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Music reading activities using pitched and non-pitched percussion instruments and their effect on the general reading comprehension of third-grade students.

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MUSIC READING ACTIVITIES USING PITCHED AND NON-PITCHED PERCUSSION INSTRUMENTS AND THEIR EFFECT ON THE GENERAL READING COMPREHENSION OF THIRD-GRADE STUDENTS

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THESIS ACCEPTANCE

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ABSTRACT

The purpose of this study was to investigate the effects of different music activities on reading comprehension. Ninety-six third-graders (N=96) from an urban primary school were divided into three groups: a pitched group which played 1½ octave metallophones reading pitched notation; a rhythm group which played non-pitched classroom percussion instruments reading non-pitched notation; and a control group which sang and reviewed familiar songs. The 24 treatment/control sessions were given by the music specialist/researcher during the first ten minutes of the regular music classes over a three month term. All groups underwent a pretest and posttest using the reading comprehension portion of the Gates-MacGinitie Reading Tests (3rd ed.) (1989), Forms K and L. Statistical analysis was conducted at $p<.05$. Results indicated that reading comprehension in the control and pitched treatment groups improved significantly in some of the comparisons and not in others. Pitch and gross motor cross-over activities were identified as possible influencing factors. Questions arose concerning how these results would compare with a longer study with more students or with other types of treatments such as a non-music treatment. More study was recommended.

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Chapter I

Introduction

A 1995 study showed that the anterior half of the brain's corpus callosum "was significantly larger in professional musicians" (Schlaug, Jancke, Huang, & Jochen, et al., 1995, AN 83-13746) particularly in the subgroup of musicians who had begun their musical training before the age of seven. According to Schlaug et al., "a difference in interhemispheric communication and in hemispheric asymmetry of sensorimotor areas was observed" (AN 83-13746) between the musicians and the otherwise matched adults--using age, sex, and handedness controls.

There may be strong implications from this study for music education, particularly when considering the function of the corpus callosum. According to Hart (1983) the corpus callosum is the main connection of nerve fibers between the two halves of the cerebrum. Sylwester (1995) stated that even with specialization of the hemispheres of the brain, the two hemispheres collaborate in most brain functions with the corpus callosum helping to synchronize their activities. By processing the related information from different perspectives, the two hemispheres work together to produce something that becomes a "unified mental experience" (p.49). If music training does affect the ability of the corpus callosum to function more effectively as a bridge between the two hemispheres, as is implied by the increased size, then it would seem apparent that music education could play a vital role in enhancing brain and learning processes which depend on that area of the brain for communication of information.

The Schlaug et al. (1995) study attributed the definite physical difference in the corpus callosum to the study of music begun before the age of seven. These results were compatible with general knowledge that plastic changes can occur in that area of the brain within the first decade of life. Maturation of certain cortical areas and the various physical changes in the brain's neural structure can occur only within certain time frames, called "critical periods" or "windows of opportunity" (Begley, 1996). The window of opportunity for language development is birth to ten years, whereas for music it is three to ten years (Begley, 57, 61).

This developmental time frame parallels certain cognitive theories of development as well. Jean Piaget (as cited in Radocy & Boyle, 1988) theorized that children go through certain stages of development based roughly on their age. A child between the ages of seven and eleven would be in the "concrete operations" (Radocy & Boyle, p. 336) stage where the child becomes able to apply the concepts of conservation. At that stage, a child can begin to recognize similar information regardless of differing contexts or forms. Zimmerman (as cited in Scott-Kassner, 1992) conducted several studies to test musical intelligence according to Piaget's theory on stages of development. In 1968 Zimmerman and Sechrest (as cited in Scott-Kassner, 1992) found a marked difference in ability to conserve information between five- and eight-year-olds. Other studies, such as Davidson and Scripp (as cited in Hargreaves & Zimmerman, 1992), found that typical eight-year-olds have a much more stable melodic perception than younger children. Although viewed from differing perspectives, cognitive, cortical, and musical development are related to each other and should all be taken into consideration when seeking a better understanding of music learning and performance (Davidson and Scripp, 1992).

When mammals learn, the network of neurons (or nerve cells) goes through physical changes which strengthen the neural connections (Sylwester, 1995). This strengthening process has led many researchers to speculate that music, which stimulates several different sensory neural networks at one time, could act as an enhancement to learning (Gardiner & Fox, 1996; Gardner, 1983; Hurwitz, Wolff, Bortnick, & Kokas, 1973; Movsesian, 1967; Rauscher, Shaw, Levene, & Wright, 1994; Sylwester, 1995; and Zinar, 1976). Along with this speculation is the belief that the study of music and its relation with the brain can provide help in understanding the complex workings of the human mind (Fowler, 1987; Large, 1995; and Wilson, 1985). Large (1995) stated:

> The problem of how the human brain perceives and represents complex, temporally structured sequences of events is central to cognitive science. Music is an ideal domain for the addressing [of] this issue. Music provides a rich source of data, generated by a natural human activity, in which complex sequential and temporal relationships abound (AAC-9505246).

Many studies (Collett, 1991; Hurwitz, et al., 1975; Martin, 1995; Mead, 1986; Morrison, 1994; Rauscher, 1993; and Rauscher, 1994) have found possible connections between music and learning. The results of a study comparing S.A.T. scores of high school students found that the music students were 18 points above the mean in the math portion of the S.A.T. and 22 points higher on the verbal portion compared to non-music students (Martin, 1995). Rauscher (1993) reported results showing a 46% increase in spatial mathematical reasoning with her experimental group of three-year-olds receiving music lessons. Gardiner and Fox (1996) found significant improvement in math and reading scores as a result of sequential music training with primary aged students.

Music's possible effects on reading is of particular interest to researchers and educators because of the high importance of reading success within the school curriculum (Wixson & Peters, 1987). Shanahan and Barr (1995) stated:

> Children who have difficulty learning to read do less well in other subject areas, have lower self-esteem, pose greater discipline problems in school, and are less likely to complete a high school education. For adults, limited reading ability is correlated with unemployment, crime, lack of civic awareness and involvement, poor health maintenance for self and family and other social problems (p. 958).

Several studies have specifically considered the effects music might have on language and reading ability (Colwell, 1994; Douglas, 1994; Gardiner & Fox, 1996; Hurwitz, Wolff, Bortnick, & Kokas, 1975; Movsesian, 1967; and Pellitier, 1963). In the Hurwitz et al. study (1975) experimental first-graders receiving Kodaly instruction showed an overall reading score of 87.9 percentile compared to the control group's 72.3 percentile. Movsesian's study (1967) tested primary students after half received instruction in reading music and playing bells. After one year the experimental first- and second-graders scored significantly higher on basic reading skills. A principal in a Bronx elementary school reportedly became convinced that music was the key to learning to read after the school implemented a music and movement program (Levine, 1965). "Since all the grades in his school began using the technique, the percentage of retarded readers there has been halved. In a nine-month trial one class that employed the music jumped four months ahead of a class using standard methods" (p.64).

In spite of previous research, concise studies appear needed; 1) to help define and verify any possible relationship between music and reading, 2) to determine at what age music can affect reading, and 3) to investigate which aspect(s) of music may be important to reading. Several researchers have focused on different aspects of music as being important to reading. Uhl (1969) suggested that the vocalization in singing develops "auditory acuity" (p. 45) which is a basic skill in reading readiness. Pellitier (1963) attempted to show the importance of the tracking of musical notation to reading improvement. Lamb (1993) concluded that awareness of pitch changes influences reading ability. Douglas and Willatts (1994) found that rhythmic activities were important to improving reading ability. Mead (1986) suggested that the Dalcroze method could play a major role in reading improvement. Kokas (1970) argued that it is the combination of musical activities that brings about enhanced learning.

Despite positive research on music's relationship to academic achievement, there appears to be some lingering debate on its effectiveness. Groff (1977) criticized studies connecting music to reading ability. He chided studies by Nicholson (1972) and Movsesian (1967) for bias and invalidity. Movsesian countered Groff for his "inaccurate" statements and resubstantiated the results of his study (1977). Groff called for more controlled, well designed research before making assumptions about music and its relationship to reading ability. Wolff (1978) also criticized several studies such as Movsesian's (1967) and Nicholson's (1972). Wolff concluded that although most of the research relating nonmusical outcomes to music education is positive, "definitive evidence of the nonmusical outcomes of music education is yet to be provided" (p. 21).

A great deal of the debate continues, especially since many previous studies have found only correlational or anecdotal relationships between music and nonmusical learning. Very few causal relationships have been shown, largely due to the lack of controls in the study designs (Rauscher, 1996). This would seem to suggest that more specific and well designed studies are needed for future research. Rauscher called for goals in future research that would:

> 1) identify the specific cognitive processes that are enhanced by music training, 2) examine the properties of music training that are responsible for these effects, [and] 3) determine the age levels at which children are most likely to show an enhancement of cognitive ability as a result of music training (1996 lecture).

The continuing controversy on the relationship between musical training and nonmusical outcomes seems to have warranted these calls for further investigation. Therefore, the purpose of this study was to investigate the effects of a general music curriculum which incorporated music reading activities using pitched and non-pitched classroom percussion instruments on the general reading comprehension of third-grade students. The following specific research questions were addressed:

1. Do teacher directed music reading activities that involve rhythm recognition and performance on percussion instruments affect general reading comprehension?
2. Do teacher directed music reading activities that involve pitch recognition and performance on pitched percussion instruments affect general reading comprehension?
3. Do teacher directed activities that involve the use of gross motor skills in the playing of percussion instruments, pitched versus non-pitched, affect general reading comprehension?
4. Do teacher directed music reading activities involving the use of pitched and non-pitched percussion instruments affect students of various cognitive ability levels differently?
5. Can teacher directed music reading activities that involve the use of pitched and non-pitched percussion instruments within a limited amount of classroom instruction time affect general reading comprehension?

The independent variables in this study were the two types of treatments--pitched versus non-pitched music reading activities. The dependent variables were the post-test scores on the reading comprehension tests.

Music reading activities was defined as those which had the student decipher and perform written musical notation, both pitched and/or rhythmic. "Playing" of the instruments was defined as performance of the written musical notation on the instruments within a group setting. Pitched classroom percussion instruments was defined as fully chromatic, 1½ octave barred metallophones, played with the use of either rubber or wooden mallets. Non-pitched percussion instruments were a wide variety of typical classroom rhythm instruments such as tone blocks, jingle clogs, triangles, rhythm sticks, tambourines, etc. which did not have a specific pitch in their design. General reading comprehension was defined as the ability to silently read passages of prose and poetry and to consequently show understanding through correct responses to questions concerning the written material.

Chapter II

Related Literature

According to research, music activities involve mental processes which may influence a transfer of learning to other subject areas (Fowler, 1987; Gardiner & Fox 1996; Rauscher, 1994). Fowler (1987) indicated that this possibility may be due to the multiple areas of knowledge or cognition used in any musical activity. Gardner (1983), likewise, pointed out several "integral links between music and other spheres of intellect" (p. 122). He called attention to musical relationships with bodily-kinesthetic intelligence, spatial intelligence, personal intelligences, linguistic intelligence, and logical-mathematical intelligence. Gardner also called attention to the various mental processes involved in language activities that, though largely situated in the brain's left hemisphere in most people, are also dependent upon some right brain mental processes. Furthermore, Gardner stated, "The more complex interactions that characterize our daily linguistic intercourse depend upon a seamless flow of information among these crucial linguistic regions" (p. 87).

A substantial amount of literature and research has addressed the issue of possible similarities between music and reading, and possible transfers of learning, enough to warrant further discussion and investigation. This chapter begins with a discussion on some of the recent discoveries in neuroscience as related to the mental processes involved in music. Next will be more detailed discussions concerning current knowledge on music reading and reading comprehension followed by a section which will look at several related studies and methodologies.

Music and the Brain

Wilson (1985) stated, ". . . music may be capable of providing one of the most powerful experimental tools we have ever had for studying the workings of the human brain" (p. 40). Scientific evidence (Ackerman, 1992; Aleksander & Morton, 1993; Ayres, 1979; Begley, 1996; Fowler, 1987; Hart, 1983; Sylwester, 1995; and Wilson 1985) supports the following: 1) The brain contains approximately 100 billion neurons which can serve in more than 100 trillion possible neural connections working together as a system. 2) Mental and sensory stimulation activate the neurons to form connections with other neurons. 3) Frequent stimulation strengthens the neural networks through development of tiny spines or receptors called dendrites, making it easier for the neurons to connect through the synapses. If a neuron is not activated frequently, it "dies" or becomes less able to connect within the neural network. 4) A single neuron can be part of more than one neural network. 5) Musical stimulation activates more neural networks than does most non-musical stimulation because of the many different sensory and cognitive domains involved. Hence, strong possibilities exist that musical stimulation could enhance other areas of learning.

Despite these strong possibilities, researchers and theorists have been cautious to lay claims to actual causal effects that music might have on the functions of the brain and learning. Schlaug (1995), for instance, even in finding a scientifically measured difference in the corpus callosum between professional musicians and non-musicians could not claim a causal effect of music on the size of the corpus callosum. Yet the possibility remains that stimulation of the brain through early musical training may have caused the corpus callosum to become larger and conceivably allow for more integrated communication between the two hemispheres of the brain.

Music Reading

The processes involved in reading music include several different sensory and cognitive areas. Music reading involves a temporal visual perception and tracking of notation. When an individual reads musical notation the eyes have to look ahead and look back to the point of performance. Goolsby's study (1994) found that more skilled music readers look farther ahead in the music than do less skilled readers, hence they have farther regressions to the point of performance. Goolsby also found that the more complicated the notation, the longer the eye fixation. This process of looking ahead while maintaining the moving point of performance also involved a certain amount of short-term memory (Goolsby, 1994).

Research has also indicated that music reading involves visual perception of patterns and spatial relationships. Some researchers have found that our minds seem to process information using patterns and spatial relationships. Shaw and Leng found that visual representations of brain activity during transmissions of information from one area of the brain to another, when matched with pitches and duration, actually sounded like recognizable patterns in music (Frances Rauscher citing her study with Shaw and Leng, in an interview by Snyder, 1995).

Music reading involves decoding skills (Rogers, 1996). Musicians extract meaning and sound from printed symbols, sometimes involving sequential, temporal skills as well (Wolff, 1978). Music literacy and the ability to decode printed musical symbols prompted Shehan's (1987) study. Shehan found that presenting students with the visual stimulus of written musical notation along with aural and mnemonic approaches greatly enhanced rhythmic performance when compared to aural and mnemonic approaches alone.

Physical performance is another aspect of music reading. Depending on the instrument, the performance can physically involve the lungs, airways, nasal and oral cavities, facial muscles, digital muscles, eye-to-hand coordination, and/or gross motor movements (Hurwitz, et al., 1975). Gross motor movements could contain the additional element of "cross-lateral movement" or "cross-over" of the mid-line between the two hemispheric planes of the brain which exercise added dimensions of cognition (Dennison & Dennison, 1989; and Young, 1994). Hannaford (1995) stated:

> We have known for years that children who miss the vitally important crawling stage may exhibit learning difficulties later on. Crawling, a cross-lateral movement, activates development of the corpus callosum... This gets both sides of the body working together including the arms, legs, eyes (binocular vision) and the ears (binaural hearing). With equal stimulation, the senses more fully access the environment and both sides of the body can move in a more integrated way for more efficient action (p. 100).

Studies have shown that exercising with certain gross motor movements helps the brain to "unlock" its ability to function as a whole, leading to successful integration of information (Dennison & Dennison, 1989). These exercises have helped students to process linear, symbolic and written codes which are "fundamental to academic success" (p. 1).

Music reading activities include aural and affective responses. Movsesian (1967) and Pellitier (1963) surmised that the aural aspect of exercises in music reading and performance led the students to improved abilities in listening and focusing. The seemingly simple mental processes involved in passive listening have shown causal short-term effects on spatial reasoning when certain music is used (Rauscher, et al. 1994). A study conducted by Peretz and Kolinsky (1993) found that auditory processing of rhythmic and melodic information goes through an early separation before becoming integrated. This counters the view that mental processing of the two aspects of music are unified and invites further study into how the brain processes different aspects of music in different areas.

Emotional and affective response is an important aspect of musical activities, according to many researchers and theorists. Hurwitz, et al. (1976) attributed some of the success of their study to the innate emotional response of the children to the music activities. Kokas (1970) claims that the emotional responses to musical activities helped to create a source of motivation in students. Sylwester (1995) suggested that emotion is a much overlooked but integral part of developing motivation in students. Such motivation could assist in the development of reading abilities.

In summary, the process of music reading appears to involve several sensory areas of activity, perception, and response, making it a very strong medium for developing higher levels of thinking (Fowler, 1987). Sylwester (1995) said,

A memory is a neural representation of an object

> or event that occurs in a specific context, and emotionally important contexts can create powerful memories. When objects and events are registered by several senses (e.g., seeing, hearing, touching, tasting), they can be stored in several interrelated memory networks. A memory stored in this way becomes more accessible and powerful than a memory stored in just one sensory area, because each sensory memory checks and extends the others (p. 96).

Reading Comprehension

In reviewing research regarding the different aspects of reading, a notable recurrence of descriptive terms was found that parallel many of the terms used to describe the music reading processes. These include, left-to-right eye movement, focus, decoding, auditory acuity, listening skills, structure, clustering and patterns, short term memory, and brain hemisphere interaction.

Reading specialists have dramatically changed their views over the past fifteen years toward the processes involved in comprehension (Muth, 1989). For several years the focus of attention was on the differing functions of the left-brain versus the right-brain (Lewin, 1974). The left side of the brain was associated with language, logic, and sequential reasoning whereas the right side was associated with music and spatial or creative reasoning (Hart, 1983).

Hart said,

> But a moment's thought should show that language is anything but logical, full of often absurd twists and turns, accidents and usages, and words and phrases that have dozens of different meanings in various uses. Nor is listening to speech more sequential than listening to music. In my view, the two sides of the cerebrum work very much the same way, but have different assignments (p. 41, 43).

Sylwester (1995) suggested that the left side of the brain processes "what was said" and the right side processes "how it was said" (p. 49). Sylwester maintained that both sides of the brain need to be able to work together in processing information.

Current theories on language and reading center around a debate between the neural model of representation or the symbolic model, with the underlying argument of acquired learning or innate learning, respectively (Aleksander & Morton, 1993). Regardless of the side of the issue taken, comprehension is viewed as more than a sequential, left-brain process. It is viewed instead as a more holistic process which incorporates many areas of brain interaction (Hart, 1983). The reading process is more than knowing the letters, "sounding out" the words, or decoding. Reading entails knowledge of context cues within the text, knowledge of the form and structure of the material, the reader's prior knowledge, the ability to group the words into clusters or word patterns, short term memory, and the reader's ability to make inferences from the material (Yuill & Oakhill, 1991).

Along with cognitive issues, reading also involves auditory acuity and temporal, rhythmic aspects, which may also relate to musical processes. Uhl (1969) argued that singing can greatly enhance the ability to distinguish vocal sounds through auditory acuity which has been found to be a major contributor to reading readiness. Martin and Meltzer (1976) found that presenting words in a text through the use of "visual rhythms" enhanced reading ability. Sounding much like a describer of a musical composition, Muth (1989) suggested that a story or document is presented in a certain order, unfolding as the reader's inner response or feeling moves the story forward. Muth cited Iser (1974) who suggested that readers go through a continual process of modification which closely parallels the way we gather our life experiences. "We look forward, we look back, we decide, we change our decisions, we form expectations, we are shocked by their non-fulfillment, we question, we muse, accept, we reject" (Iser, 1974 as cited by Muth, p. 108). Muth concluded by emphasizing that the reading process does not yield right or wrong answers but rather "moves students through higher levels of thinking" (p. 126). This was also found to be true for musical activities.

Similar Studies

Studies in related fields such as concept development and perception will be examined before taking an in-depth look at studies which have specifically attempted to find a relationship between music and reading ability.

Nelson (1976) conducted a study which compared concept development results from five different experimental conditions on three- and five-year-olds. Subjects were presented with geometric blocks of varying shape, color, size, and thickness through visual experience, visual plus motor training, visual plus verbal-orienting instruction, visual plus motor plus verbal, and a control. Subjects were assessed orally and with the Klausmeir, Ingison, Sipple & Katzenmeyer transfer test on an individual basis following the training. Children who received more sensory stimuli in the training (such as visual, motor, and verbal) scored significantly higher than children who had received less stimuli in training. Five-year-old subjects scored much higher in the visual only category than did the three-year-olds. Indications were given for the importance of motor and verbal experiences in children's concept development. These results are especially significant for the purposes of the present study, given the effect of multisensory exercise on learning.

Martin and Meltzer (1976) compared the reading abilities of randomly selected 2nd-, 3rd-, and 4th-graders

(N=24) after training sessions which used a "visual rhythm" method versus training sessions which did not. The subjects in the rhythmic training sessions were exposed to twenty sentences from the Scott Foresman Reading System Study Book, Level 2 one sentence at a time, and one syllable at a time. The control group received the same amount of exposure time in training but each sentence was displayed all at once. All subjects were pre-tested and post-tested orally using audio cassette tapes. Subjects were then scored and judged by three professional reading educators and three "lay" reading educators who reviewed the tapes. Students in the rhythmic training group scored better in the reading fluency post-test than did students in the control group.

Goolsby's (1994) research sought to investigate certain aspects of eye movements which successful musicians used during the process of music reading. Subjects (N=24) were selected through the review of audition tapes and the administration of the Belwin-Mills Singing Achievement Test. The twelve students with the highest scores and the twelve with the lowest scores were chosen and grouped accordingly. Using the SRI, measurements of the eye movements involved during music reading were made three times each for all students. Results showed that skilled music readers used more eye movements in looking ahead and more regressions to the point of performance when compared to the less skilled music readers. The less skilled music readers had longer but fewer instances of regressive saccades or eye movements. Results also showed fewer and shorter eye movements where the notation was more complex and spaced closer together.

Besides testing perceptual aspects of music reading, several studies have sought possible transfers of learning from the music activity to other areas such as reading. One study (Hurwitz, et al., 1975) tested the effect of Kodaly instruction on normal, middle class American school children (N=20) regarding spatial abilities, sequencing skills, and academic achievement. The first-grade subjects were matched and compared with a similar control group (n=20) which did not receive the Kodaly instruction. The Kodaly treatment was administered for seven months by an experienced music specialist, five days a week for forty minutes each. Following the treatment, assessments were administered to show sensorimotor sequencing ability, verbal perceptual sequencing ability, and achievement ability. Subjects were again posttested and compared at the end of second-grade using the Metropolitan Achievement Test Primary II. Results showed more improvement for boys than girls in the spatial and temporal assessments. However, significant differences were shown both years in the increased reading ability of the experimental group compared to the control group.

Another study (Wheeler & Wheeler, 1952) compared ability levels in music reading and language reading among fifth- and sixth-grade students (N=243) in an urban elementary school. Subjects were tested using the Knuth Achievement Test in Music, Form A. These scores were compared with scores on permanent record from the vocabulary and comprehension portions of The Progressive Reading Tests, Form A. Private music study was taken into account but gender differences were not. Higher scoring music reading students were used for the selected group (n=96) to compare separately. No correlations were found between students who were good music readers (scoring 4 and above) and language reading ability. Intelligence was found to be more of a factor in language reading ability than ability in reading music.

A more recent study with younger students (Douglas & Willatts, 1994), however, did find a connection between music and literacy skills. Subjects (N=78) were children between the ages of seven and eight from two different schools in a large town in England. The subjects were administered a series of tests on vocabulary, reading, spelling, pitch, and rhythm. Results showed correlations between the items tested. The highest relationships were between reading and spelling, followed by rhythm relating to reading and spelling. Pitch was found to be somewhat related to the other areas. Douglas and Willatts suggested the results show a linkage between musical ability and reading ability, and that training in music skills led to an improvement in language skills.

Pellitier (1963) utilized toy ukuleles with violin tuning for pitch reading music activities followed by testing in vocabulary, spelling, and reading comprehension. Subjects (N=35 third-grade students) underwent twenty-five weeks of the treatment, exercises in rote-memory playing of the instrument, pizzicato style, progressing to reading of standard musical notation. Although no significant improvements in vocabulary and spelling appeared, significant improvements were found at the .10 level in the area of reading comprehension. The experimental group showed a mean gain in reading comprehension that was 1.9 months greater than the control group and the lower half of the experimental group showed a mean gain that was 3.5 months greater than the control group.

The Gardiner and Fox (1996) study investigated 80 students' achievement test scores following seven months of sequential music training using Kodaly methods ("test-arts" groups) versus the control's regular music training. It was found that the "test-arts" classes started behind the control classes in percentage of students at grade level but, after seven months, they had caught up to statistical equality in reading and were ahead in learning mathematics.

Some studies which have sought a connection between music and reading have been heavily criticized (Movsesian, 1967; and Nicholson, 1972). Nicholson compared six- to eight-year-old students (N=50) who were grouped as slow learners. Although Nicholson found significant correlations with music and reading readiness abilities at the .001 level, Groff (1977) chastised her for not creating equivalent conditions between the control and experimental groups. Groff criticized Movsesian (1967) for several weaknesses in his study's format. Movsesian countered (1977) stating that Groff's assumptions were not true. Movsesian then justified the format and findings of his study. According to Zinar (1976), Movsesian's experiment was "carefully conducted with paired groupings under controlled conditions, and the results can be considered valid and reliable" (p.72).

The Movsesian (1967) and Pellitier (1963) studies appear to be the most similar to the current proposal in that they used instruments with third-graders for music reading activities and tested the students on aspects of reading ability. Movsesian treated the first-, second-, and third-grade subjects (N=135) with music reading lessons using resonator bells. Using one control and one experimental class from each grade level in two different districts, the students were given lessons on musical terminology and the reading of musical notation. They were then introduced to one pitch at a time, how it looked on the staff, and how it should be played on the bell. The students were each assigned to one bell to be played whenever it appeared in the melody. Subjects were pre- and posttested using the California Achievement Tests (Reading Section), the Gray Oral Reading Test, and the Survey of Primary Music Reading Development. Movsesian found significant improvement in reading comprehension in the first- and second-grade groups. Although improvement was also noted in the third-grade group, when the t-test was applied, no significant differences were found. Movsesian suggested further studies in this same area.

Summary of Related Literature

Several studies have found a correlation between music and other learning, particularly learning activities involving spatial-temporal cognition. This relationship may be due to what current research and theories in neuropsychology attribute to actual "strengthening" of the neural network which can occur through sensory stimulation. Plastic changes are possible in a child's brain for the first ten years of life. Music activity, because of its multi-sensory input and response, may be able to strengthen the neural network, and in turn, enhance reading and learning abilities if exercised during this time period.

The purpose of this study was to compare the effects of music reading activities involving pitched and non-pitched percussion instruments on the reading comprehension of third-grade students.

Chapter III

Methodology

Subject Selection

This study was conducted at the Howard Kennedy Primary Center (K-3) in the Omaha, Nebraska Public School district. The school was selected due to its availability and good representation of a broad racial, socioeconomic, and academic mixture of students. Subjects (N=96) were third-grade students selected for the following reasons: 1) The experimental treatments of teacher guided pitched and non-pitched music reading activities were age-appropriate for the third-grade level (Hargreaves & Zimmerman, 1992; and Scott-Kassner, 1992). 2) As eight-year-olds, third-graders were within the "window of opportunity" (Begley, 1996, p. 57) time-frame for neural growth in the area of language cognition (up to age 10). 3) No previous study of this design was found, but need for this type of study has been shown (Gardiner & Fox, 1996; Hurwitz, Wolff, Bortnick, & Kokas, 1975; Movsesian, 1967; Pellitier, 1963; and Rauscher, 1996). And, 4) The school contained sufficient numbers of third-grade classes to enable a comparison of subjects under controlled conditions.

Procedure

Approval to conduct the study was obtained from the building principal, the music coordinator, the classroom teachers, and the Omaha Public Schools research department prior to commencement of the study. Exemption status was then obtained from the University of Nebraska Institutional Review Board for the Protection of Human Research Subjects. Parents were informed of the study and signed letters of consent were required for student participation in the reading comprehension testing.

The participating school contained six third-grade classrooms, with approximately twenty students of mixed academic ability levels in each classroom. The classes met with the investigator four times out of each ten-day cycle (school calendar) during their regularly scheduled music class periods with one class added every three weeks to facilitate having the study fit within school calendar limitations. Each class period was 25 minutes long utilizing the first 10 minutes for the experimental treatments or control activities. The remaining 15 minutes of each class involved the same lessons in general music for all six third-grade classes following the outline in the Omaha Instructional Process Course Guide: General/Vocal Music (Buller, Chuda, Misner, Meyer, & Wright, 1985). To control for consistency, the investigator conducted all of the treatments, control activities, testing, and regular music lessons. The study included a total of 24 music class periods. The amount of time allowed for the study seemed justified based on results from other studies. Martin and Meltzer (1976) found a significant effect on reading ability with three treatments of ten minutes each which ran over a period of about two weeks. Gardiner and Fox (1996) found that after seven months of treatment, students who had scored low on reading tests prior to the study were at grade level by the end of the study. Movsesian (1967) conducted his study for a full school year using the regular music class periods and designed his study to progress very slowly with each student assigned to a single resonator bell. The current study was designed to test a limited time frame, as in Martin and Meltzer's (1976) ten minute sessions, for a shorter portion of a school year compared to the Gardiner & Fox (1996) and Movsesian (1967) studies.

All students in the six regular classrooms participated in either the control activities or experimental treatments. Each classroom was randomly assigned a letter (A-F) and received the corresponding experimental treatment or control activities accordingly (two "control" classes, two "rhythm" classes, and two "pitched" classes).

Classes "A" and "B" acted as the "control" groups and participated in singing/review activites during the first ten minutes of each class. They did not participate in music reading activities which involved the playing of either pitched or non-pitched percussion instruments. They did engage in gross motor movement activities such as patching patterns or "actions" to add meaning to the words.

This was done only with songs which had previously involved the movements in the regular music class time. No new music instruction was given during this review time.

Classes "C" and "D" acted as the "rhythm" treatment group and participated in music reading activities using a variety of non-pitched classroom percussion instruments which were provided by the participating school. The rhythmic notation exercises were displayed on a large chart and included regular note heads and stems displayed in a horizontal configuration rather than on a staff or percussion notation line (Figure 1). The rhythms displayed were the same rhythms as the corresponding lesson for the pitched percussion treatment classes. All students and subjects in the rhythm treatment classes had instruments at the same time and performed the rhythmic notation exercises simultaneously. The initial lesson included a brief review on how each of the percussion instruments is played. The instructor pointed to the notation while the students played in order to keep the group focused together. Where the notation was primarily whole and half notes, the students were given metallic instruments which could sustain long sounds. Where the notation was primarily quarter and eighth notes, the students were given instruments which have shorter sounds. Students were assigned to the various instruments randomly. Students in the rhythm group switched at the same point in the treatments as the pitched group from dominant hand to non-dominant hand for holding/playing the instrument. The exercises were played using a steady tempo (approximately ♩ =84) which was adjusted according to class ability level. The instruments were traded among students so that each student could experience several different instruments.

Example a) 

Example b) 

Figure 1

Classes "E" and "F" acted as the "pitched" treatment group and engaged in music reading activities using fully chromatic 1½ octave barred metallophones which were provided by the participating school. All students had metallophones at the same time and performed the pitched music reading activities simultaneously. The initial lesson included a review of the names of pitches on the staff and practice in locating the corresponding pitches on the metallophones. The pitched rhythmic notation was displayed on a large chart and was performed at a steady tempo (approximately ♩ =50). The tempo was adjusted according to class ability level. The instructor pointed to the notation as the exercises were played in order to keep the group focused together. Beginning with treatment number 13 the students were asked to switch from their dominant hand to their non-dominant hand in playing the metallophones at which point they reverted to earlier exercises (Appendix B).

Subjects in all of the experimental treatment and control classes were pre- and posttested by the investigator on reading comprehension using the Gates-MacGinitie reading tests (3rd ed.) (1989), Forms K and L. With a reliability rating in the upper .80s and .90s, and a validity rating of "excellent" in assessing general reading achievement, the tests used a paragraph format with multiple choice questions and have been recommended for general use (Swerdlik, 1992).

Students were identified for the statistical analysis at the conclusion of the study as being of low, medium, or high ability based on the previous years' California Achievement Test (CAT) scores and were categorized as the negative level, zero level, or positive level sub-groups respectively. Standardized tests such as the CAT tests "are designed and constructed to yield accurate results... Standardized tests are usually published with normative data with which scores for students from a specific population can be compared to the population" (Phelps, Ferrara, and Goolsby, 1993). Identification of the students' ability levels was based on the students' CAT national percentage rankings in reading comprehension (weighted three times) averaged with their CAT national percentage rankings in total battery (weighted once). The reading comprehension percentage was weighted more heavily in establishing the CAT average due to the nature of this study, however, total battery percentage was also included in order to incorporate an aspect of the student's over-all ability into the categorization. Scores of 30 or below and 70 or above were established as cut-off scores based on a combination of factors: similar cut-off scores for placement of students into resource and gifted programs, potential numbers of students in each group, and the establishment of an equivalent number away from both the top and bottom.

The negative level sub-group consisted of students whose CAT average as defined above was 30 or below. In addition, any student who had no CAT scores from the previous year and who had been assigned to the special education resource program, was also placed in the negative level sub-group. The zero level sub-group consisted of students whose CAT average was between 31 and 69, and the positive level sub-goup consisted of students whose CAT average was 70 or above. The subjects were at no time identified but were assigned numbers for the purpose of recording data. All personal information and records were kept confidential.

Subjects received their general reading instruction from their regular classroom teachers during the investigation. The classroom teachers presented the reading instruction in accordance with the Omaha Instructional Process Course Guide: Reading (Adams, Johnson, Kloppenborg, & Nolan, 1991). To control for possible differences in instruction, several precautions were taken: 1) Lesson plans were reviewed by the building principal on a regular basis. 2) Lesson plans reflected the outcomes as outlined in the course guide (Adams et al., 1991). 3) The teachers met occassionally to compare instruction concerns. And, 4) benchmarking assessments were conducted to determine and verify the outcomes learned.

Treatment Design

The pitched and rhythm treatment groups underwent the same sequence of exercises rhythmically. The pitched exercises (see Appendix B) were simple diatonic melodies written or chosen by the investigator based upon a gradual increase in difficulty (Gardiner & Fox, 1996; and Kokas, 1970). The first exercise, for example, used only two pitches which were primarily whole notes, the second exercise in the first session used three pitches which were also primarily whole notes, and the third exercise in the first session used three pitches which were primarily half notes. Only one or two new notes, rhythms, or concepts were added with each new session. The melodies employed three different major tonal centers (C, F, and G) but did not include the use of sharps or flats. Subjects were allowed to use their dominant hand for holding the mallet or playing the rhythm instrument at the beginning of the treatments and were directed to switch to their non-dominant hands beginning with lesson #13 through lesson #20. This was intended to exercise and stimulate a crossing of the brain's hemispheric plane (Dennison & Dennison, 1986; Dennison & Dennison, 1989; Young, 1994).

The rhythm and pitched treatments were similar in that both used gross motor movements, aural stimulation, left-to-right visual tracking, and the same rhythmic notation. The treatments were different in that the pitched groups received a greater degree of visual, aural, and gross motor stimulation. Increased visual stimulation of the pitched groups included 1) tracking the melodic coutours, 2) working with the graphic and visual layout of the pitches on the metallophones (Walczyk, 1991), and 3) the increased complexity of eye-to-hand coordination in decoding, locating, and playing the actual pitches. Increased aural stimulation was from hearing pitches as part of actual melodies. The melodies always ended on the tonic and followed basic tonal phrasing patterns. Increased gross motor stimulation included 1) Exercises which "crossed the mid-line" of the brain hemispheres (Dennison & Dennison, 1986; Dennison & Dennison, 1989; Hannaford, 1995; Young, 1994) as subjects physically played the pitches; 2) Exercises in the use of the non-dominant hand (the rhythm group's switching of hands still involved primarily simple movements with the hands together at the body's center whereas the pitched group involved more complicated fine motor movement with the non-dominant hand working independently over a larger area); 3) Exercises which involved gross motor movement which was counter to eye movement (the visual tracking of the pitches continually moves to the right but if the pitches go downward, the hand would have to go to the left); and, 4) Exercises in pin-pointing the destination of the tip of the mallet to a relatively small surface area and hitting the target.

Pilot Study

To test the administrative procedures, a pilot study was conducted using similar students from the same school not participating in the main study. These students were in a self-contained classroom and were be selected on the basis of similar age and a similar academic range of abilities. The pilot study followed the same procedures that were presented in the full investigation and lasted over the course of four class sessions (two weeks). Procedures in the investigation were modified somewhat following the pilot study: tempos for the pitched treatment were made slower; and sustaining metalic instruments were used for exercises containing predominantly whole and half notes in the rhythm treatments.

Data Analysis

The effects of the independent variable (the music activities) were evaluated on the dependent variable (the individual standardized reading posttest scores). Pre- and posttest scores were hand scored to reduce administrative costs. To control for possible scoring error, all hand scored sheets were checked for accuracy by an objective observer during the scoring process. With the assistance of the Computing and Data Communication Department at the University of Nebraska at Omaha, the data was analyzed using analysis of covariance (ANCOVA) procedures at $p<.05$. According to Williams (1986) "Analysis of covariance provides a basis for ruling out pretreatment differences when our interest is in testing posttest-treatment differences" (p. 91). ANCOVA procedures were selected due to the study's three population means, the study's design meeting the interval measurement criteria, and the need to control for possible pre-existing differences among subjects who may have previous musical training and/or tutoring in reading comprehension. The pretest scores served as the covariate.

Chapter IV

Results

A total of 96 students participated in the study. Fourteen additional students participated in the activities who were not considered in the results due to parents and/or students not consenting to the testing, teachers recommending that the students were not capable of testing as either non-readers or students for whom English is a second language, the student not being in attendance at the school for the total course of the experiment because of relocation, or misplacement of the tests before the scores were recorded. Due to calendar time constraints, such as not finishing the proposal until January, required school Benchmark testing, and the need to have time to prepare for the spring program, the study was condensed to three months including the administration of pre/posttests and the 24 treatments. Estimated time as originally stated in the proposal was four months.

For the statistical analysis, the "A" and "B" classes which were the control (or singing) group have been renamed the "A" group (n=37). The "C" and "D" classes which were the rhythm (or non-pitched) group have been renamed the "B" group (n=27), and the "E" and "F" classes which were the pitched group have been renamed the "C" group (n=32).

Students were identified for the statistical analysis as being of low, medium, or high ability and were categorized as the negative level, zero level, or positive level subgroups respectively. Within the negative level subgroup 8 students were from the A (control) group, 3 were from the B (rhythm) group, and 7 were from the C (pitched) group. Within the zero level subgroup there were 15, 9, and 12 subjects respectively. Within the positive level subgroup there were 14, 15, and 13 subjects respectively.

Table 1 shows a comparison of the pre/posttest mean scores from each group and subgroup. The highest possible raw score of the pre- and posttest was 48. Mean scores in all of the treatment groups and ability level subgroups reflect an improvement from pre- to posttest. This would seem to indicate that though the groups received different musical stimulation, influences such as maturation and different regular classroom instruction could have contributed to this overall improvement.

Table 1 reveals that the amount of improvement in mean scores varied. Overall (4.6562) and in the negative and zero levels (7.4286 and 6.5834 points respectively), the pitched group reflected the largest amount of improvement of any group. Overall (2.1852) the rhythm group improved the least. In the negative and positive levels the rhythm group improved by less than 2 and 1 points respectively but the group improved by 5 points in the zero level subgroup. The control group overall improved by 3.5136 points and at the negative, zero, and positive level improved by 4.7500, 4.3333 and 1.9285 respectively. The negative level showed the widest range of pre- to posttest score differences whereas the zero level score differences were not as pronounced. The amount of improvement in pre- to posttest scores was smallest in the positive level. This was possibly due to the number of high pretest scores (23 of the pretest scores were 42 or above).

These data indicate that overall and in the low and high ability levels, the control group and the pitched treatment group improved more than the rhythm treatment group. The data indicate that the rhythm treatment group showed its greatest amount of improvement in the medium ability level, whereas both the control and pitched treatment groups showed their greatest amount of improvement in the low ability level.

Table 1

Comparison of Mean Scores: Whole and Subgroups (N=96)

Group	Pretest Mean	SD	Posttest Mean	SD	Dif.
Overall (N=96)					
A	28.5405	12.096	32.0541	10.306	3.5136
B	32.0000	9.499	34.1852	8.996	2.1852
C	28.0938	12.698	32.7500	11.325	4.6562
Negative Level (n=18) [low ability subgroup]					
A	13.7500	6.431	18.5000	6.782	4.7500
B	17.6667	4.619	19.3333	8.963	1.6666
C	12.8571	6.466	20.2857	10.920	7.4286
Zero Level (n=36) [medium ability subgroup]					
A	26.2667	8.439	30.6000	1.690	4.3333
B	27.2222	2.296	32.2222	5.495	5.0000
C	24.3333	8.866	30.9167	9.681	6.5834
Positive Level (n=42) [high ability subgroup]					
A	39.4286	6.161	41.3571	3.815	1.9285
B	37.7333	6.595	38.3333	7.306	0.6000
C	39.7692	5.134	41.1538	3.913	1.3846

Table 2 presents t-test comparisons of pre- and posttest mean scores within each group and subgroup. Overall, the A and C groups showed significant improvement ($p<.001$) whereas the B group did not show significant improvement ($p=.132$). This would seem to indicate that the music activities in the control group and in the pitched treatment group did have a significant effect on reading comprehension and the rhythm treatment activities did not. Within two levels (negative and zero) both the A and C groups again showed significant improvement in the pre/posttest scores (A group was $p<.01$ at the negative level and $p<.05$ at the zero level; C group was $p<.05$ at both the negative and zero levels). This suggests that reading comprehension improved for students with low or medium ability due to the music activities in the control and pitched treatment groups.

The B group did not show significant improvement at any ability level in Table 2 which would suggest that the rhythm group's activities had no significant effect on reading comprehension whether the students were of low, medium, or high ability. Within the positive level none of the treatment or control groups showed significant improvement. This suggests that reading comprehension of students with high ability was not affected by any of the treatment or control activities.

Table 2

T-Test Comparison of Pre/Posttest Mean Scores

Within Each Group (N=96)

Group	n=	T-Value	DF	Sig.
Overall (N=96)				
A	37	-3.95	36	.000
B	27	-1.55	26	.132
C	32	-3.93	31	.000
Negative Level (n=18)				
A	8	-3.80	7	.007
B	3	-0.36	2	.753
C	7	-2.50	6	.047
Zero Level (n=36)				
A	15	-2.79	14	.015
B	9	-1.36	8	.210
C	12	-3.01	11	.012
Positive Level (n=42)				
A	14	-1.30	13	.217
B	15	-0.65	14	.527
C	13	-1.40	12	.187

Table 3 shows t-test comparisons between each treatment/control group and each subgroup. None of the treatment/control groups or groups within the different ability levels showed significant differences in pre- to posttest scores. This suggests that the treatment/control music activities did not appear to affect the students' reading comprehension when comparing groups with each other. The similarity of scores and the low number of students in several of the subgroups could have affected the t-value (four of the nine subgroups had less than ten students) and subsequent significance.

Table 3

T-Test Comparison of Mean Scores

Between Whole and SubGroups (N=96)

Groups	n=	T-Value	DF	Sig.
Overall (N=96)				
A/B	64	0.84	62	.406
B/C	59	-1.35	57	.181
A/C	69	-0.78	67	.436
Negative Level (n=18)				
A/B	11	-0.17	9	.870
B/C	10	-0.13	8	.898
A/C	15	-0.39	13	.706
Zero Level (n=36)				
A/B	24	-0.62	22	.540
B/C	21	0.36	19	.722
A/C	27	-0.10	25	.920
Positive Level (n=42)				
A/B	29	1.38	27	.178
B/C	28	-1.24	26	.225
A/C	27	0.14	25	.892

Tables 4-6 show ANCOVA comparisons among the three groups within each ability level. The covariates in these tables are the pretest scores which were found to be effective in controlling for any pre-existing differences in the subjects. In all of the levels the pretests were significant in accounting for the amount of variance in the different groups ($p<.01$ at the negative and zero levels and $p<.001$ at the positive level). None of the three treatment/control groups at different ability levels showed significant differences in pre- to posttest scores. This suggests that when comparing the groups to each other, the music treatment/control activities did not seem to affect the students differently. Again, the low group sizes and the similarity of scores within each ability level would have been factors in the calculations. This, combined with the significant amount of improvement shown in two of the groups rather than just one, may account for the lack of significant differences in this comparison.

Table 4

Analysis of Co-Variance/ A, B, and C Groups / Negative Level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates					
Pretest	551.213	1	551.213	13.134	.003
Main Effects					
Negative Level	77.223	2	35.612	.849	.449
Explained	622.436	3	207.479	4.944	.015
Residual	587.564	14	41.969		
Total	1210.000	17	71.176		

Table 5

Analysis of Co-Variance A, B, and C Groups / Zero Level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates					
Pretest	451.594	1	451.594	10.151	.003
Main effects					
Zero Level	12.312	2	6.156	.138	.871
Explained	463.906	3	154.635	3.476	.027
Residual	1423.650	32	44.489		
Total	1887.556	35	53.930		

Table 6

Analysis of Co-Variance / A, B, and C Groups / Pos. Level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates					
Pretest	625.994	1	625.994	43.4730	.000
Main Effects					
Positive Level	29.893	2	14.947	1.0380	.374
Explained	655.887	3	218.692	15.1810	.000
Residual	547.184	38	14.400		
Total	1203.071	41	29.343		

Tables 7-9 show an analysis of covariance comparing the different ability levels within each control/treatment group. The covariates as the pretests were found to be significant at the p<.001 level indicating that the pre-tests accounted for pre-existing differences in subjects. The A (control) group showed significant differences between scores in the different ability levels at the p<.05 level. The B (rhythm) and C (pitched) groups showed no significant differences in scores. This suggests that differing ability levels, particularly low and medium abilities (referring to Table 1), may be factors in the improvement in reading comprehension scores when combined with singing/review activities.

Table 7

Analysis of Co-Variance / Neg., Zero, and Pos. / A Group

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates					
Pretest	3064.950	1	3064.950	166.484	.000
Main Effects					
A group	151.414	2	75.707	4.112	.025
Explained	3216.364	3	1072.121	58.236	.000
Residual	607.527	33	18.410		
Total	3823.892	36	106.219		

Table 8

Analysis of Co-Variance / Neg., Zero, and Pos. / B Group

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates					
Pretest	999.131	1	999.131	24.136	.000
Main Effects					
B group	152.837	2	76.419	1.846	.180
Explained	1151.968	3	383.989	9.276	.000
Residual	952.106	23	41.396		
Total	2104.074	26	80.926		

Table 9

Analysis of Co-Variance / Neg., Zero, and Pos. / C Group

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates					
Pretest	2874.694	1	2874.694	74.513	.000
Main Effects					
C group	21.080	2	10.540	.273	.763
Explained	2895.774	3	965.258	25.020	.000
Residual	1080.226	28	38.580		
Total	3976.000	31	128.258		

Summary

These data suggest that music activities in the control and pitched groups had a significant effect on the improvement of reading comprehension to a certain extent (t-test comparisons within the groups). Both the control and pitched groups showed significant improvement in students of low and medium abilities and not in students of high ability. The control group in particular seems to have affected students of different ability levels differently (ability level comparisons). In comparisons between groups, however, no significant differences were found. The rhythm group showed no significant improvement in any of the comparisons.

Chapter V

Conclusion

This study examined the effects of certain music activities on the general reading comprehension of third-grade students. Specifically, the study investigated possible differences in pre- and posttest scores caused by various combinations of aural stimulation, reading of musical notation, and gross motor movement. Answers in the resulting data were found to the research questions, some that were unanticipated. This chapter will examine and discuss those results.

Research Questions

In answer to research question number one, the use of non-pitched percussion instruments did not significantly affect reading comprehension scores. The data showed overall less improvement in mean test scores with the non-pitched groups and comparison analyses showed no significant differences in pre-/posttest scores within or between groups.

Research question number two produced significant results in some areas of comparison. The use of pitched percussion instruments did seem to significantly improve the reading comprehension of third-grade students at some levels of comparison but not at others. The mean scores in the pitched treatment group showed more improvement than the other groups except in the high ability subgroup where the amount of improvement was second by .5439 of a point. Analysis within the groups showed significant improvement overall and in the low and medium ability levels for the pitched group, and did not show significant improvement in the between group comparisons. These results can be considered very important but not as conclusive as they might have been if there had also been significance in the between group comparisons. Perhaps the lack of significance in these may have been due to low number of subjects, the similarity of scores within each level, and the significant improvements in yet another one of the groups--the control group.

The singing/review activities in the control group also seemed to significantly improve reading comprehension. Comparison analysis within the groups showed significant improvement overall as well as in the low and medium ability levels. Between group analysis did not show significant differences. Ability level comparisons did show significant differences with the control group and not with the others. The fact that the control group had significant results similar to the pitched group presented intriguing questions. Although the results cannot be considered conclusive because of the lack of significance in all of the comparisons, the implications are strong and will be discussed more fully later.

Research question number three was answered with qualifications. Certain gross motor activities did seem to have a significant effect on reading comprehension in third-graders. Since all of the control/treatment activites involved some gross motor movements, a closer look at how they differed is needed. The pitched treatment group used gross motor stimulation through exercises which crossed the mid-line of the cerebrum sometimes contrary to the visual tracking stimulation (as in places where the notes went downwards and to the right requiring a gross motor cross-over to the left). The control group received gross motor stimulation in some song review activities. These movements were patching patterns which sometimes crossed the mid-line in the normal review of the song, however the actual amount of movement used in the control group was not measured nor was that type of movement used with each song. The rhythm treatment group received more limited gross motor stimulation which, except for switching of dominant to non-dominant hand to hold the instrument, did not involve cross-over of the mid-line. Since the groups that incorporated a gross motor cross-over of the mid-line were the same groups that showed some significant improvement in test scores (analysis within groups) and the group that did not incorporate a cross-over did not show significant improvement, implications suggest that the cross-over activities may have been an important factor in the test improvements. Music activities that involved certain use of gross motor movements (specifically mid-line cross-over) seem to have affected the reading comprehension of third-grade students. This would support research of Hurwitz (1975), Dennison (1989), and Hanneford (1995); however, a more controlled study connecting movement with reading comprehension is needed for more definite conclusions.

In answer to research question number four, the singing/review activities appeared to affect reading comprehension of students of different ability levels differently. Significant differences in improvement were found when comparing ability levels within the control group. These differences were not found in the pitched or non-pitched treatment groups. Perhaps the determining factor in this comparison is the word usage that sets aside the control group from the treatment groups. As the control group sang, they were verbalizing and using words in meaningful ways whereas the pitched and non-pitched groups made no use of words in their treatments. These findings seem to support former research of Gardiner (1996) and Hurwitz (1975).

In response to research question number five, despite the limited time frame, some significant improvements in reading comprehension did seem to occur. The ten-minute long sessions given over a span of three months were enough to significantly affect some of the reading comprehension scores in the groups that sang or played pitched percussion instruments particularly with students of low or medium ability. Music activites which used non-pitched percussion instruments did not affect reading comprehension of the students within the limited time frame.

Discussion

Review of the results provokes several questions. How important was timbre to the results? The question of how one timbre versus several timbres affected the outcome should be addressed. The rhythm group included activities using several different timbres at once whereas the control and pitched treatment groups utilized a single timbre (either vocal or metallophone) in their exercises. The fact that both of the pitched groups did show some significant results whereas the rhythm group which used several timbres did not, might seem to suggest that exposure to a single timbre has more of an effect on reading comprehension than exposure to several. However, there is little substantiation in this or other studies to support this.

Why did both the control and pitched treatments seem to affect reading comprehension whereas the non-pitched treatments did not? Certainly, it would not have been the anticipated influence of visual tracking of notation since the control group did the least amount of exercise in that regard through their review activities. The visual tracking with the non-pitched instruments involved concentration on the notation that the singing review activities did not require. Perhaps the influencing factors in the improvement of reading comprehension were the incorporation of pitched and cross-lateral gross-motor activities which were common to both the control and pitched percussion groups and were not a part of the rhythm group's treatment. It appears that the pitched aural stimulation played an especially large role in the outcome of this experiment since cross-lateral gross motor activities were not used consistently in the control group, and since the two groups shared little else in common. The control group incorporated the use of words and complicated rhythms, whereas the pitched group incorporated no words, simple rhythms, and made use of eye-hand coordination and visualizing the graphic layout of the metallophones. This may point to the possibility that pitch was a determining factor in this experiment. The importance of pitch to reading ability was determined to be the main influence in other studies (Lamb, 1993; Movsesian, 1967; Pelletier, 1963; and Uhl, 1969). Perhaps this issue should be studied further.

Why were the results in this study significant in some areas of comparison and not in others? In looking at the different tables the low number of students in several of the groups could have been a factor in the statistical calculations which compared groups. The fact that both a treatment and control group showed significant differences may have also underscored the significance when comparing between groups. Some groups did seem to be more affected by ability level, the control group in particular. The results in this study do suggest definite possibilities, that, though not conclusive, may indicate that reading comprehension may be improved by certain music activities and may affect students of different ability levels differently.

This study could be considered preliminary to future research which might consider the following modifications:

1) Time. This study was relatively short compared to others (Hurwitz, 1975; Movsesian, 1967; Pellitier, 1963; Rauscher, 1994). The fact that results were significant but not conclusive might be answered more fully with a longer study such as one lasting from seven to nine months (Hurwitz, 1975; Movsesian, 1967; Rauscher, 1994).

2) Number of subjects. The small subgroup sizes in this study caused difficulty in making accurate comparisons especially between groups. Perhaps the same number of subjects divided into two ability levels would have shown clearer results. Replications of this study might be improved by either equalizing or enlarging the sample sizes.

3) More different treatment/control groups. This study was not able, because of curriculum requirements and number of subjects, to include the following other treatment/ control groups in addition to those used: a non-music group, a gross motor non-music group, and a rhythmic group

which verbalizes the rhythms. The incorporation of a non-music group with which to compare results would be especially informative. These added groups would help define even more how much effect pitch, timbre, rhythm, gross motor movement, or word usage have on reading comprehension.

4) Broader scope. Involvement of several schools in the study with different teachers may help to eliminate the possibility of teacher influence in the outcome and show more accurate results.

5) Treatment design. Sequencing the pitched treatment to advance more slowly with the pitches and more quickly with the rhythms might be helpful in future research. This study's pitched treatments seemed to be very difficult and the tempo had to be slowed in order for the students to be able to play the exercises. The above mentioned modification would help control the variable of tempo by making it the same between groups yet would maintain a level of challenge for both groups.

Whether replicated or not, the implications in this study suggest the possibility that certain musical activities may improve reading comprehension particularly when they incorporate the use of pitch and possibly when they incorporate the use of cross-lateral gross motor skills. This is very important when, in light of schools facing budget cuts, many schools consider music to be expendible rather than a core subject, vital to the curriculum. Attention to research, however, would prevent music cuts from the curriculum. Many studies point to very apparent results that indicate that activities in music do seem to enhance higher learning and, as Hancock (1996) said,

> If more administrators were tuned into brain research, scientists argue, not only would schedules change, but subjects such as foreign language and geometry would be offered to much younger children. Music and gym would be daily requirements. Lectures, work sheets and rote memorization would be replaced by hands-on materials, drama and project work. And teachers would pay greater attention to children's emotional connections to subjects (p.58).

In spite of research's strong implications which suggest that music might be very important to enhanced learning, still more research is needed. Studies such as this which show strong connections between music and its possible influence on reading comprehension fall short of being conclusive--pointing all the more to the need for further research.

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Appendix A

Parental Permission Letter
(on school letter-head paper)

Dear Parent/Guardian of Howard Kennedy Third-Grader,

This year your child has been specifically selected to take part in a study to test possible connections with music and its effects on reading ability.

The study will be conducted by Mrs. Miller as part of her thesis research project. It has been approved by the Omaha Public Schools and will be conducted with the permission of principal, Mrs. Clarke, and with the cooperation of the Howard Kennedy third-grade teachers. We feel that the findings from the study will prove beneficial to our students and to our teachers.

We ask that your child be allowed to participate in the study by taking a test to determine the effects of music on reading. This participation is strictly voluntary on your child's part and in no way will it affect your child's grades. No student will be identified in the study. All scores and personal information will be kept strictly confidential. Regular instruction will continue and no instruction time will be lost.

We would like to encourage as many students as possible to participate. A large number of student participants in the study will help to assure accurate results. Mrs. Miller would be happy to answer any questions you might have. If you would like her to contact you please call the school at 457-5520 and leave a message. She will return your call as soon as possible.

Please sign and return the form below by Friday, January 10.

Yours Truly,

Mrs. Karen Miller, Music, and

Mrs. Julieta Clarke, Principal

_____Yes, my child may participate in the study with the music activities and testing.

_____No, my child may only participate in the music activities and not the testing.

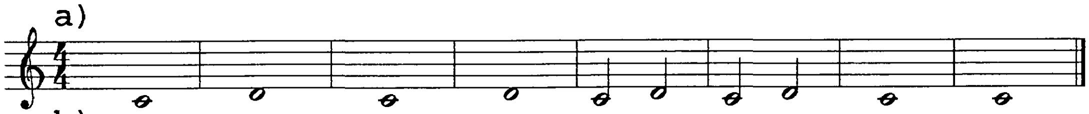
_____I would be interested in seeing the results of the study.

Parents's Signature______________________________Date_______

Appendix B
Pitched Treatments

Session 1

a)



b)

c)

Session 2

a)

b)

c)

Session 3

a)

b)

c)

Session 4

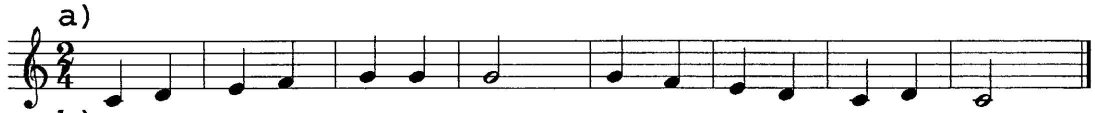
a)

b)

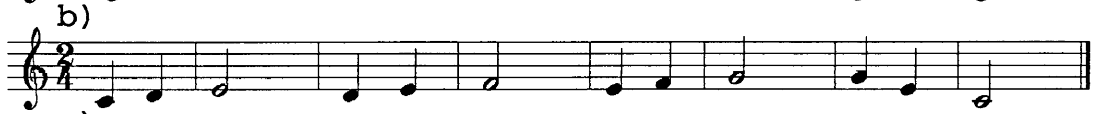
c)

Session 5

a)



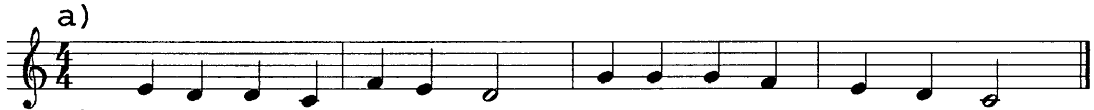
b)



c)

Session 6

a)

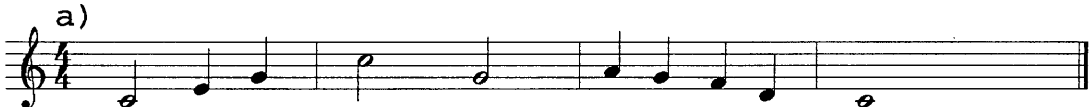


b)

c)

Session 7

a)



b)

c)

Session 8

a)

b)

c)

Session 9

a)

b)

c)

Session 10

a)

b)

c)

Session 11

a)

b)

c)

Session 12

a)

b)

c)

Session 13: Switch to other hand (non-dominant) and play exercises in session 4.

Session 14: Switch to other hand (non-dominant) and play exercises in session 5.

Session 15: Switch to other hand (non-dominant) and play exercises in session 6.

Session 16: Switch to other hand (non-dominant) and play exercises in session 7.

Session 17: Switch to other hand (non-dominant) and play exercises in session 8.

Session 18: Switch to other hand (non-dominant) and play exercises in session 9.

Session 19: Switch to other hand (non-dominant) and play exercises in session 10.

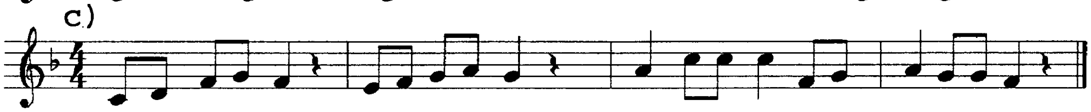
Session 20: Switch to other hand (non-dominant) and play exercises in session 11 and 12.

Session 21: Play with each hand.

a)

b)

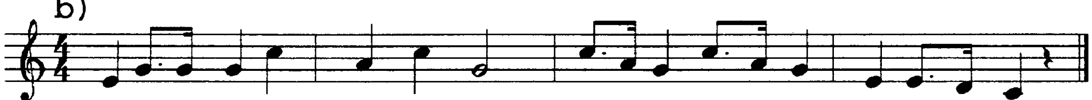
c)



Session 22: Play with each hand.

a)

b)



c)

Session 23: Familiar tunes. Play with each hand.

a)

b)

c)

Session 24: Familiar tunes, play with each hand.

a)

b)