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THE EFFECT OF MOVEMENT INSTRUCTION ON SIXTH-GRADE BEGINNING INSTRUMENTAL MUSIC STUDENTS’ PERCEPTION, SYNCHRONIZATION, AND PERFORMANCE WITH A STEADY BEAT

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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* * * * *

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1997

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ABSTRACT

The purpose of this study was to investigate the effect of movement instruction on sixth-grade beginning instrumental music students' perception, synchronization, and performance with a steady beat. This experimental study used the posttest-only control group design. Three dependent variables (perception, synchronization, and performance) were measured to assess the impact of movement instruction on three aspects of rhythmic ability. Seventy students were randomly assigned to either the treatment or control groups. The treatment group received movement instruction generated from general music, dance, and theoretical ideas. The control group received "traditional rhythm instruction" operationalized through qualitative description of normal classroom activities. After 10 weeks of instruction, a researcher-designed battery of tests was administered. The three tests used Musical Instrument Digital Interface (MIDI) technology to ascertain detailed comparisons of the students' rhythmic abilities. A t-test of the perception measure showed that although the
abilities. A $t$-test of the perception measure showed that although the treatment group perceived the tap sequences more accurately and with less variability, the results were not statistically significant, $t(66)=.84, p=.20$. The ability to synchronize taps to a musical stimulus varied significantly as a function of group membership, $t(68)=4.22, p=.0001$, favoring the treatment group. Performances differed significantly as a function of group, favoring the treatment group, $t(68)=5.74, p=.0001$. An important implication for music teachers is the knowledge that steady beat skills can be developed, most notably in the area of overt psychomotor activities. Even with older elementary students who may be less accustomed to kinesthetic learning than younger students, movement activities may develop psychomotor awareness and lead to more steady performances. Just as students in the treatment group displayed a greater tendency to correct their synchronizations and performances in songs at various speeds, beginning music ensembles may wish to consider the value of participating in activities at multiple tempi. It may also be useful for music directors to note that longer duration notes gave students greater steadiness problems than shorter duration notes.
To Bennett and Edwin,
my musically educated cats
First, and foremost, I must thank my Mom and Dad and brother for modeling a love of learning and a drive for perfection. Their lives have been a constant inspiration to me. On the homefront, my husband Mark's support has been unwavering. He patiently listened as I debated issues aloud and took me out for coffee when the number-crunching became too much. I so appreciate the love of my family. Without their support this document would never have been completed.

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# TABLE OF CONTENTS

Abstract ................................................................................................................ii

Dedication ..........................................................................................................iv

Acknowledgments ...............................................................................................v

Vita......................................................................................................................vi

List of Tables ........................................................................................................x

List of Figures ......................................................................................................xi

Chapters:

1. Introduction .............................................................................................1

   1.1 Statement of the Problem............................................................4

   1.2 Purpose of the Study.................................................................5

   1.3 Research Questions .....................................................................6

   1.4 Ancillary Research Questions ......................................................7

   1.5 Definition of Terms ....................................................................7

   1.6 Assumptions ...............................................................................8

   1.7 Limitations .................................................................................9

2. Review of literature................................................................................10

   2.1 Methodologies ............................................................................13

   2.2 Research on Rhythm & Movement............................................16

   2.3 Relationship between Movement & Perception .......................19

   2.4 Relationship between Movement & Synchronization ..............26

   2.5 Relationship between Movement & Performance .................28

   2.6 Relationship between Movement & Other Variables..............28

   2.7 Summary......................................................................................32

viii
3. Methodology ........................................................................................................ 33
   3.1 Subjects ........................................................................................................ 37
   3.2 Instrumentation .......................................................................................... 39
   3.3 Procedures .................................................................................................... 46
   3.4 “Traditional” Activities determined through Qualitative Observation .... 49
   3.5 Treatment Group Activities ....................................................................... 51
   3.6 Data analysis ................................................................................................ 55

4. Results .................................................................................................................... 59
   4.1 Perception ...................................................................................................... 59
   4.2 Synchronization ............................................................................................ 68
   4.3 Performance .................................................................................................... 73
   4.4 The Three Dependent Variables .................................................................... 81

5. Summary, Conclusions, and Recommendations ........................................ 82
   5.1 Purpose of the Study ..................................................................................... 82
   5.2 Subjects ........................................................................................................ 84
   5.3 Summary of Method ..................................................................................... 84
   5.4 Results ........................................................................................................... 88
   5.5 Conclusions .................................................................................................... 90

References ................................................................................................................ 99

Appendices ............................................................................................................... 113
A. Perception Rating Forms ................................................................................... 113
B. Three Notated Synchronization Songs ......................................................... 118
C. Student Instructions for the Performance and Synchronization Tasks ........... 122
D. Two Notated Performance Songs .................................................................... 124
E. Content Validity Forms .................................................................................... 127
F. Verbal Explanation of Study for Students ....................................................... 132
G. Letter to Parents and Students ........................................................................ 134
H. Example Permission Forms ............................................................................. 136
I. Treatment Group Lesson Plans ......................................................................... 139
J. Perception Test Results: Frequency Distributions ...................................... 150
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Subject Count by Group and Instrument .......... 38</td>
</tr>
<tr>
<td>3.2</td>
<td>Order of test administration for the three-week measurement period .......... 49</td>
</tr>
<tr>
<td>3.3</td>
<td>Scoring grids for the tempo and steadiness subtest items .......... 56</td>
</tr>
<tr>
<td>4.1</td>
<td>$t$-test of perception scores for control and treatment groups .......... 61</td>
</tr>
<tr>
<td>4.2</td>
<td>$t$-test of synchronization scores for control and treatment groups .......... 70</td>
</tr>
<tr>
<td>4.3</td>
<td>Percentage of control and treatment students showing a majority of synchronization taps faster than the musical stimulus .......... 71</td>
</tr>
<tr>
<td>4.4</td>
<td>$t$-test of performance scores for control and treatment groups .......... 74</td>
</tr>
<tr>
<td>4.5</td>
<td>Student A performance of song one at the slow tempo .......... 78</td>
</tr>
<tr>
<td>4.6</td>
<td>Percentage of control and treatment students performing a majority of notes faster than the metronomic steady beat .......... 80</td>
</tr>
<tr>
<td>4.7</td>
<td>Spearman rank-order correlation coefficients for perception, synchronization, and performance .......... 81</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Means of incorrect responses for perception test - steadiness</td>
<td>63</td>
</tr>
<tr>
<td>4.2</td>
<td>Means of incorrect responses for perception test - tempo</td>
<td>66</td>
</tr>
<tr>
<td>4.3</td>
<td>Summed performance responses for the control and the treatment groups</td>
<td>76</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

The sense of underlying beat is an integral aspect of basic rhythmic ability (Mursell, 1937; Radocy & Boyle, 1979).

For most Western cultures and for a good many non-Western ones, the study of rhythm begins with perception and cognition of the beat and proceeds to development of performance proficiencies, such as the keeping of a steady beat. Intermediate students are asked to keep the beat by moving, tapping the foot, and so forth, whereas advanced students might be required to vary the subtlety of the beat in accordance with a given musical style. (Heller, 1989, p. 35)

Music educators as well as dance educators have advocated the teaching of a steady beat, stressing that it is the most basic rhythmic competency (Ludowise, 1985; Weikart, 1982). “Watch any group that is singing together, playing instruments, or participating in locomotor rhythmic movements activities—the greater the number of individuals who perceive the common beat, the more successful
the group experience will be” (Weikart, 1982, p. 20). Some practitioners have said that “unless an established pulse can be held steady, further development is not possible” (Warner, 1991, p. 35).

Many general music methodologies have advocated movement instruction as a primary step in the multifaceted process of learning music. The instrumental music program, however, has not ordinarily stressed this form of basic kinesthetic learning. Instrumental instructors often assume that students have developed elementary rhythmic ability before the age of instrumental ensemble participation.

Yet, this assumption may not be valid. A number of factors in the past several decades may have negatively impacted children’s kinesthetic and rhythmic development. As shown in Thompson’s (1991) study of 576 junior high students from 1970 to 1990, changes in time scheduling for classes have impacted the regularity of many general music class meetings. The number of minutes allotted to the teaching of general music has also significantly decreased over the last twenty years (Leonhard, 1991). The change of childhood activities outside of the classroom may be a further impediment to basic rhythmic ability. “Passive forms of play, as with popular electronic games, often take the place of more vigorous physical activity” (Weikart, 1982, p. 6).
Children who move away from a kinesthetic awareness are more prone to inhibition and a feeling of physical awkwardness, especially as they become older (Mursell, 1951). Because of the possible change in basic kinesthetic abilities, students may be in need of rhythmic reinforcement. As Jaques-Dalcroze (1930) stated, "if these defects are not corrected in the early years, they will subsequently appear in the playing of music" (p. 52).

Without an automatized sense of the steady beat, beginning instrumentalists are confronted with the ominous task of learning basic musical skills, as well as kinesthetic skills. Instrumental instruction adds the further challenges of note reading, technique, and aural skills to the task of feeling a steady beat. Miller's information processing theory describes the limited amount of information the brain can handle before it begins to filter out data (Miller, 1956). When confronted by a difficult task, the brain defaults to automatized strategies and practices while concentrating on the new activity. Once basic concepts are mastered, however, expectations develop about future events allowing learning to be more productive and efficient (Butler, 1992). In beginning instrumental music this can mean that those children who have an
internalized sense of steady beat will more readily learn a new concept, such as slurring or tonguing, while also maintaining a steady beat.

The question becomes what are the best means toward obtaining the goal of basic rhythmic ability. In the instrumental ensemble, this basic form of rhythmic ability becomes a multifaceted phenomenon involving not only the sensing of a steady beat but also the ability to synchronize to a steady beat and play an instrument while having internalized the steady beat. Although childhood general music pedagogues, such as Jaques-Dalcroze, Kodály, and Orff, have advocated instruction in movement concepts as a productive way to obtain basic rhythmic ability, much of the research on movement training has produced mixed findings. The many possible confounding effects of age, treatment, and numerous other musical variables, have caused music specialists to question the validity of movement training in the instrumental ensemble.

Statement of the Problem

It appears that many young musicians are entering beginning instrumental lessons with a deficit of rhythmic ability. The basic
rhythmic ability which some of these students lack needs to be addressed with the intention of alleviating the difficulty these students encounter when beginning to learn a musical instrument.

Little research has been conducted concerning the viability of movement instruction with middle school students in an instrumental setting. Although there is literature concerning movement instruction for very young students in general music settings, developmentally appropriate activities which are applicable to a more mature instrumental ensemble are not as readily available.

Research that has been accomplished with post-elementary students has most often been limited to a population of choral students, who do not have the added kinesthetic concern of instrument manipulation faced by beginning instrumentalists. Furthermore, many of the studies have been conducted in open-spaced settings, allowing for a wide range of movement activities, unlike the normally crowded instrumental classroom setting with set rows of chairs and music stands.

**Purpose of the Study**

This study investigated the effect of movement instruction on beginning instrumental music students' perception of a steady beat,
synchronization with a steady beat, and maintenance of a steady beat while performing on their instruments. Subjects were sixth-grade band students in a medium-sized, midwestern school district. Three measurements were used for the purposes of determining the effect that movement training has on each dependent variable, as well as determining the relationship of the three dependent variables.

**Research Questions**

The specific research questions were:

Do treatment group subjects receiving movement instruction perceive a steady beat more or less accurately than control group subjects not receiving movement instruction?

Do treatment group subjects receiving movement instruction synchronize to a steady beat more or less accurately than control group subjects not receiving movement instruction?

Do treatment group subjects receiving movement instruction perform on their instruments more or less steadily than control group subjects not receiving movement instruction?
Ancillary Research Questions

Beyond the hypothesized relationships of treatment and perception, synchronization, and performance, the ancillary research questions that were addressed were:

1. Do sixth-grade subjects perceive taps with a great amount of precision (continuously) or in large segments (categorically)?

2. To what degree do sixth-grade subjects' synchronizations speed up, slow down, or show an unsteadiness factor throughout an example?

3. What contextual factors in the music help or hinder synchronization scores?

4. To what degree do sixth-grade subjects' performances speed up, slow down, or show an unsteadiness factor throughout an example?

5. Are large performance deviations more apparent with longer duration notes or shorter duration notes?

6. To what degree do the three dependent variable measures correlate with each other?

Definition of Terms

Movement Instruction can be constitutively defined as the teaching of “sequences or patterns of body movements that combine
elements of time and space" (Weikart, 1982, p. 3). For the purposes of this study, movement instruction was operationalized through a 10-week treatment, designed and taught by the researcher. The instruction began with bilateral activities and progressed to alternating sequences involving flow, weight, space and time.

Beat can be constitutively defined as the "unit of measurement of rhythmic pulse of music" (Kennedy, 1980, p. 56). For the purposes of this study, abilities related to the steady beat were measured by a perception score, a synchronization score, and an instrumental performance score for each subject. In the perception task each subject rated the perceived steadiness of click track listening examples. In the synchronization task each subject tapped a steady beat to sequenced musical examples. In the performance task each subject performed a musical example on his or her own musical instrument.

Assumptions

The following assumptions have been made in this study:

1. All subjects possess normal physical abilities.

2. Musical Instrument Digital Interface (MIDI) recording is a valid method for collecting data on the performances.
3. It is possible to implement a test using nonverbal techniques to measure perception, synchronization, and performance skill.

4. All students have obtained a basic level of proficiency on their musical instruments; therefore, the skill level requirements of the performance test will not directly interfere with each student's ability to perform with a steady beat.

Limitations

The present study was limited to the investigation of a movement treatment on the steady beat abilities of sixth-grade beginning instrumentalists in one school. No attempt was made to measure instrumentalists in different grade levels, at different experience levels, or from differing locations.

Acknowledging that "artistry lies not in maintaining a rhythmic pattern in even time, but rather in the hearing and making artistic deviations in the pattern" (Seashore, 1938, p. 147), this study limited itself to the primary stage of rhythmic ability learning—maintaining a steady beat— with the hope that future research could evolve from this information and possibly yield information on artistic deviations from the steady beat.
Numerous music education documents have stressed kinesthetic learning as a facilitator to basic forms of rhythmic understanding. The Music Educators National Conference (MENC) underscored this concept in 1946 by stating that "bodily response to music of simple rhythms was fundamental to rhythmic learning" (Sidnell, 1981, p. 29). General music textbooks have further accentuated the beneficial relationship between movement and rhythm by emphasizing the developmental appropriateness of movement activities for young children (Ernst & Gary, 1965; Hoffer, 1964; Nye, Nye, Martin, & Van Rysselberghe, 1992; Swanson, 1981). Documents such as these highlight the young learner as the perfect candidate for rhythmic growth through movement experiences (Choksy, 1981).
Developmental theorists have proposed a hierarchy of cognitive stages in which active manipulation appears as the initial stage (Bruner, 1960; Piaget, 1973; Vygotsky, 1962). Bloom (1976) organized a taxonomy of educational objectives related to learning. The hierarchical stages begin with basic knowledge of a topic, progressing to increasingly complex applications and analysis of the topic. The most basic stage, "which is at a very low level of abstraction, may be thought of as the element from which more complex and abstract forms of knowledge are built" (Bloom, 1956, p. 201). For example, "knowledge of the processes, directions, and movements of phenomena with respect to time" (Bloom, 1956, p. 202) can provide learners with a holistic setting for basic skill acquisition. "There is hardly a better way to present a concrete representation of an abstract idea than through visual and tactile experience that is reinforced and coordinated with the auditory and the kinesthetic" (Mark, 1986, p. 172).

Music education theorists have clearly emphasized the connection between movement and rhythmic learning in statements such as: "underlying rhythmic behaviors is the ability to perceive rhythmic structures and perform rhythmic movements" (Radocy & Boyle, 1979, p. 103). Even though many of these theories have factionalized into
subtheories, such as physiological theories (Jaques-Dalcroze, 1921) and motor/learned theories (Lundin, 1967; Mursell, 1937), each acknowledges the value of movement as a rhythmic facilitator.

Theorists who advocate movement are often emphatic about the developmental need for movement education: “Rhythm must be taught through muscular response. Unless this is done, it can never be taught properly” (Mursell & Glenn, 1938, p. 188). Many of these theorists are as emphatic about the derogatory effects of the more analytic type of early rhythmic learning. “Music and art are intrinsically nonverbal, yet these arts are taught at the present time primarily on the verbal level. There is a conflict here and a basic misunderstanding” (Fowler, 1966, p. 127).

As Mursell (1934) stated:

> The idea that rhythmic grasp depends upon the experience of free expressive bodily movement is an admirable instance of the expert direction of a piece of primary learning. It is entirely and indubitably correct. To attempt to develop the sense of rhythm by essentially arithmetical means, such as counting and subdividing time values, is excessively clumsy (p. 195).

Although there are many theorists who have advocated the use of movement in the music classroom, there are also those who have felt movement to be an unnecessary technique. Seashore (1938) headed a
group of instinctive theorists who proposed that rhythm was an inherited trait that could not be improved through training. Other supporters of this conservative school, such as T. P. Giddings, Will Earhart, and Jacob Kwalwasser, felt that note-reading and singing should be the primary emphasis of early music training. Although a more progressive view of educational aims and the success of Dalcroze's Eurhythmics helped to persuade many of the value of movement experiences, the debate still continues as to the worth of movement training (Campbell, 1991).

Methodologies

Many music educators believe that the abilities related to steady beat form the foundation of rhythmic learning and provide structure for the future growth of musical skills (Gordon, 1989; Mursell, 1951; Weikart & Lambie, 1970). "The ability to play music in time is one of the fundamental skills that a musician must possess. Whether solo or with accompaniment, music is played in relation to an implied or audible beat and the timing, relative to this beat, cannot be tampered with by any more than the smallest amount" (Gordon & Martin, 1993/94, p. 59).
Numerous general music methodologies stress the need for movement as an assistance mechanism to rhythmic learning. Although each methodology emphasizes different aspects of musical learning, a dominant theoretical basis is the belief that movement instruction can serve to internalize a sense of beat (Choksy, 1981; Gordon, 1989; Jaques-Dalcroze, 1930; Warner, 1991). Free expression activities as well as locomotor and nonlocomotor movements displaying the beat, the divisions of the beat, and the subdivisions of the beat may provide the foundation for further musical growth (Mark, 1986).

With the young learner, many music specialists stress uninhibited motor exploration activities which work in conjunction with the child's own personal tempo (Jaques-Dalcroze, 1930; Montessori, 1965). Montessori emphasized the learning potential of children between three and six years of age, saying that they are "sensitive to sensory-motor activities, which provide foundations for subsequent intellectual development" (Barnett, 1973, p. vi). Methodological theorists concern themselves with developmentally appropriate tasks. As Kodály advocated, "the child's body relates more easily and naturally to self-produced music than to music from an external source, instruments or records" (Choksy, 1981, p. 22). The Orff methodology utilizes
kinesthetic activity which “is transferred from the body to a family of melodic and percussive instruments. Not only do the instruments provide opportunities for movement, but they offer the chance for improvisation” (Mark, 1986, p. 122).

The educator who is well versed in many methods can apply various procedures to each learning task, all contributing to a unifying, foundational goal. As Mursell stated, “Anything can be taught effectively in a considerable number of ways. There is hardly ever any one, unique, ‘best’ method” (1934, p. 197). “Children profit intellectually from any curriculum that is based on a wide range of experiences” (Weikart & Lambie, 1970, p. 88). A variety of experiences will not only enliven the learning environment, but can also positively contribute to the education of students with diverse learning styles (Sheldon, 1991).

“The planning of musical experiences that make possible such interaction and translation seems to be a crucial strategy in sponsoring the achievement of music concepts interrelated in a useful structure” (Aronoff, 1969, p. 33).
Research on Rhythm and Movement

Numerous researchers have studied the assumed relationship of movement and rhythm. Advocates of movement instruction have reported increases in sight-reading skill (Boyle, 1970; Skornicka, 1958), general rhythmic ability (Cheek, 1979), affect (Callen, 1985; Carlson, 1983; Cheek, 1979; Rowen, 1967), expressiveness in conducting (Miller, 1988), developmental music aptitude (Blesesdell, 1991; Moore, 1984), and tempo perception skills (Schmidt & Lewis, 1987) following movement instruction. Serving as a theoretical link to much of the research is the belief that kinesthetic training can provide a useful way for many children of various learning style dispositions to musically develop (Bennett, 1981; Hibbard, 1994; Lewis, 1989).

Although movement has been documented as a useful learning strategy, its effect in a training situation has had mixed results. Certain studies have noted a lack of improvement, citing movement instruction as more difficult than counting (Salzberg & Wang, 1989) and a distraction to rhythmic learning, in that the students concentrate on the movements more than the music (Persellin, 1992). Perceptual studies often show improvement in one perceptual domain and a lack of improvement in another (Cheek, 1979; Lewis, 1988; Lewis, 1989; Schmidt
& Lewis, 1987). Many researchers studying mixed age groups postulate that maturation, rather than training, may have the greatest effect on improvement (Gardner, 1971; Groves, 1969; Jersild & Bienstock, 1935; Smoll, 1974; Smoll, 1975). As Lewis (1988) hypothesized, "If musical listening skills develop gradually, movement-based instruction may produce long-term rather than immediately discernible changes" (p. 132).

The most extensive body of information concerning movement instruction can be found in studies determining the effect of instruction on students' perception of musical characteristics, ability to synchronize to an external stimulus, or performance level. Past research has cited perception, synchronization, and performance abilities as basic components of rhythmic learning (Radocy & Boyle, 1979; Thackray, 1969; Thackray, 1972). Studying the cognitive as well as the skill-oriented aspects of rhythm corresponds to the theoretical belief that rhythmic response involves a perceptual as well as a motor response (Lundin, 1967). Although some studies concentrate on one dependent variable, others provide multiple measures to assess the differential change that the treatment may have on several criterion variables.
In rhythm instruction, measurements involving multiple factors may provide a more comprehensive understanding of rhythmic skill (Cuddy & Upitis, 1992). Multiple measures display the discrete strengths of each subject in relation to a general rhythmic ability. Even though, in practical terms, it may be difficult to separate the interdependence of a motor response from a perceptual one, learning may impact one area more than another (Lewis, 1988).

Thackray (1969) indicated that the imperfect correlation of multiple rhythmic variables demonstrated the differential learning of rhythmic skills. In this way, Douglass (1977) and Jordan (1986) noted improvement on a performance/action test, but not a written/cognitive measure after a movement training program. There may be a multitude of reasons for the discrepancy in training impact found in many studies. While it may have to do with the innateness of rhythm perception skills, as Seashore (1938) believed, or, the inherently cognitive aspect of perceptual testing which clouds the measurement process, as Thackray (1972) believed, a definitive answer is not clear.
Relationship between Movement and Perception

Rhythmic perception serves as a basic factor in any musical activity. "The perceptual side is emphasized when we simply listen to a rhythmic pattern or analyze some composition for its rhythmic content" (Lundin, 1967, p. 101). These perceptions involve "both perceptual organization of rhythmic stimuli and discrimination among stimuli" (Radocy & Boyle, 1979). Todd (1995) hypothesized that perception of rhythm and motion are inextricably linked. The distinction between constant tempo and variable tempo can be compared to the difference between consistent, pendular motion and a more free, gestural motion.

Although perception is considered to be an interdependent aspect of the basic movement process (Lundin, 1967), critics stress the lack of empirical evidence in support of a cognitive/psychomotor connection. Activities designed for discrimination improvement may be more effective than experiences that rely on transfer from other experiences (Gebhardt, 1973). Some researchers qualify the conditions under which the perceptual/body connection might exist. Ellis (1992) speculated that the perception and performance skills of children in grades three through six may become more integrated.
Many studies have obscured the relationship between movement and perception by asking subjects to physically demonstrate perceptual competence. This research technique confuses the covert perceptual ability with an overt movement ability (Rainbow, 1981). Under these auspices, perception of beat has been assessed using action measures such as marching to a beat, chanting rhythms, and ability to count (Lundin, 1967; Petzold, 1969; Radocy & Boyle, 1979).

Context complexity is yet another broad factor which has been found to cloud perceptual research findings. Many researchers have disagreed as to what amount of musical context is appropriate for valid and meaningful rhythmic research. The belief that “rhythm training solely concentrated on structural aspects in patterns isolated from any musical context is highly insufficient” (Gabrielsson, 1982, p. 45) has lead many researchers to investigate perception in a musically complete setting. Dowling (1973) and Deutsch (1982a) noted the way that metric grouping of pitch sequences assisted the memory capability of subjects. Many context-inclusive studies, however, have not only reported conflicting results concerning context and perception, but have also been clouded by the question of what aspect of the research actually had the effect on the outcome measure.
Boisen (1981) and Schellenberg & Moore (1985) found a melodic-rhythmic context to have a beneficial effect on rhythmic perception. Petzold reported that a melodic-rhythmic setting did not affect perception in auditory tasks (1960) or rhythm performance (1966). Moog (1979) and Sink (1983,1984), however, found that melody may indeed interfere with students' abilities to attend to rhythmic structure. As Duke (1989) noted, "The relative tempo judgments of listeners with limited musical training may be greatly confounded by the melodic content of the musical examples employed in discrimination tasks" (p. 256).

Contextual overload may severely hinder the attention and memory capabilities of some subjects (Love, 1989; Sloboda, 1985). Both too much information at one time and information that is too complex can cause overloading. As Fiske (1987) noted, "Discrepancies of a 2nd required more processing time than did discrepancies of a 6th; diatonic discrepancies required more time than did chromatic discrepancies; and identifying the type of discrepancy required a greater amount of response time than simply detecting discrepancies" (p. 35).

Contextual distracters can, therefore, be a major factor in valid and reliable measurement and evaluation. Subjects who experience
information overload may rely on categorical perception to simplify the data. "Categorical perception is the phenomenon whereby stimuli that differ by equal steps along a continuum are assigned by listeners into distinct categories, despite the physically continuous nature of the stimuli" (Howard, 1992, p. 205). When incoming musical material does not fit with an individual's internal structure, then perceptual distortions of the material may result. These distortions apparently are the attempts of the individual to make the musical material fit their own internal structure (Povel, 1981).

In normal life settings, the benefits of categorization are numerous. The ability to categorize allows individuals to "separate relevant from irrelevant items" (Dixon & Shedden, 1987, p. 457), increase the "accuracy of judgment" (Miller, 1956, p. 90), and "decrease reaction time" (Harnad, 1987, p. 18). In fact, "categorical perception may not only furnish the building blocks—the elementary units— for higher-order categories, but it may also provide a representative model for the categorization process in general" (Harnad, 1987, p. 3). Miller (1956) highlighted the ability to encode a greater amount of information as a benefit of "chunking" or categorizing information groups.
"In music as in language, we are aware of the grammatical features of the stimulus" (Aiello, 1994, p. 46). "Mental structures may facilitate comprehension of global aspects of musical structure and lead to expectations about future events" (Palmer & Krumhansl, 1990, p. 728). For complex information like music to be internalized it must be encoded in an efficient manner for ease of operation and retrieval. Hence, music listening involves a selection process "in which certain elements in the total complex of the musical experience become controlling while others are subordinated" (Mursell, 1937, p. 201). The musical information is analyzed and synthesized according to structural and musical rules (Deutsch, 1982a; Deutsch, 1982b). Bruner (1973) alluded to each individual's ability to categorize efficiently as a perceptual readiness factor that can inhibit or enable understanding.

Although categorical perception can facilitate learning, the major drawback associated with categorization must also be recognized. Students who categorize continuous data into discrete cells are demonstrating the inherent loss of precision which can accompany categorization. This lack of precision makes it difficult for the educator or researcher to understand students' degrees of comprehension. Musical context may play a big part in a student's perceptual acuity. As
Sloboda (1985) stated, “under ‘ideal’ conditions a listener may, indeed, be able to detect certain small differences in timing or tuning, but in the welter of a complex musical event discrimination may be much poorer” (p. 85).

Acontextual musical settings, while having the advantage of a controlled testing scenario, may have their own set of confounding factors. Povel and Essens (1985) hypothesized that an individual’s internal clock may not be accessed when music devoid of accent is heard, for example.

Contextual aspects of the learning environment may affect the precision capabilities associated with categorization. Familiarity of the musical material (Lynch, Eilers, & Bornstein, 1992), meaningful context (Fiske, 1982), and repetition (Zatorre & Halpern, 1979), can all positively or negatively affect memory storage depending on the degree of attentional saturation. Acculturation to a native musical idiom has often been cited as a memory enhancer (Lynch, et al., 1992; Lynch, Eilers, Oller, Urbano, & Wilson, 1991; Morrongiello, 1992; Palmer & Krumhansl, 1990; Siegel & Siegel, 1977; Walker, 1987).

Research settings utilizing a melodic-rhythmic context can be further confounded by subjective rhythmic alterations of the beat, such
as rubato and accelerando. “In an actual performance all the notes will be more or less out of time, but the listener must build a conceptual structure which adequately represents the rhythmic relationships between them” (Longuet-Higgins & Lee, 1982, p. 115).

The expressive element can, however, serve two very positive purposes for the listener: The variety that expressive performance provides can bring musical interest to a piece, and the structure that expressive performance can add by highlighting the important elements of a musical work can aid in the musical comprehension for the listener. As Todd (1985) stated, “Hierarchical slowing at points of stability is a kind of parsing device that enables the listener to perceive the hierarchical structure of the music and thus to comprehend the complex musical relationships at the surface” (p. 49). There also exists an inherent perceptual problem associated with expression - that of ambiguity. The manipulation designed to heighten anticipatory expectation can impair listeners’ perceptual skills.
The lengthening of a note can indicate that it is accented, that it finishes a structural unit at some level, or that the following (delayed) note is of structural significance. Similarly, although an underlying correlation between structural significance and increased legato articulation appears to prevail, it is not uncommon to find structural significance indicated by means of emphatically staccato articulation. (Clarke, 1985, p. 228)

Tempo has also been shown to be an extremely important factor in beat perception (Handel & Lawson, 1983). Wang (1984) found that subjects required "more time to perceive tempo increase than decrease, more time to perceive tempo change when the rhythm was uneven than even, and when the melody was played alone than when accompanied with steady rhythm" (p. 174). Tempo, however, may also be context specific; Brittin (1992) found subjects responded more accurately to the increased tempo of a fast excerpt, and the decreased tempo of a slow excerpt.

**Relationship between Movement and Synchronization**

The general ability to synchronize to a beat plays a fundamental role in ensemble setting where musicians must play together (Fraisse, 1982). Many researchers have tested synchronization by asking subjects
to synchronize a movement to a musical stimulus. In this way, synchronization tasks can show basic motor responses devoid of technical performance skill.

Studies involving synchronization highlight the many contributing factors that may influence rhythmic assessments. Many studies note the difficulty that young subjects have with synchronizing movement to music (Gordon & Martin, 1993/94; Grieshaber, 1987; Rainbow, 1981; Thackray, 1972). "Entries were more frequently early than late, owing to the failure to feel the pulse through to the end of each phrase. Triple time generally gave more trouble than duple or quadruple: slower tempi proved more difficult than fast" (Thackray, 1972, p. 41).

Whether the ability to synchronize is stabilized or even fixed early in life (Petzold, 1969; Bayless & Ramsey, 1991) or whether accuracy increases with age (Cox, 1977; Schleuter & Schleuter, 1985; Ellis, 1992) remains unresolved. The degree of improvement that students can gain from rhythmic training is yet another debated question (Groves, 1969; Howell, Flowers & Wheaton, 1995). Personal tempo (Nelson, 1991; Walters, 1983) and the developmental difficulty of the movement task (Frega, 1979; Rainbow, 1981) may also directly impact subject success rate.
Relationship between Movement and Performance

Research describing steady beat performance in a musical setting is limited. Wis (1993) provided a philosophical study which cited active participation, visible accountability, metaphoric learning, natural inclination, and aesthetic sensitivity as viable reasons to use kinesthetic learning in the choral rehearsal. Major (1982), McCoy (1989), and Jordan (1986) noted experimental group improvement in maintaining a steady pulse in high school ensemble settings. Ellis (1992) stated that young musicians are more likely to perform faster than the provided tempo and, in general, young musicians are more accurate at faster tempi. Kuhn and Gates hypothesized that performance tempi may increase more often because any decreases are perceived more quickly and accurately than increases (1975).

Relationship between Movement and Other Variables

Researchers have investigated the effect of numerous other variables in order to obtain a comprehensive view of rhythmic ability. Although age and gender have been found in some studies to be stronger contributors to rhythmic movement ability than any form of training,
other studies propose that “disparate results may be due to interactions among age, gender, and training variables” (Sink, 1989, p. 9). Interactions may also have an effect on other confounding variables such as the combination of age and learning disability (Gilbert, 1983). These interactions may be more telling than the noted lower movement performance scores (Atterbury, 1983; Brunt, Magill, & Eason, 1983) documented for the learning disabled population.

Schleuter and Schleuter (1985), and Ruffer, Grapenthin, Huey, & Patterson (1985) noted the significant effect of gender. Girls in grades one through three displayed higher rhythmic scores (Schleuter & Schleuter, 1985), while boys in grades seven though ten had quicker reaction times in measured psychomotor tasks (Ruffer, et al., 1985). In a study by Gilbert (1981) the effect of gender was not consistent across all tasks. Zikmund and Nierman (1992), Thackray (1972) and Smoll (1975) discovered no difference attributable to gender. Frega (1979), Groves (1969), Schleuter and Schleuter (1985) and Ruffer, et al., (1985) found maturation to be a significant factor in rhythmic ability; students in higher grades displayed improved rhythmic abilities. Thackray (1972), Zikmund and Nierman (1992), and Weikart (1982) found no such relationship. Noting that maturation did not contribute substantially to
rhythmic development, Weikart (1982) concluded that training may factor out any differential movement experience that boys may lack in the early years, and therefore minimize any gender discrepancies related to rhythmic achievement.

Even within the group of individuals who support movement training a lack of consensus exists as to which movements are most appropriate. "Some early childhood music specialists recommend exploring the beat first via small muscle movements (by tapping or chanting beats) while other specialists support the importance of and need for beat exploration via large muscle movements (walking to beats)" (Sink, 1989, p. 1). As Schleuter and Schleuter (1985) stated:

Clapping, stepping, and chanting patterns are frequently used as teaching techniques. Music teachers often assume that these tasks are appropriate and effective for all students regardless of grade level and that these response tasks accurately represent student achievement. (p. 24)

This concern has led researchers to experimentally document that the most difficult movements involve locomotor activities and multiple level activities, such as walking and clapping at the same time (Frega, 1979; Rainbow, 1981; Schleuter & Schleuter, 1985; Schleuter & Schleuter,
In contrast, Jersild and Bienstock (1935) reported no difference between walking and clapping movement techniques. But, as Sink (1989) added:

Perhaps, whether music educators should use large or small muscles during early beat experiences is not the complete question. Rather the problem of providing successful beat experiences also relates to using inappropriate or appropriate instructional preparation for movement activities involving large-muscle, locomotor coordinations. (p. 7)

Therefore, instead of dogmatizing the sequence or content of instructional practices, many researchers have advocated a wide application of instructional practices:

Teachers might want to encourage students to respond to rhythmic patterns discernible at various levels of musical organization in a number of ways, so that flexibility and involvement with the music rather than a single, rigid manner of assimilation, might be promoted. (Gardner, 1971, p. 360)

The realization that “not all students will benefit equally from movement-based instruction” (Lewis, 1989, p. 16), reinforces the need for a variety of instructional practices. If some students improve their perceptual skills through certain movement activities, and others
improve their ability to synchronize through other activities, then it seems that with a greater variety of instructional practices, there may be a greater likelihood of student improvement.

Summary

The review of literature has highlighted research on many aspects of rhythmic ability. The current study seeks to measure the effect of movement training on three aspects of rhythmic ability. Although there have been studies that have measured young children, or young adults, in choral or general music settings, on one or possibly more dependent measures, there are no studies which measure beginning instrumentalists (6th grade) on three rhythmic abilities. Moreover, the current study may be valuable in its individualized testing of synchronization and performance which allows for a more discriminating look at rhythmic ability than a group measure can provide. The perception measure could be valuable in its investigation of rhythmic perception which factors out the confounding aspects of musical ambiguity. The movement treatment differs from past research in that it can be implemented in a large ensemble or small group setting of seated instrumentalists.
CHAPTER 3

METHODOLOGY

Research Design

This experimental study used the posttest-only control group design. There were relatively few threats to internal validity related to the specific design that may have had an effect on the outcome of the study. There are threats, though, which “cannot be controlled by any design, since they are independent of the design itself” (Fraenkel & Wallen, 1993, p. 248). The involuntary threats, the minor threats endemic to the design, and the subsequent control measures noted for the purposes of the present study are listed below:

Mortality - The attrition rate of the treatment group and the control group was analyzed to note any possible unequal attrition in terms of number of subjects. Because all students continued to the end of the study, this threat was nonexistent.
Implementation - Researcher bias was monitored through the review of audiotaped, treatment and control group teaching episodes.

Data collector characteristics and data collector bias - Data collector threats resulting from variability in data collection were controlled by using the researcher as sole collector. Bias in administration of the posttest was unlikely because of the computer-generated nature of the instrument, leaving little manipulative control to the collector.

Intrasession History - A qualitative journal was kept to document the possible extraneous events which may have affected one group over the other. During the week of state-mandated proficiency testing for eighth-grade students, all sixth-grade students had one-hour blocks of classes. Due to the longer periods, not all classes met every day. Although the testing was a scheduling distraction, it did not affect the groups unequally.

Attitudinal - The researcher was present in the classroom as an aide for three months prior to the treatment. The novelty of a new instructor's presence was, therefore, reduced. Subjects from the treatment group were taken out of regular class time to
experience the movement training. To counter the possible effects of novelty, control groups were also taken out of regular class time to experience the reinforcement of classroom rhythmic topics with the researcher. The classroom teacher validated the researcher's equal treatment of subjects in aspects other than the administration of the independent variable.

Location - The instruction for the treatment and control groups was administered to all subjects under similar conditions. Although two rooms were used, both rooms were appropriate and equitable.

Generalizability has been approached through detailed description of the accessible population, i.e., sixth-grade beginning instrumentalists in a medium-sized, midwestern school district. It is assumed that the target population is equal to the accessible population, and no further inferences have been made. The population validity subcategory of external validity has, therefore, been described instead of controlled.

The possible ecological threats to external validity and the subsequent control measures or concessions noted for the purposes of the present study are listed below:
Hawthorne effect - Although subjects' knowledge of participating in an experiment may indeed alter the response to treatment, both treatment and control groups in the current study experienced instruction from the experimenter. Hence, knowledge of the "special" group was obscured.

Experimenter effect - The concern that the researcher was an expert on the treatment and the expertise was the reason for a difference between groups was controlled by using easily approachable procedures taken from general music textbooks, theoretical articles, and books.

Posttest sensitization - It was unclear whether students who do not have the opportunity to learn from a posttest would be as successful as those who do take the posttest. Generalizations, therefore, were not made to any students not taking the posttest.

Interaction of history and treatment effects - A qualitative journal was kept to document the possible extraneous events which may affect ecological generalizability.

Interaction of time of measurement and treatment effects - It is unclear whether the dependent variable scores, measured immediately after the treatment, will be durable over
time. Replication of the experiment in different settings, with different populations, at different points in time, would help to build the external validity of the current set of findings.

Subjects

The population of the study was sixth-grade beginning instrumentalists from a medium-sized, midwestern school district. The school was chosen as an experimentally accessible population. All middle school students in the district experienced general music in grades K-5 at one of five elementary schools that send students to the middle school. Sixth-grade students were then provided with the opportunity to join band and learn a wind or percussion instrument as a component of the middle school integrated arts program.

The 102-member class of beginning instrumentalists used for this study represented 43% of the sixth-grade population of the school. From the 102 sixth-grade beginning instrumentalists, 70 affirmatively replied to the human subjects consent form. The 45 females and 25 males who replied were then randomly placed into the treatment or the control group. Of the 70 participating students, 67 were Caucasian, 2 were African-American, and one was Asian. These racial demographics reflect
the corresponding data in the school and community. Table 1 shows
the breakdown of instruments studied by students in the treatment and
control groups.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Treatment Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flute</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Oboe</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Clarinet</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Eb Alto Saxophone</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Trumpet</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>French Horn</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Trombone</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Baritone</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Percussion</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>35</td>
<td>35</td>
</tr>
</tbody>
</table>

Table 3.1: Subject count by group and instrument.
Instrumentation

The present study measured the three variables of perception, synchronization, and instrumental music performance on three researcher-designed tests. The taps for the perception test and the songs for the synchronization test were sequenced using Opcode Systems' Vision 2.0 (1993) and were patched through a Yamaha PSR-410 synthesizer. Song notation for the performance test was produced through Coda Music's Finale software (1990). Recording of the performance test was done on a Sony DAT TCD-D7 recorder with Sony SRS-PC40 powered stereo speakers. Digital audio tapes (TDK, DA-R60) were used to ensure that note attacks were as precise as possible. Analysis of the performance test was conducted using Digidesign's Sound Designer II software (1994).

The perception instrument consisted of two parts. The first task asked subjects to listen to eight successive taps generated from a synthesizer and then recorded onto digital audio tape (DAT). The primary two taps in each example represented steady beats, providing subjects with the ability to compare from the third tap on (Fraisse, 1982). In the following six taps, two taps were placed that may have
had some degree of unsteadiness. The randomly placed taps ranged from exactly steady to as much as one-half of a beat before or after the intended steady beat.

The subjects rated their perception of steadiness for each exercise on a linear rating scale ranging from steady to very unsteady (Hopkins & Stanley, 1981). Example rating scales and answer sheets can be found in Appendix A. A perfectly steady series of eight taps was provided before each item, so as to avoid any carry-over effects in the form of psychological comparisons made to the steadiness of the previous item. The students completed three practice exercises before starting the test. The practice items showed the range of possible responses on the linear scale. The tempo of 90 taps per minute was used as a documented, appropriate median tempo for perception tasks (Geringer, Duke, & Madsen, 1992; Kuhn, 1974). The students answered 15 questions related to steadiness.

The second perception task also asked the students to listen to eight successive taps generated through a synthesizer. Instead of placing an unsteady factor somewhere in the example, however, this perception task introduced a degree of tempo modulation across the example. All examples began at 90 beats per minute and then the taps either sped up
to some degree, slowed down to some degree, or remained at the set tempo. The possible responses ranged from an item that decreased to an ending tempo of 66 beats per minute to an item that increased to an ending tempo of 130 beats per minute, with 90 beats per minute being the constant, perfectly steady response. The subjects rated their perceptions of the overall tempo maintenance of each exercise on a linear rating scale ranging from steady to “big tempo change” (Hopkins & Stanley, 1981). Example rating scales can be found in Appendix A. Again, a perfectly steady series of eight taps was provided before each item, so as to avoid any carry-over effects in the form of psychological comparisons made to the tempo modulation of the previous item. The students completed four practice exercises which showed the range of responses before starting the test. The students answered 18 questions related to perception of tempo modulation.

The perception instrument was administered in a group setting and provided a summed score, describing each subject's ability to perceive various degrees of beat steadiness. Twelve has been documented as an adequate number of items for rhythmic test sections (Geringer, et al., 1992; Gordon & Martin, 1993/1994; Schleuter &
Schleuter, 1985). Fifteen- and 18-items were used, respectively, to adequately represent each of the distinct deviations from the steady beat.

The synchronization task asked subjects to listen to a musical example and synchronize with a finger tap. Subjects tapped the synchronization responses on a keyboard linked to a computer. The three songs that were used as musical examples were quantized for steady tempo, equal note values, and equal velocity. As in Froseth's (1986) audiotaped measure of kinesthetic response, the segments represented both duple and triple meters. Tempi of the three examples ranged from 60 to 120 beats per minute, as has been cited as appropriate in research (Duke, 1989; Duke, Geringer, & Madsen, 1991; Geringer, et al., 1992; Kuhn, 1974). For each song, the students tapped 48 to 59 times, depending on the length of the musical example. The three song examples can be found in Appendix B. After hearing four “in tempo” introductory taps and then four taps synchronized to the musical example, the subject were asked to continue the steady beat of the musical example without the assistance of the provided taps. The subjects provided the synchronized beat using a single finger tapping gesture with their dominant hand (Grieshaber, 1987). Each tap
produced a tone two octaves above the melody so that the subject could monitor the synchronization. Student instructions for the synchronization task can be found in Appendix C.

Subjects tapped the responses on a Yamaha synthesizer linked to a Macintosh computer using Vision software (1993). This technology recorded the accuracy of the response in relation to the actual metronomic beat of the example. The item sequence within the task was counterbalanced to help control for a possible order effect. The measurement was administered to each subject individually and provided a summed score, describing the total absolute value of the unsteady responses across all items. In this way, a response 10-milliseconds fast and another response 10-milliseconds slow were both scored as deviating from the standard by the value 10. Descriptive data on type of unsteadiness (i.e., tendencies to rush or delay) were also compiled.

The performance task asked subjects to perform on their own musical instrument. Researcher-composed songs were used to help control for any possible regression of tempo to a commonly learned tempo associated with a familiar song. The skill requirements of the songs were kept to a minimal level so as to avoid performance ability as
a confounding variable. Song material was validated through comparison to materials covered in the instrumental music method book. The technical level of the songs was easier than the music which the students were practicing in band, but included the same note values, key centers, and meters. The songs were rehearsed in a group setting to control for the possibility of diverted attention from the primary task of steady performance to the extraneous tasks of reading and playing an unprepared piece of music (Ellis, 1989). The three songs were introduced to the group at a slow, a medium, and a fast tempo. The subjects were then directed to practice the songs at home at a slow, a medium, and a fast tempo. The two researcher-composed song examples can be found in Appendix D.

The subjects were asked to perform each song three times, at 60, 90, and 110 beats per minute. The tempo was given in eight taps prior to each performance. The students performed each song without the assistance of a synchronized metronomic tap. The performances were analyzed using Sound Designer II (1994) software. This technology recorded the accuracy of each performance in relation to the metronomic steady beat of the example. The measurement provided results in real time, detailed in hundredths of a second. Song sequence
within the task was counterbalanced to help control for a possible order
effect. The measurement was administered to each subject individually
and provided a summed score, describing the total absolute value of the
unsteady responses across all performances. Student instructions for the
performance task can be found in Appendix C.

The three dependent variable instruments were reviewed for
content validity by a panel of three experts in the fields of music
education and music perception. The content validity information can
be found in Appendix E. The following changes were made to the initial
instruments based on the panel members' responses.

1. The tempo range of the perception measure was modified for
the slowing items to an increment of six beats per minute (bpm) instead
of 10 bpm.

2. The slow synchronization song was replaced with a song that
had eighth-notes instead of sixteenth-notes as the smallest division of
the beat.

3. Simplifications were made to one of the performance songs to
avoid any possible confounding skill requirements. Two moving note
passages were changed to repeated note passages.
The measurement instruments were tested for reliability in a comparable school setting with sixth-grade beginning instrumentalists. Gender was balanced in the pilot study sample. Five musical instrument families were represented (flute, clarinet, Eb alto saxophone, trumpet, and trombone). The perception, synchronization, and performance measurements each resulted in a single, summed score for each individual on each test. A test-retest format was used with a Spearman rank order correlation coefficient. The reliability measure evaluated the consistency of the subjects' performances across testings. The test-retest format provided the further benefit of a stability check because of the two-week passage of time between measurements. The perception measurement resulted in a reliability coefficient of $r_s = .80$. The synchronization measurement resulted in a reliability coefficient of $r_s = 1.0$ and the performance measurement resulted in a reliability coefficient of $r_s = .90$.

**Procedures**

The experimentally accessible population for this study was solicited for participation on the basis of its well-grounding in a balanced curriculum for beginning instrumentalists. The band director
was an alumna of The Ohio State University and had also been a cooperating teacher for collegiate student teachers. Before the inception of the study, compliance was obtained from the following people: superintendent of the school district, principal and vice-principal of the school, the school’s band director, and the University’s Human Subjects Review Board.

The researcher spent three months as a teaching aide in the sixth-grade instrumental music classroom. The three-months class time provided a comprehensive look at the activities which were normal for the setting. These activities were then used as control group rhythmic activities. At the end of the three months, the researcher verbally explained the study and provided a letter of explanation and a permission slip for each parent and student to sign if they were interested in participating in the study. The students had three weeks to return the permission form. The verbal explanation of the study can be found in Appendix F. The letter to parents and students can be found in Appendix G, and example permission forms can be found in Appendix H.

The participating students’ names were then randomly drawn and placed in either the treatment or control group. Even though both the
control and treatment groups participated in activities with the researcher, only the treatment group received movement instruction. The control group instruction reinforced the rhythmic instruction that was already occurring in the everyday classroom.

After the 10-week treatment, the three dependent variable measurements were administered in a staggered manner over a three-week period as portrayed in Table 3.2. The synchronization and performance tests took a week of administration time due the individual nature of the test, and the perception test took twenty minutes of a class period for group administration. A greater amount of testing was able to be accomplished in week two because of the elongation of class periods for eighth-grade state proficiency testing. Students who were absent at the original time of testing were tested at the end of week three.
<table>
<thead>
<tr>
<th>Group</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>synch.</td>
<td>perform.</td>
<td>perception</td>
</tr>
<tr>
<td>Treatment</td>
<td>–</td>
<td>synch.</td>
<td>perform. &amp; perception</td>
</tr>
</tbody>
</table>

Table 3.2: Order of test administration for the three-week measurement period.

"Traditional" Activities determined through Qualitative Observation

The control group experienced "traditional" instrumental music rhythm activities, as operationalized through qualitative observation of the classroom teacher's standard activities. The qualitative descriptions that follow highlight the instruction that every student in the instrumental program received.

The classroom teacher approached rhythm instruction through a variety of instructional means. New rhythms were most often
approached through sound and then symbol. The instructor would chant, first on a neutral syllable and then on a rhythm syllable, the new rhythm patterns and the students would then echo the pattern. After this process was deemed successful, the instructor would vocally model the rhythm and show a flashcard of the pattern, which the students would again echo. Finally, the students would look at the flash cards in a random order and provide the rhythm syllables without the aid of the instructor.

The instructor used a variety of rhythm syllables and vocalization techniques to obtain the goal of rhythmic fluency. Because each of the elementary school general music settings used Kodály syllables as a rhythmic teaching and learning strategy, these syllables served as a familiar reinforcement entity in the middle school instrumental setting. Clapping of note values and rests was also used to reinforce past musical experiences. The teacher used a numerical syllable system at times to highlight the steady beat and at other times to stabilize the division of the beat. The instructor used the technique called “sizzling” which asks the students to articulate the rhythm of the music with a vocalized sizzle. This teaching strategy is designed to give a full sense of value to each note in the rhythmic phrase. At times when the rhythm was less of
a concern than the note reading aspect of the music, the instructor would have the students say the note names in the rhythm of the musical line.

Once rhythms were reintegrated into the music, the students were encouraged to tap their feet along with the steady beat. Although this task was very difficult for some of the students, others tapped with a great deal of ease. To help assist the students, the teacher either clapped the melodic rhythm, clapped the steady beat, or numerically counted the melodic rhythm. When the students had gained some facility with the rhythmic and melodic aspects of the piece, the instructor would sometimes have the students perform the song in synchronization to a tape that accompanied the method book.

**Treatment Group Activities**

The treatment group experienced 20 movement instruction episodes of ten-minutes each that were designed to be useful in the instrumental music setting. Activities were intended for an instrumental setting in which the space limitations of chairs and music stands usually preclude the instruction of locomotor activities. Movement activities were planned with the older elementary student in mind, unlike many
of the movement methods designed for the very young child. Each lesson included listening, synchronizing, and performing. The activities stressed the comparison of steady and unsteady beats in a musical setting, the body connection related to hearing and feeling the beat, and instrumental performance while concentrating on the steady beat.

The conceptual framework for the choice of basic movements in the treatment is well documented in general music, dance, and physical education literature (Bartenieff & Lewis, 1980; Dauer & Pangrazi, 1983; Lee, 1991; Nye, et al., 1992; Siedentop, Herkowitz, & Rink, 1984; Swanson, 1981). Movements such as twisting, striking, gliding, and tapping correspond to the instructional concepts of space utilization, sensation of weight, sensation of weightlessness, and movement synchronization. A variety of instructional materials allowed the older student to feel less inhibited concerning the kinesthetic process. Paired and individual activities also provided variety to the instructional activities.

Each session focused on the perception of steady and unsteady factors in music, synchronization activities to musical stimuli, and performance activities on pitched and non-pitched instruments. Listening activities highlighted possible perceptual distracters, such as syncopation, dynamics, tempo, meter, and expressiveness. The
movement activities synchronized to music stressed the concepts of weight, time, space, and flow. Specific activities included non-locomotor body percussion, bean bag toss, conducting, rope pulls, and imaged movements, such as weight lifting and basketball playing. Performance activities stressed the transfer of coordination, listening, and synchronization skills to pitched and non-pitched musical instruments. Students performed at multiple tempi on drum sticks, drums, tambourines, shakers, and bongos. Students then performed on their own instruments with drum track accompaniment.

The 20 lesson topics that were addressed in the 20 treatment group sessions centered around three main practices:

1) Gaining body comfort and coordination

2) Understanding the space/weight continuum through synchronization activities

3) Transferring the basic concepts of movement and synchronization into musical performance activities

The 20 topic areas are listed below. For a detailed description of the lesson plan activities, as well as the music and materials used, see Appendix I.
1) Understanding the basic, steady beat
2) Finding the steady beat in music
3) Finding the steady beat in music - The effect of syncopation
4) The relationship of movement and space
5) Steadiness and the effect of tempo
6) Steadiness and the effect of melodic rhythm - duple divisions
7) Steadiness and the effect of melodic rhythm - triple divisions
8) Steadiness and the effect of melodic rhythm - long notes
9) Steadiness and the effect of dynamics
10) Steadiness and the effect of expressiveness
11) Steadiness and listening/synchronizing
12) Steadiness and the effect of tempo and melodic rhythm - rushing
13) Steadiness and the effect of tempo and melodic rhythm - slowing down
14) Steadiness and the effect of attention
15) Steadiness related to musical instrument family
16) Steady beat related to a non-pitched instrument
17) Steady beat on percussion instruments of various timbres
18) Playing melodic rhythms on percussion with attention to tempo and steady beat
19) Steady beat performance in groups
20) Review of steady beat activities
Data Analysis

After the 10-week treatment, the posttests were administered to the subjects. The perception test was administered to the whole group in a 20-minute period, and the synchronization and performance test were administered individually over a three-week time frame.

Each perception item was analyzed in relation to the amount the response deviated from the correct answer. The line, upon which the subjects were asked to mark the response, was measured with a ruler to document the number of millimeters that the answer deviated from the intended response. Deviations could range from one to 80 for each question in the steadiness portion of the test. Tempo items could range from one to 160, because the answer could be faster or slower in this category. See Table 3.3 for example scoring grids for the tempo and steadiness subtests.
Steadiness Item (score range 0-80)

<table>
<thead>
<tr>
<th>Steady</th>
<th>Very unsteady</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>80</td>
</tr>
</tbody>
</table>

Tempo Item (score range 0-160)*

(circle one) STEADY SPEEDS UP SLOWS DOWN

<table>
<thead>
<tr>
<th>Steady</th>
<th>Big Tempo Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>80</td>
</tr>
</tbody>
</table>

*80 points were added to each item score when the incorrect direction was circled

Table 3.3: Scoring grids for the tempo and steadiness subtest items.

The sequenced music for the synchronization measure was created on Vision software. This software quantized the performances so that each beat was zeroed and the beats were each broken down into 480 units. In this way, deviations were described by the numerical amount before (showing a faster performance) or after (showing a slower
performance) the steady beat. For ease of viewing and description, each subject's beat scores were multiplied by .001. Each beat, therefore, would normally range from .00 for synchronized to .480 for unsynchronized within that beat. Subjects who deviated more than one beat ahead or behind the beat had .480-units added to their score once, each time the tap deviated more than one beat ahead or behind the intended beat.

Performances were recorded on Digital Audio Tape (DAT) and then placed on Sound Designer II software for extraction. Each note, one beat or longer, was measured from one note onset to the onset of the next note, displaying the interattack interval (MacKenzie & Van Erd, 1990). Rhythm patterns of two eighth-notes were analyzed in full beat increments. The measurement provided results in real time, detailed in hundredths of a second. Each performance measurement started at zero and additively progressed until the end of the performance. The students' performed times for each beat were then compared to the metronomically correct times for performances at that tempo, and deviations were assessed for each beat. For instance, a quarter note performed at 60 beats per minute should be metronomically performed at exactly 1 second. If a student played too slowly the quarter note may result in a time of 1.45 seconds, for which the deviation would be .45.
When performance errors occurred, the measurement was taken from the attack of the student-performed note to the attack of the next notated note.

Control and treatment group results on the three dependent variables were compared using a $t$-test. Nondirectional hypothesis testing was performed at an alpha level of .05. Descriptive statistics, such as mean and standard deviation, detailed the responses associated with the perception, synchronization, and performance responses. A description of each subject's responses documented the direction of deviation from the steady beat, whether it was speeding up, slowing down, or showing an unsteadiness factor throughout an example. A correlation coefficient stated the relationship of the dependent variables for the present study.
CHAPTER 4

RESULTS

The results of the study will be presented in four sections: perception, synchronization, performance, and finally, the relationship of the three dependent measures.

Perception

Subjects responded to 33 paper-pencil perception items. Fifteen of the items related to perception of tap steadiness, and 18 items related to perception of tap tempo change. Subjects indicated the degree of steadiness or tempo change for each item by placing a vertical straight line on a horizontal linear scale. The scales ranged from “steady” to “unsteady” and from “steady” to “big tempo change.” See Appendix A for the perception rating forms.

The tests were analyzed by measuring, in millimeters, the distance from the subject response to the correct response. A lower item score,
therefore, demonstrated more accurate perception. Steadiness scores of
the deviations could range from zero to 80 (millimeters) for each item.
Tempo scores of the deviations could range from zero to 160 for each
item, because the answer could be faster or slower in this category.
Scores for the two subtests were summed to obtain one perception score.
Two subjects' scores, one control and one treatment, could not be used
because of mistakes in filling out the form. The 68 remaining perception
scores were compared for treatment and control groups. Summed scores
ranged from 324 to 1195 points for the control group and from 258 to
864 points for the treatment group. The standard deviation (133.95) for
the treatment group was smaller than the control group standard
deviation (170.00). The mean (517.79) for the treatment group was
lower than the control group mean (548.88). The scores were compared
statistically for group differences. Table 4.1 presents the t-test results
for the two groups. Although the treatment group perceived the tap
sequences more accurately and with less variability on both of the
perception subtests, the results were not statistically significant,
\[ t(66) = .84, \ p = .41. \]
Even though the students were responding on a linear scale, the steadiness subtest only contained five possible types of stimuli of increasing unsteadiness: eight perfectly steady taps (0 deviation), two of the eight taps being one-sixteenth of a beat before or after the beat (1/16), two of the eight taps being one-eighth of a beat before or after the beat (1/8), two of the eight taps being one-quarter of a beat before or after the beat (1/4), and two of the eight taps being one-half of a beat before or after the beat (1/2).

Subjects' mean scores display the magnitude of the incorrect responses for each of the five items (Figure 4.1). While the perfectly
steady items (0) were answered correctly more than any other item, it must also be noted that the perfectly steady response was often used as a default response for items that the subjects did not perceive as unsteady. In this way, 51% of the incorrect responses related to the 1/16 item were categorically answered as perfectly steady.
Means of Incorrect Responses for Perception Test - Steadiness

Figure 4.1: Means of Incorrect Responses for Perception Test - Steadiness

* Magnitude of incorrect responses for each item could range from 0 to 80. The higher the number, the greater magnitude of incorrect response.

** The ratio under each column represents one of five possible degrees of unsteadiness for a given item. The larger the ratio, the more unsteady the item.

= Treatment group  = Control group
Subjects also used the 1/2 item (most unsteady) as a type of default mechanism for the 1/4 item, although not to the same extent; 20% of the incorrect responses to the 1/4 item were categorized into the most unsteady response (1/2) by the listeners. Categorical labeling of the middle, 1/8 item was balanced, with 4% of the 1/8 item errors being categorized as the most unsteady response (1/2) and 4% of the 1/8 item errors being categorized as perfectly steady (0). Overall, 64% of all response errors in the steadiness subtest tended to be perceived as more steady than the true response. See Appendix J for a complete listing of descriptive statistics related to perception responses.

As in the steadiness subtest, even though the students were responding on a linear scale, the tempo subtest contained only nine possible degrees of tempo change. The perfectly steady category (90) had no tempo change. The other eight categories either increased or decreased to some degree from the initial rate of 90 beats per minute. Through study of past research and the two pilot tests of the perceptual instrument, increments of 10 beats per minute were deemed appropriate for the tempo increase items, whereas 6 beats per minute were deemed appropriate for the tempo decrease items. Because of the differential
increments of the tempo increases and the tempo decreases, generalities related to tempo perception cannot be made. Figure 4.2 shows the nine items (listed from the slowest to the fastest ending tempo - 66, 72, 78, 84, 90, 100, 110, 120, 130) and the magnitude of the incorrect response means.
Means of Incorrect Responses for Perception Test - Tempo

- I ----------- > _  _  1 -  _  1 I  —  _ t  t

I 0
I U
-S

66 72 78 84 90 ICO

Ending Tempo of Item**

|= Treatment group  = Control group

*Magnitude of incorrect responses for each item could range from 0 to 160. The higher the number, the greater the magnitude of incorrect response.

**The metronomic marking under each column represents the ending tempo of a set of taps. Each set of taps began at 90 beats per minute.

Figure 4.2: Means of Incorrect Responses for Perception Test - Tempo
Subjects perceived the perfectly steady (90) category most accurately. As in the steadiness subtest, however, subjects used the perfectly steady response as a default for those items not perceived as changing in tempo. The slower tempo items showed a large amount of dichotomous category labeling (either steady or unsteady), with 61% of the incorrect responses to the 84 item, 37% of the 78 item, 7% of the 72 item, and 3% of the 66 item errors all being categorized as perfectly steady.

Category labeling of the tempo increase items was mixed with some of the categorizations tending toward the most steady response and some tending toward the most extreme tempo change response. Twenty-four percent of error responses for the 100-item and 3% of the 110-item were perceived as perfectly steady, and 10% of error responses for the 110-item and 21% of the 120-item were perceived as the most extreme tempo change. Overall, 76% of all response errors for decreasing tempo items tended to be perceived as more steady (faster) than the true responses, and 66% of all response errors for increasing tempo items tended to be perceived as a larger tempo change (faster) than the true responses.
Out of the 18 tempo items to which the 68 subjects responded (1224 responses), there were 13 responses (11 by treatment group subjects and two by control group subjects) that showed errors in tempo direction. For example, a subject may have circled the SPEEDS UPS response when the SLOWS DOWN response would have been correct. The 13 direction errors were made by 13 different subjects, and therefore did not appear to indicate any subjects with serious perceptual deficiencies. See Appendix J for a complete listing of descriptive statistics related to perception responses.

**Synchronization**

In the synchronization measurement, the subjects heard three examples of sequenced music, one at a slow tempo (60 beats per minute), one at a medium tempo (90 beats per minute) and one at a fast tempo (110 beats per minute). The three notated synchronization songs can be found in Appendix B. After hearing four taps in tempo and then four taps synchronized to the music, the subjects were asked to tap the steady beat by themselves on the sequencer while listening to the music.
Scores were extracted from Vision software, which provided the amount that each tap deviated from the steady tap. A lower total score would, therefore, demonstrate a higher level of synchronization accuracy. The software numerically described each beat in 480-unit segments per beat. For ease of viewing and description, each subject's beat scores were multiplied by .001. Each beat, therefore, would normally range from .00 for perfectly synchronized to .480 for unsynchronized within that beat. Subjects who deviated more than one beat ahead or behind the beat had .480 units added once, each time the tap deviated more than one beat ahead or behind the intended beat.

Scores for the three songs were summed to obtain one synchronization score. Scores ranged from 4.72 to 46.22 points for the control group and from 3.39 to 13.77 points for the treatment groups. The standard deviation (2.28) for the treatment group was smaller than the control group standard deviation (12.55). The mean (6.35) for the treatment group was lower than the control group mean (15.45). Total scores were compared statistically. Table 4.2 shows the t-test results for the treatment and control groups. The ability to synchronize taps to a musical stimulus was found to vary significantly as a function of group membership, $t(68) = 4.22, p = .0001$, favoring the treatment group.
The tendencies related to tapping faster than the musical stimulus can be seen in Table 4.3. Subjects tapped faster than the music more often in slower than in faster pieces. Examples of tapping faster than the music were fairly balanced across groups. Although not to the same degree, synchronizations which were slower than the steady beat were observed more often in faster than in slower pieces.
Table 4.3: Percentage of Control and Treatment Students showing a majority of synchronization taps faster than the musical stimulus

<table>
<thead>
<tr>
<th>Song Tempo</th>
<th>Control (n=35)</th>
<th>Treatment (n=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow</td>
<td>69% (n=24)</td>
<td>74% (n=26)</td>
</tr>
<tr>
<td>Medium</td>
<td>46% (n=16)</td>
<td>60% (n=21)</td>
</tr>
<tr>
<td>Fast</td>
<td>49% (n=17)</td>
<td>40% (n=14)</td>
</tr>
</tbody>
</table>

Even though both treatment and control groups demonstrated similar tendencies for tapping, treatment group subjects showed qualitatively different abilities related to synchronization. Students who were most accurate at the synchronization task could be described as having a balance of taps both before and after the beat. Unlike many of the students who began the excerpt by tapping faster or slower than the music and then continued to augment the distance between the steady
beat and their own tap, the more accurate responses approximated the steady beat in a pendular fashion. For example, a student's response may speed up for three taps and then slow down for three taps. Treatment group subjects demonstrated a greater tendency to correct their synchronization responses than the control group.

Specific examples of slowing down or speeding up related to the musical stimulus seemed to occur in two instances. In the medium excerpt, many students demonstrated their most unsynchronized taps during a series of melodic sixteenth-notes without a basic beat in the harmony line. The division of the beat seemed to have required students to have internalized the steady beat, instead of just tapping with an obvious steady beat in the bass line. Twenty-three percent of the students reported their highest (least accurate) scores for the medium song during the eight melodically unaccompanied taps.

In the fast excerpt, a strong cadence showing the end of a section of music seemed to affect students' synchronization scores. Although it did not affect students equally, the strongest phrase ending corresponded to extreme score responses in the steady tap performance.
of 17% of the subjects: 10% of the tapping performances showed their worst scores at the cadential phrase ending, and 7% of the tapping performances showed their best scores at this point.

**Performance**

In the performance measurement, students performed on their own instruments two songs composed by the researcher. Each song was performed at a slow tempo (60 beats per minute), a medium tempo (90 beats per minute), and a fast tempo (110 beats per minute). The recorded student performances were placed on Sound Designer II software for data extraction. Performances were analyzed in real-time increments, related to the amount of deviation from the steady beat for each given tempo. In this way, the lowest scores represent the most steady performances at the given tempo.

For each subject, scores for the slow, medium and fast performances of the two songs were summed to obtain one performance score. Scores ranged from 66.84 to 373.96 points for the control group and 24.95 to 202.74 points for the treatment group. The standard deviation (43.96) for the treatment group was smaller than the control group standard deviation (76.30). The mean (98.18) for the treatment
The scores were compared statistically for group differences. Table 4.4 presents the $t$-test comparison for the treatment and control groups. The performances differed significantly as a function of group membership, $t(68) = 5.74, p = .0001$, favoring the treatment group.

<table>
<thead>
<tr>
<th>Group</th>
<th>$n$</th>
<th>$M$</th>
<th>$SD$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35</td>
<td>183.54</td>
<td>76.30</td>
<td>5.74*</td>
</tr>
<tr>
<td>Treatment</td>
<td>35</td>
<td>98.18</td>
<td>43.96</td>
<td></td>
</tr>
</tbody>
</table>

* $p < .001$

**Table 4.4**: $t$-test of Performance Scores for Control and Treatment Group
In general, performance deviations increased throughout a given performance. To provide an opportunity to look at individual note values related to steady beat performance, three tempo performances (summed) of Song One for the control group and the treatment group were analyzed. See Appendix D for the notated performance songs. Figure 4.3 shows the summed performance responses for the control and the treatment groups. Even though the control group showed greater deviations throughout the song, the general positioning of the deviations for both groups was fairly consistent. Dotted half notes caused the most problems, with other long notes falling not far behind. Single beat and shorter note patterns caused fewer performance deviations than the longer notes.
Means of Deviation from a Steady Performance for Song One (Summed)

Sequential Listing of Notes Performed

* Summed responses of performances at 60bpm, 90bpm and 110bpm, measured in real time

**Figure 4.3:** Summed Performance Responses for Control and Treatment Groups
As in the synchronization test, the students who were most successful at the performance measurement demonstrated a self-correction ability. Also, as in the synchronization measure, treatment group subjects displayed a greater likelihood of correcting their performance while they were playing. Because deviations were measured by an absolute value around the steady beat, the students who could approximate the steady beat in performance reported the lowest scores.

For an example of self-correction, see table 4.5 which shows Student A's pendular-like performance of Song One at the slow tempo. Note that the performance speeds up and slows down around the metronomic beat. The ability to balance on the early and late sides of the steady beat makes this performance sound relatively steady. Only at the end of the performance did a progressive deviation away from the steady beat affect the student's score to any degree.
<table>
<thead>
<tr>
<th>Song note</th>
<th>Note Value</th>
<th>Deviation</th>
<th>Tempo</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>D₄</td>
<td>half</td>
<td>.00</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>F₄</td>
<td>quarter</td>
<td>.06</td>
<td>early</td>
<td></td>
</tr>
<tr>
<td>F₄</td>
<td>quarter</td>
<td>.07</td>
<td>early</td>
<td></td>
</tr>
<tr>
<td>Bb₃</td>
<td>dotted half</td>
<td>.03</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>C₄</td>
<td>quarter</td>
<td>.01</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>D₄D₄</td>
<td>two eighths</td>
<td>.05</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>D₄D₄</td>
<td>two eighths</td>
<td>.09</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>D₄</td>
<td>quarter</td>
<td>.05</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>E₄</td>
<td>quarter</td>
<td>.16</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>F₄</td>
<td>whole</td>
<td>.35</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>D₄</td>
<td>half</td>
<td>.40</td>
<td>early</td>
<td></td>
</tr>
<tr>
<td>F₄</td>
<td>quarter</td>
<td>.12</td>
<td>early</td>
<td></td>
</tr>
<tr>
<td>F₄</td>
<td>quarter</td>
<td>.07</td>
<td>early</td>
<td></td>
</tr>
<tr>
<td>Bb₃</td>
<td>dotted half</td>
<td>.09</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>C₄</td>
<td>quarter</td>
<td>.15</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>Bb₃Bb₃</td>
<td>two eighths</td>
<td>.27</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>Bb₃Bb₃</td>
<td>two eighths</td>
<td>.40</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>Bb₃</td>
<td>quarter</td>
<td>.44</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>A₃</td>
<td>quarter</td>
<td>.43</td>
<td>late</td>
<td></td>
</tr>
<tr>
<td>Bb₃</td>
<td>whole</td>
<td>.59</td>
<td>late</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.5:** Student A’s Performance of Song One at the Slow Tempo
One artifact of the measurement process was the occurrence of performance errors. Playing extra notes, pausing, and other such performance errors affected almost all scores to some degree. Errors of this sort, although equally detrimental to treatment and control groups, increased the total deviation score or lowered the score (if the mistake happened to slow down a rushing performance). Performance errors, therefore, may have clouded the true steady beat ability of some students.

The students' tendencies related to rushing the tempo can be seen in Table 4.6. Students in both groups performed faster than the steady beat more often in slower pieces than in faster pieces. Although not to the same extent, performances which were slower than the steady beat were observed more often in faster than in slower pieces.
Group students.

Tempo was a notable phenomenon associated mainly with the control group. Students were unable to accomplish the task. This inability to vary performance tempo at which these students performed may have overridden the chosen tempo at which they were practiced. The crossover to playing songs with much success in a solo setting, the various speeds in a group setting, not all students were able to make the transition. Although students practiced songs at various tempos, the majority of notes faster than the metronomic steady beat were performed at each tempo.

Table 4.6: Percentage of Control and Treatment students performing a majority of notes faster than the metronomic steady beat.

<table>
<thead>
<tr>
<th>Tempo</th>
<th>Control (u=70)</th>
<th>Treatment (u=70)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast</td>
<td>3.7% (u=26)</td>
<td>3.4% (u=24)</td>
</tr>
<tr>
<td>Medium</td>
<td>4.4% (u=31)</td>
<td>5.0% (u=35)</td>
</tr>
<tr>
<td>Slow</td>
<td>8.4% (u=59)</td>
<td>8.0% (u=56)</td>
</tr>
</tbody>
</table>
The Three Dependent Variables

In this study, perception, synchronization, and performance were studied as individual entities, so as to measure the specific impact of movement training on each variable. Although researchers hypothesize that these three variables are constituent parts of rhythmic ability, the degree of association among these variables is unclear. Table 4.7 displays the correlations of the three dependent variables in this study. The low degree of association between the perceptual measure and the other two measures highlights the independence of the perceptual task.

<table>
<thead>
<tr>
<th>Test</th>
<th>Perception</th>
<th>Synchronization</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception</td>
<td>—</td>
<td>.18</td>
<td>.08</td>
</tr>
<tr>
<td>Synchronization</td>
<td>—</td>
<td>.39</td>
<td>—</td>
</tr>
<tr>
<td>Performance</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Table 4.7: Spearman rank-order correlation coefficients for Perception, Synchronization, and Performance
CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Purpose of the Study

This study investigated the effect of movement instruction on students’ perception of a steady beat, synchronization with a steady beat, and maintenance of a steady beat while performing on their instruments. Three instruments measured the effect that movement training had on each dependent variable, as well as the relationship of the three dependent variables. Detailed measurements also enabled the researcher to analyze the data for the ancillary research considerations of internal steadiness and tempo deviations.

The study investigated the following research questions:

Do treatment group subjects receiving movement instruction perceive a steady beat more or less accurately than control group subjects not receiving movement instruction?

82
Do treatment group subjects receiving movement instruction synchronize to a steady beat more or less accurately than control group subjects not receiving movement instruction?

Do treatment group subjects receiving movement instruction perform on their instruments more or less steadily than control group subjects not receiving movement instruction?

The study also investigated the following ancillary questions:

1. Do sixth-grade subjects perceive taps with a great amount of precision (continuously) or in large segments (categorically)?

2. To what degree do sixth-grade subjects' synchronizations speed up, slow down, or show an unsteadiness factor throughout an example?

3. What contextual factors in the music help or hinder synchronization scores?

4. To what degree do sixth-grade subjects' performances speed up, slow down, or show an unsteadiness factor throughout an example?

5. Are large performance deviations more apparent with longer duration notes or shorter duration notes?

6. To what degree do the three dependent variable measures correlate with each other?
Subjects

The population of the study was sixth-grade beginning instrumental music students from a medium-sized, midwestern school district. The school was chosen as an experimentally accessible population. The 102-member class of beginning instrumentalists in this study represented 43% of the sixth-grade population of the school. From the 102 beginning instrumentalists, 70 replied affirmatively to the human subjects consent form. The 45 females and 25 males who replied were then randomly assigned to the treatment or the control groups.

Summary of Method

This experimental study used the posttest-only control group design. The independent variable, movement instruction, had two levels, treatment and control. Three dependent variables (perception, synchronization, and performance) were measured to assess the impact of movement instruction on three aspects of rhythmic ability.

Through three months of qualitative observation of the research setting, the researcher designed rhythm instruction that was consistent with the students' everyday classroom activities. These instructional activities were used in the control group classes. The pre-instruction
time allowed all of the students to become familiar with the researcher. The researcher presented both the treatment and control group activities. The treatment group participated in movement activities designed to (a) gain body comfort and coordination, (b) lead toward an understanding of the space/weight continuum through synchronization activities, and (c) transfer the basic concepts of synchronization and movement into musical performance activities.

The treatment group sessions focused on the perception of steady and unsteady factors in music, synchronization activities to musical stimuli, and performance activities on pitched and non-pitched instruments. Listening activities highlighted possible perceptual distracters, such as syncopation, dynamics, tempo, meter, and expressiveness. The movement activities synchronized to music stressed the concepts of weight, time, space, and flow. Specific activities included non-locomotor body percussion, bean bag toss, conducting, rope pulls, and imaged movements, such as weight lifting and basketball playing. Performance activities stressed the transfer of coordination, listening, and synchronization skills to pitched and non-pitched musical instruments.
Students performed at multiple tempi on drumsticks, drums, tambourines, shakers, and bongos. Students then performed on their own instruments with drum track accompaniment.

After the 10-week instructional setting (20 sessions of 10 minutes each), all subjects took the three dependent variable measurements. The perceptual measure was a 33-item, paper-pencil test, which assessed the students' abilities to perceive degrees of steadiness and tempo change in compared isochronous tap sets. For the synchronization measure, subjects attempted to tap a steady beat on a synthesizer to three synthesized musical examples: one slow piece at 60 beats per minute (bpm), one medium piece at 90 bpm, and one fast piece at 110 bpm. For the performance measure, students played, on their own instruments, two researcher-composed songs each at 60 bpm, 90 bpm, and 110 bpm. A panel of experts verified the content validity of the instruments. A pilot test given in a comparable setting of sixth-grade instrumentalists yielded test-retest reliability coefficients of $r_s=1.0$ (synchronization), $r_s=.90$ (performance), and $r_s=.80$ (perception).

The taps for the perception test and the songs for the synchronization test were sequenced using Opcode Systems' Vision 2.0 (1993) and were patched through a Yamaha PSR-410 synthesizer.
Recording of the performance test was done on a Sony DAT TCD-D7 recorder with Sony SRS-PC40 powered stereo speakers. Digital audio tapes (TDK, DA-R60) were used to ensure that note attacks were as precise as possible. Analysis of the performance test was conducted using Digidesign's Sound Designer II software (1994).

Data analysis for the three measures was based on how much a subject's response deviated from the true metronomic ideal. Hypothesis testing was performed at an alpha level of .05. Perception items were measured on a linear scale describing the deviations from the correct item response. Deviations were described for the synchronization measure by the numerical amount that the subject's tap occurred before (showing a faster performance) or after (showing a slower performance) the steady beat. The performance measurement provided results in real time, detailed in hundredths of a second. Each performance started at zero and additively progressed until the end of the song. The times for each beat were then compared to the metronomically correct times for performances at each tempo; deviations were then assessed for each beat.
Results

1. A t-test of the perception measure showed that although the treatment group perceived the tap sequences more accurately and with less variability, the results were not statistically significant, $t(66) = 0.84$, $p = 0.41$.

2. In both the steadiness and tempo subtests of the perception measure subjects in both groups heard the “perfectly steady” response most accurately. Subjects used the “perfectly steady” response as a default response, however, for several unsteady items. Many of the poorest scores, therefore, showed dichotomous categorical labeling - steady or unsteady.

3. Subjects in both groups more often perceived the items in the steadiness subtest as steadier than they actually were. Subjects more often perceived the items in the tempo subtest as faster than they actually were.

4. The ability to synchronize taps to a musical stimulus varied significantly as a function of treatment group, $t(68) = 4.22$, $p = 0.0001$. Treatment group students synchronized more accurately than control group students.
5. Heightened melodic/rhythmic activity, without a bass line that emphasized the steady beat, detrimentally affected synchronization scores. Strong cadential endings detrimentally affected some subject scores, and positively affected others'.

6. The performances differed significantly as a function of group membership, \( t (68) = 5.74, p = .0001 \). Treatment group students performed more steadily than control group students.

7. Greater performance deviations were noted during longer duration notes than during either single beat or shorter duration notes.

8. The large spread of scores for the synchronization and performance measures highlights the inability of some students to tap or perform with a steady beat.

9. Synchronizations and performances which were faster than the steady beat were observed more often in slower than in faster pieces. Although not to the same degree, synchronizations and performances which were slower than the steady beat were observed more often in faster than in slower pieces.

10. Subjects with the most accurate responses on the synchronization and performance measures displayed the ability to correct their performances. The ability to correct could be seen in
performances and synchronizations that sped up and slowed down around the steady beat in a pendular manner. Treatment group subjects demonstrated a greater tendency to correct their performances than the control group. The least accurate responses most often showed a progressive deviation from the steady beat.

11. There were low positive correlations among the three dependent variables in this study.

Conclusions

The results of the current study highlight many important factors of rhythmic development. As in studies by Douglass (1977) and Jordan (1986), treatment group improvement was noted for overt measures of rhythmic ability, but not for the perceptual measurement. Fardig (1966), Schmidt & Lewis (1987), and Lewis (1988) reported mixed results in studies of multiple aspects of rhythmic perception. The varied results bring up questions related to research treatment, measurement instrument, and perceptual improvement.

As in the literature, the lack of difference between the control and treatment group for the perceptual measure in the present study may have resulted from various factors. The first possible explanation centers
around the movement treatment. Even though every treatment session emphasized each of the three dependent variable processes (i.e., perceiving, synchronizing, and performing), the overtness of the synchronizing and performing tasks may have allowed for more accurate teacher evaluation and adjustment of learning activities than the more covert perceptual processes. The ease of assessment may have led to more direct improvement for the overt measures.

The finding may also demonstrate the small amount of steady beat internalization that each subject obtained from this study’s treatment sessions. Or, as hypothesized by Lewis (1988), growth may indeed occur from perceptual treatments, but the demonstration of the learning may be more slow to develop than the overt measures.

A more stringent explanation for the lack of perceptual improvement concerns the transferability of motoric learning to the cognitive domain. The path between kinesthetic development and perceptual growth may not be as clear as many general music/movement theorists would like to believe. As Serafine (1988) noted concerning an anomalous sixth-grade slump in some areas of perception, "It is possible that decrements in some areas of music cognition are necessary for other gains to be made" (p. 226).
present study, the connection between motor learning and perceptual learning may not be observable in 11-year olds who are just beginning to learn how to listen in an instrumental music setting.

The second possible explanation for the lack of significant results centers around the research instrument. Tests with limited numbers of questions that are taken by limited numbers of subjects are restricted by the amount of power the test can have. In this case, the small differences found between the treatment and control groups may have been larger with a test of greater power.

Another challenge of the perception measure was that the isochronous taps, while controlling for the distraction of metric, tonal, or expressive variability, may have imposed a contextual vacuum on the listening example. This lack of musical context may have disengaged any possible psychomotor/cognitive crossover from activating by making the students unable to metrically group the taps. The students' pattern of categorical responses for the more subtle items clearly demonstrates the difficulty that students had with the perceptual instrument.

Tests of discrimination which are devoid of full musical context may impose restrictions upon listeners' abilities. The written format of a perceptual measure may also be its own confounding factor, in that
students can get in a purely cognitive focus, devoid of kinesthetic functioning, when taking tests. This cognitive mindset may not be as advanced as the kinesthetic sense for sixth-grade students, and therefore, not accurately demonstrate the students’ true understanding. Standardized tests which control for extraneous variables through omission may, then, be limiting in their effectiveness.

The failure to find significant group differences in many perceptual studies may show that perception is a more enigmatic trait to measure than the more overt skills associated with synchronization and performance. The low positive correlation found between perception and the other two variables in the present study suggests that the perceptual measure, as measured, is not closely related to the more overt rhythmic skills of synchronization and performance.

If, indeed, perception is not related to synchronization and performance, then another explanation may prove credible. The third possible explanation for the lack of perceptual improvement in the present study coincides with Seashore’s statements concerning perceptual ability. Although Seashore believed in the possibility of kinesthetic and performance development, he felt that perceptual growth would be unlikely because of the instinctive, elemental nature of
perception. Kinesthetic and performance improvement would occur through coordination improvement but not perceptual growth. Even though many educators are not fond of the belief that musical perception cannot be improved, it must be considered as a possible reason for the lack of significance found in many perceptual studies.

In this particular study, however, Seashore's ideas seem less tenable. Even though the perceptual differences between groups were not significant, there were differences. The measurement itself appears to be the more likely explanation. Some students may have been hindered by the paper/pencil testing procedure. At the sixth-grade level, the cognitive nature of the perceptual measurement may have impacted negatively upon student success.

Results of the ancillary research question related to the degree of perceptual awareness show a dichotomous categorization (steady or unsteady) for the most inaccurate responses and a more continuous response scale for the most accurate responses. The items that were answered correctly most often were the extreme examples (steady or unsteady). This finding coincides with Wang's (1983) finding that the items with greater tempo change were easier to discriminate than the subtler items.
The finding that subjects perceived tempo changes as faster than the true response is consistent with the majority of research on tempo perception. As in the present study, past research has documented the tendencies to perform faster rather than slower (Ellis, 1992; Kuhn, 1977; Kuhn & Gates, 1975).

The difference between the treatment and control group scores for the synchronization measure suggests that an individual's ability to move rhythmically can be improved with training, so as to accommodate synchronization of movements in many tempi. This is in agreement with studies by Douglass (1977) and Howell, et al. (1995), but not with findings of Jersild and Bienstock (1935) and Groves (1969). For beginning music ensembles and general music classes, the importance of participating in activities in multiple tempi should be considered. While practicing teachers may note students' tendencies to gravitate to one comfortable performance tempo, efforts should be made to stretch students' tempo experiences, for instruction in multiple tempi may benefit the students' steady beat performance skills.

Moving, singing, and playing instruments in a range of tempi may help students to avoid the tendency to gravitate to a set tempo for various forms of activities. Consider the student who is most
comfortable playing his instrument at the tempo of 80 bpm. A
beginning instrumental music setting where the majority of pieces are
practiced at the tempo of 60 beats per minute could be extremely
frustrating for such a student. Also consider the student who is most
comfortable moving at the tempo of 130 bpm. A classroom setting
where movement activities are only done at the tempo of 80 beats per
minute could also be extremely frustrating. If, however, activities were
done in multiple tempi, the student may have a chance to develop
comfort in many tempi, as well as avoid a consistently frustrating
situation.

Results of the ancillary research question concerning context show
that melodic material may or may not have a detrimental effect on
synchronization ability. Heightened melodic activity detrimentally
affected some subjects' synchronization scores, and strong cadential
material positively affected some subjects' synchronization scores and
negatively affected others'. Context appears to be a highly complicated
factor which can interact with aspects such as memory, prior experience,
and perceptual acuity.

The improvement found in the present study's performance scores
is in agreement with Major (1982), Jordan (1986), and McCoy (1989).
Using bodily movement and participating in musical activities in a variety of tempi appear to have a positive effect on performance ability. It may be beneficial for beginning instrumental music directors to note that longer duration notes gave students greater steadiness problems than shorter duration notes. Because many elementary instrument methods begin the books with whole notes to avoid psychomotor challenges, supplemental activities may be warranted for the goal of steady beat development.

The most basic and important finding in this study for music educators is that steady beat skills can be improved. Even with older elementary children who may have been less attuned to participating in kinesthetic activities than younger students, synchronization and instrumental performance measures showed significant improvements. Movement activities designed for students in their younger years may provide a rhythmic foundation that will enable even further rhythmic growth.

Educators should not assume that all beginning instrumental students have a sense of the steady beat. The majority of the control group subjects had difficulty synchronizing and performing to a steady beat. Attention clearly needs to be given to this basic skill. Providing
movement and performance opportunities in short segments on a regular basis may help students bridge the gap between their body knowledge and their instrumental performance skill.

Future research focusing on the long-term development of perception, synchronization and performance skills related to a steady beat would be of benefit to the community of educators. Although single measurement studies have their use, musical growth is a complicated topic warranting many perspectives. Also, development of perceptual instruments which creatively and intelligently stretched the bounds of the current measures would help the profession further assess perceptual abilities.
REFERENCES


Froseth, J. (1986). *Primary measure of kinesthetic response to tempo in music* (Cassette Recording).


APPENDIX A

PERCEPTION RATING FORMS
STUDENT RATING SCALE FOR THE TAPED
STEADY BEAT PERCEPTION TASK

For each item you will be asked to listen to eight taps. The first two taps of each example will be completely steady. Two of the next six taps will either remain steady, or will change and be unsteady to some degree. Use the line to describe how steady you feel the last six taps were played. A series of eight steady taps will be played before every example so that you may compare the steady pattern to the item you will answer. Place a line on the place that best describes how different or similar the item is from the eight steady taps. Practice item 1 will play a series of taps that remains steady after the first two taps. Your answer would look like this:

PRACTICE ITEM 1:
Steady _____________________________________ Very unsteady

Practice item 2 will play a series of taps that changes and is very unsteady after the first two taps. Your answer would look like this:

PRACTICE ITEM 2:
Steady _____________________________________ Very unsteady

If Practice item 2 had sounded a little more steady than what was played, you might mark the item like this:
Steady _____________________________________ Very unsteady

Now listen to # (1 and place a straight line at the place between Steady and Very unsteady that best describes the item:

1) Steady _____________________________________ Very unsteady

2) Steady _____________________________________ Very unsteady

3) Steady _____________________________________ Very unsteady

4) Steady _____________________________________ Very unsteady
5) Steady ___________________________ Very unsteady

6) Steady ___________________________ Very unsteady

7) Steady ___________________________ Very unsteady

8) Steady ___________________________ Very unsteady

9) Steady ___________________________ Very unsteady

10) Steady ___________________________ Very unsteady

11) Steady ___________________________ Very unsteady

12) Steady ___________________________ Very unsteady

13) Steady ___________________________ Very unsteady

14) Steady ___________________________ Very unsteady

15) Steady ___________________________ Very unsteady
PERCEPTION TASK, Part II

For each item you will be asked to listen to eight taps. The first two taps of each example will be completely steady. The next six taps will either speed up to some degree, slow down to some degree, or remain at the set tempo. A series of eight steady taps will be played before every example so that you may compare the steady pattern to the item you will answer. Circle whether you think the example is STEADY, SPEEDS UP, or SLOWS DOWN, then place a straight line on the place that best describes how different or similar the item is from the eight steady taps. Practice item 1 will play a series of taps that remains steady after the first two taps. Your answer would look like this:

PRACTICE ITEM 1:
(circle one) STEADY SPEEDS UP SLOWS DOWN
Steady ________________________________ Big tempo change

Practice item 2 will play a series of taps that changes and has a big speed up after the first two taps. Your answer would look like this:

PRACTICE ITEM 2:
(circle one) STEADY SPEEDS UP SLOWS DOWN
Steady ________________________________ Big tempo change

If Practice item 2 had sounded a little more steady than what was played, you might mark the item like this:

(circle one) STEADY SPEEDS UP SLOWS DOWN
Steady ________________________________ Big tempo change

Practice item 3 will play a series of taps that changes and has a big slow down after the first two taps. Your answer would look like this:

(circle one) STEADY SPEEDS UP SLOWS DOWN
Steady ________________________________ Big tempo change

Now listen to the eight steady taps and the item. Circle whether you think the item SPEEDS UP, SLOWS DOWN, or is STEADY, then place a straight line on the place that best describes how different or similar the item is from the eight steady taps.
1) (circle one) STEADY SPEEDS UP SLOWS DOWN

Steady ________________________________ Big tempo change

2) (circle one) STEADY SPEEDS UP SLOWS DOWN

Steady ________________________________ Big tempo change

3) (circle one) STEADY SPEEDS UP SLOWS DOWN

Steady ________________________________ Big tempo change

4) (circle one) STEADY SPEEDS UP SLOWS DOWN

Steady ________________________________ Big tempo change

5) (circle one) STEADY SPEEDS UP SLOWS DOWN

Steady ________________________________ Big tempo change

6) (circle one) STEADY SPEEDS UP SLOWS DOWN

Steady ________________________________ Big tempo change

7) (circle one) STEADY SPEEDS UP SLOWS DOWN

Steady ________________________________ Big tempo change

(etc.)
APPENDIX B

THREE NOTATED SYNCHRONIZATION SONGS
Synchronization Song One
Synchronization Song Two
Synchronization Song Three
APPENDIX C

STUDENT INSTRUCTIONS FOR THE PERFORMANCE AND SYNCHRONIZATION TASKS
INSTRUCTIONS FOR THE PERFORMANCE TASK

The goal of this task is to perform your instrument with a steady beat. You will be asked to play two songs, each at a slow speed, then at a medium speed, and finally at a fast speed. Eight steady taps will provide you with the tempo before each song. After the eight example taps, the taps will stop and you are to play the song as steady as possible. There are written examples for you to play.

INSTRUCTIONS FOR THE SYNCHRONIZATION TASK

The goal of this task is to tap a steady beat to the provided musical example. You will be asked to synchronize your tap to three musical examples at varying speeds. Four introduction taps and then four taps with the music will provide you with an example of the steady beat. After the four introduction taps, you are to continue the steady beat by tapping on the synthesizer. You may use your left hand or right. Please tap your finger on the keyboard key with the “x” on it.
APPENDIX D

TWO NOTATED PERFORMANCE SONGS
Performance Song One

(for treble clef, C instruments)
Performance Song Two

(for treble clef, C instruments)
APPENDIX E

CONTENT VALIDITY FORMS
Dear Reader,

Your experience and knowledge in the field of instrumental music education and music technology has become evident to me as I continue work on my dissertation topic, "The effect of movement instruction on sixth-grade beginning instrumental music students' perception, synchronization and performance with a steady beat". Because of your invaluable expertise in this field, I would like to ask for your help in reviewing my dissertation instruments for content validity.

Please find enclosures consisting of an audio tape, computer disk, and student rating scale. These items will be used to measure the three dependent variables of perception, synchronization and performance. Your Macintosh computer and synthesizer will run the computer disk program. To clarify my goals and techniques you will find the introduction section to my dissertation and an explanation sheet of the instrumentation procedures. You will also find a review sheet designed to help direct your overview of the materials. Please feel free to add any other questions, statements or concerns to this sheet.

Your contribution to this study is critical to its success. I appreciate the input that your knowledge of the field will provide and I thank you for the time you will spend reviewing the instruments. Please return the comment sheet in the enclosed stamped envelope by January 6.

Thank you for your help.

Sincerely,

Debbie Rohwer
CONTENT VALIDITY REVIEW SHEET FOR THE
STUDENT RATING SCALE AND TAPE
MEASURING STEADY BEAT PERCEPTION

In terms of the purposes of my study, do you feel that this instrument
collects appropriate information__________________________________________

Do you feel that the tasks for this instrument are developmentally
appropriate?______________________________________________________________

Are the instructions clear and in developmentally appropriate language?
_____________________________________________________________________

Is the instrument an acceptable length for young subjects' attention and
comfort_______________________________________________________________

Do you feel that the content of this instrument is representative of and
relevant to the study of beat perception?____________________________________

Do you believe that this instrument is capable of achieving the aims of
my study for the intended target population?_______________________________
CONTENT VALIDITY REVIEW SHEET FOR THE
RECORDING AND TAPPING RESPONSE TASK
MEASURING Synchronization TO A STEADY

In terms of the purposes of my study, do you feel that this instrument
collects appropriate information?__________________________________________

Do you feel that the tasks for this instrument are developmentally
appropriate?____________________________________________________________

Is the instrument an acceptable length for young subjects' attention and
comfort?________________________________________________________________

Do you feel that the content of this instrument is representative of and
relevant to the study of beat synchronization?_______________________________

Do you believe that this instrument is capable of achieving the aims of
my study for the intended target population?_______________________________

________________________________________________________________________
CONTENT VALIDITY REVIEW SHEET FOR THE
PERFORMED SONGS AND COMPUTER PROGRAM
MEASURING PERFORMANCE WITH A STEADY BEAT

In terms of the purposes of my study, do you feel that this instrument collects appropriate information?__________________________________________________________

Do you feel that the tasks for this instrument are developmentally appropriate?__________________________________________________________

Is the instrument an acceptable length for young subjects' attention and comfort?__________________________________________________________

Do you feel that the content of this instrument is representative of and relevant to the study of performance with a steady beat?___________

Do you believe that this instrument is capable of achieving the aims of my study for the intended target population?______________________

Please add any further questions, statements or concerns about the three instruments that you have reviewed.__________________________________________________________
APPENDIX F

VERBAL EXPLANATION OF STUDY FOR STUDENTS
General Overview of the Study to be presented to the Sixth-Grade Band Students During Classes

1. Your teacher has agreed to work with me on a study at this school. We will be looking at band students' abilities related to feeling a steady beat.

2. Information from this study will be shared with other music teachers to help improve music teaching and learning.

3. Permission to do the study has been given by the school district, building principals, and band directors.

4. Students who are willing to participate will be asked to:
   a) learn traditional or movement teaching designed to improve basic rhythmic ability. This instruction will occur throughout the winter quarter.
   b) complete a 15-20 minute exercise in a one-to-one session that is tape-recorded so that it can be evaluated later. Participating students will listen, perform simple songs on their instruments, and tap a steady beat on a computer.

5. These tests will be completed during the regular school day.

6. Information about the study and a consent form will be sent to your parents. You and your parents should read the letter and if you want to participate, sign and return the form to class.

7. If you or your parents have any questions, they should call Mrs. Rohwer at 523-3170.
APPENDIX G

LETTER TO PARENTS AND STUDENTS

134
Dear Band Parents and Students:

This winter we will be doing a study of band students' abilities related to feeling a steady beat. Information learned from this study will be shared with other music teachers to help improve music teaching and learning. Permission to do the study has been given by the school district, building principals, and band directors.

Students willing to participate will be taught traditional or movement instruction designed to improve basic rhythmic ability. This instruction will occur during the months of January, February, and March. At the end of instruction, participating students will listen, perform simple songs on their instruments, and tap a steady beat on a computer. The exercise takes 15-20 minutes in a one-to-one session and is tape-recorded so that it can be evaluated later. Note that audio and videotapes will be erased after the study is completed. All activities will be completed during the regular school day. The student's results will be kept confidential. We will be happy to share your child's results with you if you are interested. Participants may withdraw at any time without penalty.

If your child is willing to participate, please review and sign the form enclosed. The forms will be collected in class during the next two weeks. If you have any questions or would like additional information, please do not hesitate to call any of us.

Sincerely,

Judith Delzell
Associate Professor
OSU School of Music
Office: 292-2870

Debbie Rohwer
Doctoral Student
OSU School of Music
Home: 523-3170
APPENDIX H

EXAMPLE PERMISSION FORMS
CONSENT FOR PARTICIPATION IN
EDUCATIONAL RESEARCH

I consent to my child’s participation in research entitled:

The effect of movement instruction on sixth-grade beginning instrumental music students’ perception, synchronization, and performance with a steady beat.

Dr. Judith Delzell and Debbie Rohwer have explained the purpose of the study, the procedure to be followed, and the expected duration of my child’s participation. The possible benefits of the study have been described.

I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Further, I understand that my child is free to withdraw consent at any time and to discontinue participation in the study without prejudice to my child.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date:___________ Signed:______________________________________
(Investigator)

Date:___________ Signed:______________________________________
(Student)

Date:___________ Signed:______________________________________
(Parent)
Dear Dr. Delzell and Debbie Rohwer:

We have reviewed your research project entitled, “The effect of movement instruction on sixth-grade beginning instrumental music students’ perception, synchronization, and performance with a steady beat.”

We understand the purpose of the study, the procedure to be followed, and the expected duration of the students’ participation. The possible benefits of the study have been described.

We have agreed to allow this research project to be conducted at our Middle School.

Date: ______________ Signed: ________________________________
(Superintendent)

Date: ______________ Signed: ________________________________
(Principal)

Date: ______________ Signed: ________________________________
(Instrumental Director)
APPENDIX I

TREATMENT GROUP LESSON PLANS
UNDERSTANDING THE BASIC, STEADY BEAT

I. Identification/Discrimination of Steady/Unsteady Beats
   a) teacher example of unsteady clapping
   b) teacher example of slow, steady clapping
   c) teacher example of slow, unsteady clapping
   d) teacher example of fast, unsteady clapping
   e) teacher example of fast, steady clapping

II. Provide examples of steady objects in the real world, i.e., clocks, metronomes, sprinklers, etc.

III. Movement example of steady
   a) each student takes a bean bag and tosses it from one hand to the other. Once the students feel comfortable, the group attempts to synchronize their tosses, modeling the teacher tosses, at a fast, medium, and slow rate of speed.

FINDING THE STEADY BEAT IN MUSIC

I. Review of the basic, steady beat. Echo steady beats on instruments at slow, medium, and fast speeds (concert Bb).

II. Explain the difference between steady beat and melodic rhythm

III. Steady beat movement to music
   a) teach students how to pat (or clap) with appropriate weight.
   b) Tap feet, then pat legs to fast musical example.
   Synchronize at both quarter-note = 120 and half-note = 60 (dule example):
“Main Street Electrical Parade” from The Music of Disney
- A Legacy in Song.
c) Pat legs, then tap shoulder of neighbor to slow musical example. Synchronize at both quarter-note = 80 and half-note = 40 (duple example):
   “Koyaanisqatsi” (introduction) Philip Glass

FINDING THE STEADY BEAT IN MUSIC - THE EFFECT OF SYNCOPATION
I. Review the difference between steady beat and melodic rhythm.
   Discuss the difficulty encountered with finding/maintaining the steady beat when syncopation exists in the music. Introduce the visualization of movement/space.
II. Movement to drum track recordings
   a) two fingers tap palm of hand to basic beat drum track examples at quarter-note = 60, 100, and 120 (no syncopation).
   b) two fingers tap palm of hand to syncopated drum track examples at quarter-note = 60, 100, and 120.
III. Play instrumental steady beat (Bb concert) to syncopated drum track examples at quarter-note = 60, 100, and 120.

THE RELATIONSHIP OF MOVEMENT AND SPACE
I. Discuss the normal tendency of young musicians to rush.
II. Model two forms of patting legs, asking students which form would be less likely to rush.
a) hard pat, which lacks continuous flow of movement
b) light, fluid pat, which fills the space between pats

III. Students model appropriate pat, while vocally echoing basic rhythm patterns on a neutral syllable.

IV. In pairs, students use five-foot long ropes to sense the space involved with synchronizing a movement to music. Students smoothly pull, back and forth, at quarter-note = 110, and half-note and whole-note tempi (duple example) to:

"Wright Brothers Rag" - Wynton Marsalis & Ellis Marsalis, from Joe Cool’s Blues

STEADINESS AND THE EFFECT OF TEMPO

I. Explain the relationship of tempo and space/distance. Have students conceptualize size of gesture/distance/use of space related to tempo.

II. Clap fast circles, then clap slow circles. Which takes more space?
   a) Clap slow circles to slow musical example.
   Synchronize at both quarter note = 90 and half note = 45 (duple example).

   "Symphony No. 1" (2nd mvmt.) - D. Shostakovich

III. Using a metronome, provide students with eight steady taps at a given speed and then ask them to count steady beats in their head until they are asked to stop. The goal for the students is to think distance. Is slow or fast more difficult? Why?
STEADINESS AND THE EFFECT OF MELODIC RHYTHM - DUBLE  DIVISIONS

I. Discuss the benefits of being able to sense the "little beats" (divisions) while feeling the "big beat".

II. Tap heels to a set steady beat while patting legs to the duple division (no music).

III. Tap heels to steady beat (quarter-note = 50) while patting legs to the duple division (eighth-note = 100) of:

   "Air from the Orchestral Suite #3" - J. S. Bach

IV. Tap heels to a set steady beat while patting legs to the duple division and vocally echoing rhythmic divisions on a neutral syllable.

STEADINESS AND THE EFFECT OF MELODIC RHYTHM - TRIPLE  DIVISIONS

I. Model duple and triple movements with beat and divisions and ask students to explain the difference.

II. Tap heels to a set steady beat while patting legs to the triple division (no music).

III. Tap heels to steady beat (dotted-quarter = 50) while patting legs to the triple division (eighth-note = 150) of:

   "Cap in Hand" - The Proclaimers

IV. Tap heels to a set steady beat while patting legs to the triple division and vocally echoing rhythmic divisions on a neutral syllable.
STEADINESS AND THE EFFECT OF MELODIC RHYTHM - LONG NOTES
I. Discuss the tendency of young musicians to shorten the length of long notes. Try to feel the pulse and visualize the distance.
II. Introduce duple conducting technique. Have students conduct at quarter-note = 120 and half-note = 60, to:
   "The Bare Necessities" - Harry Connick, Jr.
III. Have volunteer conductors choose a tempo and conduct the other students (Bb concert) while they play two half-notes followed by a whole-note.

STEADINESS AND THE EFFECT OF DYNAMICS
I. Discuss the tendency of musicians to play less steady at dynamic extremes.
II. March (seated) loud and soft while trying not to rush or slow down.
III. Play (Bb concert) division and elongation echoes with drum track at quarter-note = 80 (duple example), loud and soft, in a steady manner.
III. Play (Bb concert) division and elongation echoes with drum track at dotted-quarter = 90 (triple example), loud and soft, in a steady manner.

STEADINESS AND THE EFFECT OF EXPRESSIVENESS
I. Discuss how in "the real world" music is not perfectly steady, and how deviations from the steady beat are done to highlight the musical aspects of a piece of music. Explain how musicians synchronize the deviations dependent on the rules of the music and musical structure.
II. Synchronize heel tap (beat; quarter-note = 70) to:

"Adagio for Strings" - S. Barber

STEADINESS AND LISTENING/SYNCHRONIZING

I. Review the concept of steady and how music expressively moves from steady, at times.

II. Circle clap to a song which accelerates (quarter-note = 90):

"Trepak" from The Nutcracker Suite - P.I. Tchaikovsky

Ask students to identify tempo change. Repeat.

III. On instruments, students echo patterns (Bb concert) with drum track accompaniment. Accompaniment slows throughout. Ask students when they heard a change. Repeat.

STEADINESS AND THE EFFECT OF TEMPO AND MELODIC RHYTHM - RUSHING

I. Discuss the speeding tendencies:

rush fast notes; shorten long notes; rush at a slow tempo

II. Movement to feel distance needed. Slide/pat legs at half-note = 55 (duple example) to:

"Who's Afraid of the Big Bad Wolf" - L.L. Cool J

III. On instruments, students echo patterns, attempting to:

lengthen long notes in a slow tempo; think of equal halves for divisions.
STEADINESS AND THE EFFECT OF TEMPO AND MELODIC RHYTHM - SLOWING DOWN

I. Discuss the slowing down tendencies:
   drag fast notes at a fast tempo; not looking ahead or blowing through the notes - slowing down at a fast tempo

II. Movement to feel distance needed. Snap fingers at quarter-note = 110 (duple example) to:
   "Linus and Lucy" - Wynton Marsalis & Ellis Marsalis from Joe Cool's Blues

III. On instruments, students echo patterns, attempting to:
   bounce fast notes; play to the end of the phrase.

STEADINESS AND THE EFFECT OF ATTENTION

I. Discuss how musicians have to be able to do many things at the same time (reading notes and rhythms, keeping a steady beat and making sure that the steady beat is the same as the group’s steady beat, etc.). That is why it is easier if the steady beat is “in your body” and you don’t have to constantly think about it.

II. Students tap heels (steady beat) and pat legs (divisions) in duple and then triple. Have students talk to each other while doing this to evaluate level of automaticity.

III. On instruments, have students perform a written musical phrase, with varied rhythms and melodic contour. Ask the students to evaluate the steadiness of their performances.
STEADINESS RELATED TO MUSICAL INSTRUMENT FAMILY

I. Explain the tendencies of each instrument family related to slowing down or speeding up (i.e., low brass, where the air moves slower versus high woodwinds where the air moves faster, or percussion where the notes have little staying power.)

II. Students do modeled movements related to feeling the space within and between notes (dotted-quarter = 50; triple example) to:

   "Caribbean Blue" - Enya
   a) lifting imaginary weights from floor to over head
   b) dribbling a basketball and shooting
   c) lifting feet out of mud

III. On instruments, echo patterns with whole-notes, half-notes, quarter-notes, eighth-notes, and sixteenth-notes. Try to avoid the difficulties of each instrument family. Highlight each family and ask students to evaluate.

STEADY BEAT RELATED TO A NON-PITCHED INSTRUMENT

I. Explain how percussionists have to be extra smart related to steady beat, because their instrument does not sustain notes. Describe basic sticking technique.

II. On drum sticks, echo steady beat, division and elongation patterns, while trying to sound like one percussionist.
III. On drum sticks, play steady beat, division and elongation pattern synchronized to music. Split the group into 2-parts (and then 3-parts) and have each group do a separate pattern (quarter-note = 120) to:

"Joy to the World" - from The Big Chill Soundtrack

STEADY BEAT ON PERCUSSION INSTRUMENTS OF VARIOUS TIMBRE
I. Discuss technique related to basic percussion performance.

II. On percussion instruments (shakers, bongos, and tambourines) have students find and beat a steady beat (quarter-note = 80; duple) to:

"Ice Cream Man" - Van Halen I

III. Echo basic rhythmic patterns on percussion instruments

PLAYING MELODIC RHYTHMS ON PERCUSSION WITH ATTENTION TO TEMPO AND STEADY BEAT
I. Review attention component needed to accomplish the multifaceted tasks found in music.

II. Students learn rhythms for pertinent instrument parts:

Tambourine:

Bongos:

Shaker:
III. With metronomes (to get initial tempo), students practice patterns in three-member groups at quarter-note = 60. Groups then perform their pattern four times through without any external tap. Teacher evaluates steadiness.

STEADY BEAT PERFORMANCE IN GROUPS

I. Discuss the concept of group participation and attention.

Performance in a musical organization necessitates synchronization and listening

II. In pairs, students toss bean bags in synchronization to music (quarter-note = 120; half-note = 60, etc.; duple):

"Stars and Stripes Forever" - J. P. Sousa

III. In pairs, students play instruments/conduct. While one student sets the tempo through conducting, the other plays "Hot Cross Buns" (rote learned).

REVIEW OF STEADY BEAT ACTIVITIES

I. Synchronize various activities to music of various tempi:
   a) body percussion (lap pat; lap slide; heel tap; finger snap, clap; circular clap)
   b) conduct
   c) march/kick

   "Symphony #3" (2nd mvmt.) - Charles Ives (quarter-note = 60)
   "The Entertainer" - Scott Joplin (quarter-note = 90)
   "Blue Tango" - Leroy Anderson (quarter-note = 110)
APPENDIX J

PERCEPTION TEST RESULTS:
FREQUENCY DISTRIBUTIONS
Perception Results - Steadiness Subtest

Frequency distributions of the percentages of students responses in the Steadiness Subtest. The response column shows the amount the students' responses varied from the correct response. A lower number, therefore, entails a more accurate response. Response scores could range from 0-80 for each item.

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### 1/2 Deviation - third attempt

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Perception Results- Tempo Subtest

Frequency distributions of the percentages of students' responses in the Tempo Subtest. The response column shows the amount the students' responses varied from the correct response. A lower number, therefore, entails a more accurate response. Response scores could range from 0-160 for each item.

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</tr>
<tr>
<td>60-80</td>
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<td>0</td>
</tr>
<tr>
<td>80-100</td>
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<tr>
<td>100-120</td>
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<td>0</td>
</tr>
<tr>
<td>120-140</td>
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</tr>
<tr>
<td>140-160</td>
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### Ending Speed of 90 - first attempt

<table>
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<th>Response</th>
<th>Treatment</th>
<th>Control</th>
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<tbody>
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<td>94% (n=32)</td>
<td>94% (n=32)</td>
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<td>0</td>
<td>3% (n=1)</td>
</tr>
<tr>
<td>60-80</td>
<td>0</td>
<td>3% (n=1)</td>
</tr>
<tr>
<td>80-100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100-120</td>
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<tr>
<td>120-140</td>
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</tr>
<tr>
<td>140-160</td>
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### Ending Speed of 90 - second attempt

<table>
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<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>100% (n=34)</td>
<td>94% (n=32)</td>
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<tr>
<td>20-40</td>
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<td>0</td>
</tr>
<tr>
<td>40-60</td>
<td>0</td>
<td>3% (n=1)</td>
</tr>
<tr>
<td>60-80</td>
<td>0</td>
<td>3% (n=1)</td>
</tr>
<tr>
<td>80-100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100-120</td>
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<tr>
<td>120-140</td>
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</tr>
<tr>
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### Ending Speed of 100 - first attempt

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<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
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<td>65% (n=22)</td>
<td>44% (n=15)</td>
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<td>20-40</td>
<td>23% (n=8)</td>
<td>44% (n=15)</td>
</tr>
<tr>
<td>40-60</td>
<td>9% (n=3)</td>
<td>129% (n=4)</td>
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<tr>
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<tr>
<td>80-100</td>
<td>3% (n=1)</td>
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</tr>
<tr>
<td>100-120</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>120-140</td>
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### Ending Speed of 100 - second attempt

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<th>Control</th>
</tr>
</thead>
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<td>0-20</td>
<td>47% (n=16)</td>
<td>41% (n=14)</td>
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<td>44% (n=15)</td>
<td>38% (n=13)</td>
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<tr>
<td>40-60</td>
<td>9% (n=3)</td>
<td>21% (n=7)</td>
</tr>
<tr>
<td>60-80</td>
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<td>0</td>
</tr>
<tr>
<td>80-100</td>
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<td>0</td>
</tr>
<tr>
<td>100-120</td>
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<td>0</td>
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<tr>
<td>120-140</td>
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</tr>
<tr>
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### Ending Speed of 110 - first attempt

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<th>Control</th>
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<tbody>
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<td>50% (n=17)</td>
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<td>41% (n=14)</td>
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<td>12% (n=4)</td>
<td>9% (n=3)</td>
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<td>80-100</td>
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### Ending Speed of 110 - second attempt

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<th>Treatment</th>
<th>Control</th>
</tr>
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<td>41% (n=14)</td>
<td>44% (n=15)</td>
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<td>20-40</td>
<td>44% (n=15)</td>
<td>44% (n=15)</td>
</tr>
<tr>
<td>40-60</td>
<td>15% (n=5)</td>
<td>12% (n=4)</td>
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<td>80-100</td>
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</tr>
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<td>140-160</td>
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### Ending Speed of 120 - first attempt

<table>
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<th>Response</th>
<th>Treatment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>59% (n=20)</td>
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<td>20-40</td>
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<td>3% (n=1)</td>
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</tr>
<tr>
<td>80-100</td>
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</tr>
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<td>120-140</td>
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<td>3% (n=1)</td>
</tr>
<tr>
<td>140-160</td>
<td>3% (n=1)</td>
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163
### Ending Speed of 120 - second attempt

<table>
<thead>
<tr>
<th>Response</th>
<th>Treatment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>59% ((n=20))</td>
<td>64% ((n=22))</td>
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<td>20-40</td>
<td>35% ((n=12))</td>
<td>29% ((n=10))</td>
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<td>3% ((n=1))</td>
<td>6% ((n=2))</td>
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<tr>
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<tr>
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### Ending Speed of 130 - first attempt

<table>
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<th>Treatment</th>
<th>Control</th>
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<tbody>
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<td>60-80</td>
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## Ending Speed of 130 - second attempt

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<th>Control</th>
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<td>6% (n=2)</td>
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<td>60-80</td>
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<td>3% (n=1)</td>
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