subjects.

Implications for Practice

Personal tempo may be an important factor to consider when observing students in the classroom. In this study, it was found that students who demonstrated a slower personal tempo, tended to score higher on the rhythm aptitude measure. The reverse is also true: students with a faster personal tempo tended to score lower on the rhythm aptitude measure. Knowing what tendencies students bring with them into the music

classroom can help music instruction in various ways. Taking personal tempo measurements can be a valuable tool for learning more about individual differences in our music classroom. Rather than varying the tempos of familiar songs to suit the personal tempos of students, teachers might instead choose activities that allow for creative interpretation of movement, such as moving like certain animals, or vehicles, and using student ideas to improve the variety of tempos that are introduced. Instead of always asking students to copy a teacher's steady beat, a teacher gains more information about a student's personal tempo by asking them to choose a steady tempo for the class to imitate. An example of an activity using student-selected tempos would be for a student to choose a tempo for the class to move to and ask individuals to improvise rhythmically over that movement to beat. By giving frequent opportunities for the students to select tempos for the class to work with, a teacher might not only validate the personal tempo of each student, but also allow each child to use his or her individual characteristic of personal tempo in the music classroom, thus broadening the spectrum of tempos that are introduced.

Once music teachers know the personal tempos of their students, the teachers can further modify instruction in the music classroom. For example, when a teacher knows that certain students have a fast personal tempo, he or she can select repertoire to stretch and challenge those students to explore slower tempos. Additionally, those students may experience more success performing on instruments in front of the class when songs with faster (rather than slower) slower tempos are selected. In planning organized group movement activities like folk dance and creative movement, teachers can tap into the individual needs of students when they select a balanced repertoire of music to move to, including both fast and slow dances. Gathering information about student learning is an

important way for music educators to improve instruction and modify teaching strategies to meet student needs.

Because of the finding that slower personal tempos are related to higher rhythm aptitudes, the value of slow, flowing movements in the music classroom becomes increasingly clear. For students with a fast personal tempo, being encouraged to slow down and move with continuous flowing motion would be an appropriate challenge and might provide an opportunity to explore slower tempo as a readiness for moving with beat to those tempos. Certainly moving with or without music is another way for teachers to accommodate different personal tempos and aptitude levels. Broadly, the importance of continuing to include movement activities in the music classroom may be supported by the observed relationship between personal tempo and rhythm aptitude in this study.

Given the knowledge that, as students mature, their personal tempo decreases in speed, it is important for music educators to tailor lessons to meet the changing needs of their students. In first-grade, the use of faster songs and chants would be appropriate to help students in synchronizing beat and moving to music. However, the use of slow tempos would also be valuable to students at this level, by challenging students to audiate a slower beat and feel the space and rhythm between beats. The teacher, however, needs to understand that slower tempos will be more difficult for younger children. Likewise, in third-grade, knowing that students are more capable of synchronizing beat with slower tempos would help music educators in coordinating repertoire with their students' changing needs. For example, instead of relying on the performance of steady beat, in third-grade, it would be appropriate to challenge students to feel a bigger level of beat, with more space between beats. At both levels, the use of flowing movement and continuous, fluid motion through a variety of activities would continue to benefit students

by encouraging them to explore various tempos. Additionally, music educators might recognize that their own personal tempos are different than the personal tempos of their students, and should accommodate students by varying the tempos they introduce in the classroom.

Suggestions for Future Research

The extent of the relationship between motor ability and rhythm aptitude remains unclear. Future studies would benefit from the use of a rhythm aptitude criterion measure that was geared more appropriately to the selected sample. It would be interesting to explore whether including a fourth personal tempo measurement, rather than the three used in the present study, has an effect on the relationships between personal tempo and rhythm aptitude and personal tempo and motor proficiency. In addition, future studies might also consider using the entire BOT-2 battery, rather than just the short form to have a more detailed description of motor proficiency and to determine which of the four motor-area composites are more closely related to rhythm aptitude and personal tempo. It is possible that the tasks on the longer form of the test, because they are somewhat different in nature, would have resulted in different correlational strengths.

Whereas this study provided evidence of a negative correlation between personal tempo and rhythm aptitude, further studies are necessary not only to confirm the finding, but also to extend the body of research on personal tempo and music aptitude. Perhaps these studies could use a larger sample size and include additional grade levels.

An extension of the work of Walters and Nelson would be to study the personal tempos of subjects at varying grade levels. It would be interesting to explore how the relationship between music aptitude and personal tempo changes as students grow older, and as their music aptitude stabilizes (around age 9). Extending the age range of personal

tempo measurements could determine whether the observed trend of personal tempos decreasing as students mature continues into fourth and fifth-grade, and if a plateau is reached and at what age, if so. Additionally, studying the personal tempo measurements of preschool-aged children would benefit early childhood music instruction by identifying an appropriate personal tempo range for this age level if personal tempo exists at that age level. Also of interest would be a study investigating which level of beat children choose to perform when asked to find a steady beat, as related to their rhythm or total music aptitude. Future research is needed to determine best-practice techniques for personal tempo considerations in music instruction, and would serve as an important contribution to the relatively small body of personal tempo research.

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