DISSERTATION

THE INTEGRATION OF MUSIC WITH READING CONCEPTS TO IMPROVE ACADEMIC SCORES OF ELEMENTARY STUDENTS

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY LINDA LYONS ENTITLED THE INTEGRATION OF MUSIC WITH READING CONCEPTS TO IMPROVE ACADEMIC SCORES OF ELEMENTARY STUDENTS BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

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The purpose of this research was to investigate the effect of an integrated music curriculum on human learning, focusing on reading achievement. To determine if this technique would make a difference, an experimental design was employed, with a measurement of growth rate in reading skills. The curriculum was delivered, via recorded DVD lessons, to 49 second graders. The majority of the students participating in the study were either Caucasian (50%) or Hispanic (37.5%). One class received the intervention, and one was designated as a wait-list control group which received the intervention during the second half of the semester. This design allowed all students to receive the intervention and added to the effective sample size ($N = 56$), thereby increasing the power of this research.

A nationally-normed, standardized reading achievement test, the Predictive Assessment of Reading (PAR), administered before and after each intervention, was the primary instrument used to assess gains in reading achievement levels. A comparison of pretest –posttest gain scores revealed that students in the intervention groups, on average, scored significantly higher on all six subtests of the posttest. In addition, there was a statistically significant difference between the control group and the combined intervention groups on the gain scores of one subtest. A comparison of the two separate intervention groups with the control group showed that the overall F's for two of the six PAR subtests were significant. Simple effects post hoc analyses also revealed that

Hispanic students in the intervention groups had significantly higher picture recognition gain scores than Hispanic students in the control group.

The researcher believes that this holistic music intervention contains many of the elements of brain-compatible learning, and positively affected the outcome of reading achievement scores. Bringing music into the classroom enabled students to connect ideas being introduced in the music lessons, with concepts taught in their other classes. Through integrated lessons, students developed active listening skills, phonemic awareness, language and graphing skills. Teachers reported that students were engaged in the process and found it memorable. This is substantiated by the finding that gains were made on all subtests, by the intervention groups.

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CONTENTS

CHAPTER 1: INTRODUCTION

On a beautiful June day in Winston-Salem, NC, children are being greeted warmly by the principal of an elementary school and a number of other facilitators. It's the first day of the Music, Mind and Reading summer camp. Kindergarten through 3rd-grade students, attending this camp daily for a period of two weeks, will be given intensive reading instruction, integrated with live music and dance lessons

This camp is part of an ongoing study regarding the influence of music on the academic achievement of elementary students. Participants in this program receive an interdisciplinary curriculum infused with the arts. The researchers involved with this project are looking for ways to assist students (especially those with learning disorders), with the learning process; i.e., store, encode, and retrieve information from memory. Children with learning disabilities often get frustrated with the learning process and then experience emotional or behavioral difficulties as well. Hallam and Price (1998) found that using calming background music in the classroom significantly improved the behavior and mathematics performance of children with emotional and behavioral difficulties. They also found students to be more cooperative and less aggressive.

Teachers find much value in the integration of music in the classroom curriculum. Bringing live musicians into the classroom gives students the opportunity to build personal relationships with musicians (social aspect). In this brain-compatible learning environment, students can ask questions directly of the musicians. Listening lessons, such as identifying instruments by sound, strengthen listening and attention skills. Within this musical context, students can see how a storyline, complete with character, emotions, and plot is analogous with a musical piece. According to Richards (1993), "singing and rhythm enhance the development of auditory discrimination skills, including integration of letter sounds, syllabication, and pronunciation of words" (p. 99). Gardner states that "musical intelligence is almost parallel structurally to linguistic intelligence" (1999, p. 42).

The focus of this research is to explore the value of a music intervention in core academic classes, such as reading and math. The 2004 Music Mind &Reading (MMR) camp did not start out as a research project; the children were given pre- and posttests to give the parents a measure of progress. It was only mid-way into the second week that an "aha!" moment occurred, when a reading expert saw that the students who couldn't audiate (aural equivalent to "visualize") were the same ones who had phonemic deficits. The project director quickly arranged a test of pitch prediction and one of the statisticians at Wake Forest University Baptist Medical Center (WFUBMC) did the statistical analysis which corroborated the relationship. Learning disabilities were not specifically tested for, but it is believed that several were revealed by the preliminary Predictive Assessment of Reading (PAR) test.

Theoretical Framework and Grounding for Proposed Methodology

Brain-compatible learning is a construct within the theory of teaching techniques within the field of education. The brain has a natural way of acquiring and networking information. Much literature (e.g., Caine & Caine, 1991, 1997, 2000; Elster, 2001; Erlauer, 2003; Gardner, 1993, 1996, 1999) supports the theory that teaching techniques that align with the natural way the brain learns increases the potential for learning and the depth of knowledge gained from such learning experiences.

Use of music as a learning mechanism is a construct within the theory of music therapy techniques within the fields of music education and music therapy. Support can be found in the literature (e.g., Butzlaff, 2000; Chalmers, Olson, & Zurkowski, 1999; Abikoff, & Courtney, 1996) for the use of music therapy techniques in classrooms to assist a wide range of populations, such as developmentally disabled students or students exhibiting at-risk behaviors.

For infusing music therapy into core curriculum, the researchers borrowed ideas from artist-in-residence programs. Integrating the arts, such as drawing and music, has been shown to engage all types of learners in the learning process. In a Learning Through the Arts (LTTA) program, teachers reported students being engaged, motivated, and challenged by an arts-based curriculum. Through this curriculum, they saw students being calmed, validated, and focused. Teachers saw the value of LTTA curriculum as meeting the needs of every learning style, and giving all students the opportunity to be successful (Upitis, Smithrim, Patteson and Meban, 2001).

These concepts were woven together for the current dissertation research design. An integrated music and reading intervention was given to a group of elementary students during their music class, while another group received the traditional music curriculum. The integrated music and reading intervention was given over a period of 6-7 weeks, using a video/DVD format. At the end of the time period, both groups were measured on reading achievement levels.

The rationale and evidence for a quantitative approach is presented in the Conceptual Framework section. The test scores help to answer the research questions about advances in academic achievement. But test scores alone do not fully reflect the learning and development that has taken place as a result of a particular intervention. This is a holistic approach that involves the whole person, including emotional, behavioral, and psychological aspects. Some qualitative data, in the form of supporting statements, was gathered through observation of students and informal interviews with teachers at the end of the intervention.

The form for this design is applied rather than theoretical, but is based on theories found in music therapy and education. The school setting for this research was within the social context of the phenomena that would be considered a field setting. The research was conducted in a dynamic system where changes in participants and their settings were duly noted. Within this system, there was direct personal contact with the participants in their school setting.

Problem Statement

The traditional curriculum of rote learning and practice sheets no longer serves a generation of children who often have short attention spans, have been over stimulated by the environment, and have unlimited access to information (Sousa, 2001). Educators are continually looking for ways to engage students who have varying styles and abilities, in the learning process (i.e. storing, encoding, and retrieving information from memory). A review of current literature shows numerous interventions for children with learning disabilities (e.g., Abikoff & Courtney, 1996; Overy, 2003), but fewer using music therapy concepts in core classes (e.g., Anderson, Henke, McLaughlin, Ripp, and Tuff, 2000;

Brogla-Krupke, 2003; Kennedy, 2005). The use of music therapy principles might be employed in core classes to enhance the learning process for all students, especially those with learning disadvantages, such as second-language learners. It is the researcher's belief that music can be embedded in traditional curriculum to engage all students.

The purpose of this research was to investigate the effect of an integrated music curriculum on human learning, focusing on academic achievement in reading. This study furthers the extensive use of this program/intervention that has been done with similar populations, by adding a control group. A secondary goal of this study was to investigate the effects of such a curriculum with diverse groups of students and to determine if there were significantly different gains in achievement between ethnic groups. Previous literature indicates that the program may be especially helpful for at-risk and minority students.

Research Questions

One of the key questions of this research is whether a music intervention can enhance learning and improve levels of reading achievement for students in a traditional elementary classroom? What specific reading differences are found between groups of students who receive a music intervention and those who don't? Specifically, the questions addressed by this research are:

1. Is there a difference between a music intervention and no intervention with regard to gains in reading achievement scores of traditional elementary students?
2. Is there a difference between Caucasian and Hispanic students with regard to gains in reading achievement scores?

3. Is there an interaction between the music intervention and ethnicity with regard to gains in reading achievement scores?

The research questions were addressed by analyzing pretest and posttest scores of a validated, nationally-normed reading test.

Definition of Terms

Music intervention – an integrated music and reading curriculum delivered in 12 video/DVD lessons.

Plasticity – a broad term that can mean an adjustment or adaptation of a sensory or motor system to environmental stimuli; performance requirements or a compensation of some cerebral structures for others that are impaired due to injury.

Reading achievement – as measured by student scores on the Predictive Assessment Reading (PAR) tests.

Traditional elementary students – students found in traditional school settings, grades K-6.

Brain-compatible learning – any number of teaching techniques that employ methods of how the brain learns naturally; for example, engaging students through novel approaches, arousing their curiosity, and providing meaningful connections to the 'real world'.

Study Limitations and Delimitations

A study with three distinct levels of treatment type (control, live music, recorded music), all receiving the prescribed treatment at the same time, was the preferred design and would probably have been much more powerful. But, because of limited resources (time, money, assistance, and number of subjects available at any one site), this was not feasible for the dissertation study. Due to these constraints, the integrated music curriculum used in this study was delivered in a video/DVD format. One of the goals of this study was to find one or more sites, with an ethnically diversified population and large enough sample sizes, willing to participate in the research. Many schools in the Poudre School District are very homogenous without much racial diversity. The study was delimited to elementary schools within the Fort Collins area that have a high level of diversity in the student population. The school chosen had small to medium class sizes, a limitation on sample size that has been found in a number of prior studies.

Amount of testing being done in our school districts is a major concern to teachers and administrators. Reluctance to add yet another set of tests limited the availability of schools to participate in the study. To address this concern, the researcher delivered the intervention during the fall months, when there were less timing conflicts with other standardized testing.

A major limitation was which classes would get the intervention, the reading classes or the music class. If the music teacher delivered the intervention, there was a chance of bleed-through to the regular curriculum, which was being used for the control group. There was also a limitation on the random assignment of students within a class. Students are sometimes placed in particular classes because of specific needs that can be addressed within a certain group or by the teacher's style of teaching. To address this concern, the school chosen had near-random assignment of students at the beginning of the school year.

Researcher's Perspective

My interest in the use of music therapy interventions arose from my own need to find a solution to an auditory problem I was experiencing at the time. From this exploration, I became acquainted with how music is being used to facilitate learning, to memorize facts, and to assist with numerous difficulties, such as premature births and autism. I spent time with music therapists to learn about techniques being used in special needs classes. Being a secondary mathematics teacher, I began questioning how we could use music in the traditional classroom to assist students with learning academic content. Courses, workshops and readings sparked my interest in how the brain learns, and I began to see how a music intervention fits many of the tenets presented as brain-compatible learning. I learned that any time we engage students through novel approaches, pique their curiosity and provide meaningful connections, children will better attend to the concepts being learned.

While attending a Brain and Learning Conference, I met Peter Perret, who had just co-authored a book about the use of music to help students improve reading skills. The studies that had been done by him and colleagues at Wake Forest University fit so well with the ideas I was formulating for a dissertation topic. I decided to collaborate with them and to utilize their curriculum in a study with a more controlled experimental design. Up to this point, their music intervention had been delivered by a live quintet and they were working on a recorded video version. They wanted to see if the video version had the same impact as the live version, so I agreed to use video format of the music lessons in my study.

I believe that this music intervention has many of the elements of brain-compatible teaching, and is likely to positively affect the outcome of reading achievement scores. My guess, though, is that the video format did not have as great an impact on gain scores as what the live-music intervention would have had. And that a comparison of gain scores for different ethnic groups will show greater gains being made for those of Hispanic and African American decent due to a stronger connection with their rich musical heritage.

CHAPTER 2: LITERATURE REVIEW

The relationship between music and thinking has been a subject of much speculation since Pythagoras (ca. 570-497 B.C.) identified the consonant musical intervals in mathematical terms. Numerical ratios of 2:1, 3:2, 4:3, and 5:4 characterize intervals known correspondingly as the octave, the fifth, the fourth, and the third (Deutsch, 1982; Perret & Fox, 2004). The role of music in education can be traced back to Aristotle's time. Music was essentially an educational tool that Aristotle used in his teaching. A pupil of Pythagoras and Aristotle, Aristoxenus (ca. 320 B.C.) argued that "musical phenomena were basically perceptual and cognitive in nature" (Deutsch, 1982, p. 4). In the past two decades, scientists have made great strides in studying the brain by using improved testing mechanisms and refined neuroimaging techniques. Research that explores the neurobiology of music allows us to further investigate the impact of music in educational settings (Thaut, 2005; Zatorre & Peretz, 2003).

Recent brain research has done much to build awareness of how the brain processes information and learns (Diamond, 2001). Much support for using music as a learning aid in the classroom can be found in current studies that are tied to a number of other interventions used to create positive learning environments and to enhance learning for students, especially those with learning challenges (Erlauer, 2003; Jensen, 1998). Robert Brooks (2004), an expert in child development and one of the keynote speakers at the Brain and Learning Conference, emphasized the need to foster motivation, self-esteem, and resilience in children with learning and attention difficulties as a means for meeting basic needs.

Brain Research and Music Education

The 3-pound human brain contains about 100 billion neurons, each one potentially creating 5,000 to 20,000 connections to other neurons. Incoming sensory stimuli cause the neurons to transmit nerve impulses along their axons and across the synapses (gaps) to the dendrites (branches) of neighboring cells (Sousa, 2001, 2006). Chemicals called neurotransmitters, carry the impulses to receptor sites. Thus, neural connections are made by firing. Neural networks are built by this process of firing, connecting and relaying information. The building of neural networks is defined as learning (Wolfe & Brandt, 1998). Due to repeated firings that result from practice and rehearsal, groups of neurons 'learn' to fire together (Jensen, 1998; Sousa, 2001). Memory is formed when the firings become automatic under certain conditions (Sousa, 2001).

Pruning (apoptosis), the purposeful elimination of neurons, occurs because of overconnection, decay, lack of stimulation, or lack of connection. It ensures the preservation of connected neurons and prevents overcrowding with unconnected cells (Sousa, 2001). Throughout maturation, neurons are continually making connections and being pruned, with the most intense activity between age 3 and age 12. Dendritic branching is stimulated by interactions with the environment (Diamond & Hopson, 1998). "The richer the environment, the greater the number of interconnections that are made; consequently, learning can take place faster and with greater meaning" (Sousa, 2001, p. 19).

Periods of development where extensive neural networking and pruning take place, are described as "sensitive periods" or "windows of opportunity" (Wolfe & Brandt, 1998). During these critical periods between birth and age 10, synaptic connections increase rapidly, making it easy to acquire certain skills or learnings (Sousa, 2001; Wolfe & Brandt, 1998). It is thought that during the preschool years, the developmental window for sensory and motor systems peaks. Around age 6 and through the early elementary grades, sensorimotor and cognitive functions become linked; at the same time, children are entering the critical period for reading. The developmental window for cortical activity is very broad, spanning middle childhood and adolescence, making this period an optimum time to develop high-level thinking skills (Berninger & Richards, 2002).

Enriched Environment

The theory that an enriched environment stimulates growth of the brain, has been the basis for research conducted by Marian Diamond (2001). In an experimental study, rats were placed in one of three environments. In the impoverished environment, rats were isolated in small cages, with no stimulation. Those placed in the standard environment were contained in small cages with a few other rats, but without objects. In the enriched environment, the rats had a larger living space, more rats to interact with, objects to explore, and frequent introduction to new objects. One aspect of this enrichment was the physical exercise achieved by moving in a larger space and climbing on the novel objects. Diamond discovered that after 30 days, the rats from the enriched environment had an increased thickness of the cortex, partially due to larger nerve cells and denser branching of dendrites (Diamond, 2001; Diamond & Hopson, 1998). On the other hand, a boring environment resulted in a thinning of dendrites. Diamond's studies also revealed that even after four days of stimulation or boredom, a thickening or thinning of dendrites could be observed.

Diamond's significant contributions influenced studies about enrichment in school settings. In the 1970's, Ramey and Ramey (2003) conducted a study that involved an enrichment intervention for impoverished children. The treatment group was placed in an enriched environment that included proper nutrition and social services, with activities to promote language, motor, social, and cognitive development. Those who received the enriched curriculum scored significantly higher on post-treatment IQ tests than the control group. Brain-imaging techniques, used at a later time to examine the effects of the enriched environment, also revealed significant differences in the brain development of these two groups.

Diamond's research supported the concept that the brain has "neural plasticity", the ability to continually change its physical structure and functioning ability; the degree to which it can be rewired (Wolfe & Brandt, 1998). An enriched environment provides positive external experiences to stimulate the brain's growth and learning. According to Diamond, such an environment provides emotional support, free of excessive pressure and stress. It encourages social interaction, develops a wide range of skills and interests, and offers novel challenges that are age-appropriate. Within this environment, pleasurable learning is active, hands-on, and exploratory (Wolfe & Brandt, 1998; Diamond & Hopson, 1998).

Caine and Caine (1997) generated a list of 12 principles of brain/mind learning. Their comprehensive list included ideas from recent brain research, such as the brain is a social one. Not only does it search for meaning through 'patterning', but that search for meaning is an innate response to its environment; it is prewired. This patterning is highly dependent upon emotional input. While learning requires focused attention, it also involves peripheral awareness. Challenge has a tendency to augment complex learning, while threat inhibits it. These ideas are nicely summarized by Jensen (1998) when he asserts that, "Great learning states include curiosity, anticipation, and challenge" (p. 43).

The enriched environment will encompass those aspects that add to the physical comfort of students: proper ventilation, adequate lighting, adequate space for materials, and movement. Enrichment, though, is created more in the process than the structure (Jensen, 2000). It includes a number of intangibles such as a safe, non-threatening space; as well as opportunities for social interaction and feedback, collaboration, problem solving, inquiry, use of multiple intelligences, coherence through contextual activities (Gardner, 1993; Jensen, 1998; Jensen, 2000).

Intelligence is defined by Gardner (1996), as the "biopsychological potential to process information in certain ways, in order to solve problems or fashion products that are valued in a culture or community" (videorecording). In his theory of multiple intelligences, Gardner (1993) describes the various ways people know and learn; i.e., having interpersonal, intrapersonal, musical, mathematical/logical, kinesthetic, naturalist, linguistic, and spatial intelligences. He contends that each of us has all the intelligences in varying degrees. An enriched, complex curriculum allows students to access these intelligences in multiple ways.

Musical intelligence encompasses skill in the performance, composition, and appreciation of musical patterns. Gardner (1999) suggested that "musical intelligence is almost parallel structurally to linguistic intelligence" (p. 42). There is a notion that music was a precursor to language, in that early humans developed skill in identifying and responding to rhythms and tonal variations. It's interesting to note that while listening to music, the left hemisphere is activated in musicians' brains, while the right hemisphere is the one usually activated for the common listener (Sylwester, 1995). One explanation for this difference is that a musician is also analyzing the music while listening.

Engaging Students Enhances Learning

According to practitioners such as Brooks (2004) and Gardner (1993), motivation is fostered by engaging students in the learning process. Anytime students are more engaged in the process and feel comfortable in their environment, there is a much better chance that learning will take place. Multiple intelligence theory (MI), which looks at the many ways of knowing, can be used to build curriculum that authenticates learning and invites students to express themselves. Gardner has been involved with several projects, such as Project Zero, that incorporate MI theory. Project Zero encompasses open-ended projects that lead to meaningful demonstration and assessment of one's abilities and knowledge gained (Hatch & Gardner, 1996). Involving the multiple intelligences (e.g., musical and kinesthetic intelligence), in classroom activities provides a mechanism for engaging students and helping them to make connections through personal experience.

Social and Emotional

Parts of the brain that make up the emotional system, also receive input from the sensory systems (visual, auditory, etc.) Brain research has shown that the limbic system plays a major role in processing both emotion and memory, making emotion an important component of many memories. As noted by Sylwester (1995), "Far more neural fibers project from our brain's relatively small limbic emotional center into the large logical/rational cortical centers than the reverse" (p. 73). In the process of learning, emotion functions in two ways. When added to the learning experience, emotion can attach meaning and excitement. This causes the brain to pay attention to the information; thereby increasing retention (Wolfe & Brandt, 1998). On the other hand, a very strong emotional attachment may be perceived as threatening by the learner, and learning is decreased. "Emotion and attention are the principal preliminary processes that our body/brain uses in its efforts to survive (and even thrive) in the face of continual challenges" (Sylwester, 1995, p. 71).

Emotions activate and chemically stimulate the brain, assisting in the retrieval process (Jensen, 1998). Findings from research conducted by Thayer (1989), demonstrated that recall was greater for words learned in a similar mood than in an opposite one; i.e., "learning is state dependent with moods" (p. 34). Positive emotional states can enhance memory organization and the integration of concepts and diverse ideas (Greenleaf, 2003). "Joy makes learning an end in itself. Learning does not have to be imposed, forced, or externally motivated….The consequence is that the capacity to understand and perform at increasingly higher levels is natural and self-generating" (Caine & Caine, 1997, p. 144).

Social and emotional learning plays a major role in engaging students, and increasing social skills can impact cognitive functioning. In her book, *The Soul of Education*, Rachel Kessler (2000) detailed the components of a social and emotional learning environment. She describes social and emotional learning (SEL) as active learning techniques that engage the mind and heart, as well as the body. Using SEL activities gives students a greater sense of achievement, academic success, and connectedness in the classroom. An overall sense of well-being produces more endorphins, improving metacognitive abilities. This idea is championed by Robert Brooks (2004), who talks about creating safe, nurturing environments for our students to thrive in. He emphasizes the importance of having charismatic teachers in students' lives; those who touch hearts (the emotional centers) as well as minds.

Integrating the arts, such as drawing and music, has been shown to engage all types of learners while adding an emotional component to what is being learned and what gets stored in memory. Music crosses many "learning systems" (Given, 2002); e.g., it accesses the cognitive system to attend to new material, while tapping into the emotional system for feeling and creativity. This gives the student multiple reference points to the information being learned and facilitates retrieval from memory. When the cognitive system is at odds with the emotional or social systems, it must attend to the emotional input before it will be able to focus on the acquisition of knowledge and skills in the form of higher order thinking (Given, 2002). Therefore, the calm student has a much better chance of abstract learning (Caine, 2000).

Sylwester (1995) encouraged teachers to include emotion in the educative process because it "drives attention, which drives learning and memory" (p. 72). Within classroom activities, teachers can provide emotional outlets through journaling, singing, dancing, reflecting, drawing, or listening to music (Jensen, 1998; Caine, 2000). Play is a critical component of learning because the emotion aroused during play "activates attention, problem solving, and behavior response systems" (Given, 2002, p. 48). Those activities that tend to embrace social interaction and engage the entire body/brain offer the most emotional support (Sylwester, 1995). Examples include: games, physical education, interactive projects, and the arts. "Emotional-laden activities like simulations, role playing and cooperative projects provide contextual memory prompts for recalling the information in a 'real-life' situation" (p. 76).

Movement (Physical Systems)

During movement, the cerebellum has been found to be highly activated (Erlauer, 2003). Integrating movement into the daily routine with activities like stretching, walking, and playing games, releases attentional chemicals such as serotonin, epinephrine and dopamine. Sylwester's comments (1995) amplify the need for more movement:

> The traditional predominance of a 'sit quietly' approach to schooling is not compatible with what we understand about the brain's requirements for interaction, involvement, proximity, novelty, procedures, and so forth. If there are direct links between the cerebellum and the mid-brain's dorsal area (pleasure center) and the cerebellum connects movement to many areas of the brain, then it is not a great conceptual leap to acknowledge the relationship of movement to increased enjoyment in the learning experience. (p. 42)

Interestingly enough, those countries with the highest scores in math and science (Japan, Hungary, and Netherlands), have infused intensive music and art training into their elementary curriculum (as cited in Jensen, 1998).

The result of a study done during the mid-1990's showed that 46% of U.S. students in grades 3-12 preferred visual learning, 35%, kinesthetic-tactile learning and 19%, auditory (Sousa, 2001). All modes of learning, though, depend on movement to integrate the learning experience (Greenleaf, 2003). Adding movement to content instruction has been shown to greatly increase brain activity. According to Greenleaf, the integration of movement with other types of learning can be "more neurally intricate than any other form of learning. Cognitive decisions to move in a certain way or manner (however minor the act) may involve neuronal activity in the billions, 20 or more times the actual number of neurons required to activate muscle groups" (p. 17).

Music creates a natural framework for adding movement to content instruction, potentially engaging the brain and the learner in multiple ways. Dance, in its many forms, is influenced by the accompanying music. Teachers can creatively integrate learning with dance, movement, and music. As part of a reading lesson, for example, we could add music and movements that reinforce terminology already learned; e.g., move in a legato fashion, or like a lion stalking its prey.

Multimodal Learning

The brain is a parallel processor; it prefers to deal with new information using multiple modalities (Caine & Caine, 1991; Roberts, 2002). Neural networks that manage similar input are referred to as "learning systems" (Edelman, 1992); these link with other systems to form elaborate networks that progressively get more complex. Accessing multiple neural pathways is a natural way for the brain to process information (Erlauer, 2003, Jensen, 1998). Gordon Shaw tells us that higher level brain functions, such as problem-solving, make use of many of the cortical areas simultaneously (2000). According to Donald Hodges, a music professor at the University of Texas, musical experiences are multimodal, involving a variety of brain systems: auditory, visual, motor, affective, and cognitive. The processing of music is distributed across both the right and left hemispheres of the brain (as cited in Black, 1997).

Immordino-Yang (2001), suggested we think of the brain as an entire system instead of it being organized by discipline. For example, the ability to mentally represent and manipulate quantities and locations (i.e., having a concept of the number two and how two sets of three things combines to make six things) is not just a math skill; it really is a spatial-temporal ability that crosses many disciplines. Brain research from multiple fields, such as neurology, physiology, and cognitive psychology, has revealed that we create meaning by merging multi-sensory experience with intellectual thought process (Oddleifson, 1994). Emergence in a complex, multi-sensory environment invites higher level brain functioning.

Any topic can be approached using multiple entry points, which Gardner (1996) refers to as 'windows into the room'. The entry points, as defined by Gardner, somewhat correspond to the intelligences: narrative, quantitative/logical, existential, aesthetic, 'hands-on', and interpersonal/collaborative. He gives an example of creating an entry point using numbers, because they are linked with everything. "Mozart happened to love to play with numbers, and there are all kinds of numbers and rhythmic things and metric things in any musical work" (videorecording). Using the 'hands-on' entry point in this theme of numbers interacting with music, students can extend the learning by singing or performing a piece of music. Project-based and theme-related curricula have the power to activate the multiple intelligences of the learner. This type of 'real life' experience enhances academic learning. In this realm of experiential, holistic learning we might find an infusion of the arts in curriculum.

Interdisciplinary in nature, arts-based education provides an avenue for multi-modal learning, accessing multiple cognitive domains. A review of arts education studies led James Hanshumacher (1980) to deduce that activities infused with the arts will positively impact language development; specifically those that include discussion with the students, will improve "vocabulary, language fluency, and sequencing skills" (p. 21).

Upitis, Smithrim, Patteson, and Meban (2001) partially attribute the success of this type of program, Learning Through the Arts (LTTA), to the fostering of authentic relationships between artists and teachers. The artists cooperatively plan curriculum with the teachers, and deliver segments of lessons that are related to their fields (Grauer, Irwin, deCosson, & Wilson, 2001). Artists involved in the program have to demonstrate an interest in holistic education and be willing to become engaged in integrated curriculum involving areas of math, science social studies and language arts. Teachers perceive the value of an LTTA curriculum as meeting the needs of every learning style, and giving all students the opportunity to be successful (Upitis et al., 2001). In addition to students being engaged, motivated, and challenged by this arts-based curriculum, teachers have observed students being calmed, validated, and focused.

Challenge and Problem Solving

The best method of providing an enriched environment is through challenge and problem solving (Jensen, 1998). In fact, the brain thrives on it. As stated by University of Wisconsin psychology professor, Dr. Denney, "problem solving is to the brain what aerobic exercise is to the body" (as cited in Jensen, 1994, p. 144). Kearney (1996) found that PET scans done on people who frequently problem-solve, show brain activity in many regions, including the left frontal lobes (where musicians tend to process melodies), and those areas that store music, art and movement (as cited in Jensen, 1998).

"Our brain's critical-thinking and problem-solving mechanisms are especially effective at rapidly processing ambiguities, metaphors, abstractions, patterns, and changes as they create and confront concepts" (Sylwester, 1995, p. 53). Through the use of music in the classroom, teachers can create metaphors and abstractions for other content areas. The patterns found in music are very similar to those found in mathematics. A pattern-seeking activity might ask students to graph melodies, which essentially plots pitch on the y-axis and time on the x-axis (Perret & Fox, 2004). Other mathematical concepts such as matching (students identify instruments with the sound they create), sorting, and opposites (hi versus lo), are found in integrated music lessons. When children interact with music, they are able to gain time sense; i.e., counting by 3's or 4's, counting in the head versus out loud.

The integration of music with multiple subject areas creates a learning situation that requires critical thinking as students compare and contrast, analyze, and synthesize concepts. Examples of this can be found in music lessons that are delivered as part of a reading program with a major emphasis on vocabulary and language development (Perret & Fox, 2004). Some of the lessons might review the concept of character setting, which is used throughout music. Using analogies, a sonata could be compared to a well-written story, with sections of the music played to demonstrate the different elements of the story; i.e., the setting found at the beginning, each theme or character, the problem or conflict found in the middle.

An arts-based curriculum provides an enriched environment that embraces critical thinking and synthesis of ideas. Mary Siebert (personal communication, May 23, 2005), Curriculum Coordinator for the Arts-Based Elementary School in Winston-Salem, North Carolina, stated that children learn better and more joyfully through the arts; that it builds self-esteem, and develops the brain. In a list of its benefits, Angela Elster (2001) included the development of analytical and problem-solving skills, and creative thinking which leads to higher-order thinking skills. Arts education gives students a way to express their feelings and experiences. Such a holistic curriculum can give meaning to what students are learning. The integrated curriculum is hands-on, relevant and authentic.

Relevancy, Authentic Work, Contextual (Hands-On)

Relevant connections that strengthen neural networks are accomplished by linking new knowledge to prior knowledge, creating meaning and patterns through context, and making sense of the information. The maintenance and strengthening of neural connections is accomplished through a process called *elaboration* (Jensen, 1998). Elaboration allows opportunities to sort, sift, integrate, analyze, expand, test and synthesize ideas. The human brain naturally seeks meaning, but it happens internally, so Jensen advises to allow time for this elaboration to take place.

Much of what we consider to be experiential learning satisfies the search for meaning through 'patterning'. Patterning is defined by Nummela and Rosengren (1986) as the "meaningful organization and categorization of information". In its search for meaning, the brain continually integrates new information with prior learning; at the same time ignoring information that has no connectedness (Caine & Caine, 1991). When knowledge is linked to personal experience and relevant application, the learning experience is greatly enhanced (Jensen, 1998). To increase relevance in these practices, Erlauer (2003) suggested using diverse examples, metaphors, and pictures.

Often referred to as contextual learning, 'real-life' or experiential learning provides opportunities for concepts to be learned from a variety of experiences, using a multimodal approach. Experiential learning stimulates multiple neural networks (also termed neural forests by Diamond), and promotes parallel processing of information (Given, 2002; Greenleaf, 2003; Jensen, 1998; Roberts, 2002; Wolfe & Brandt, 1998).

Teachers support experiential learning through the use of classroom experiments, hands-on activities, simulations, models, and field trips.

Putting these ideas of relevant application to practice, a school in a small Iowa community participated in a program to improve student achievement through the use of music strategies. In fifth-grade Social Studies, where students lacked motivation and in-depth learning, music was chosen to increase awareness of the characteristics of the historical period they studied, while making the subject real and personal. The intervention had three major goals: (1) accommodate various learning styles; (2) implement cross-curricular thematic instruction; and (3) use aesthetic education. Test results, teacher comments, and student reactions about the project indicated an increase in student motivation, an increase in understanding relationships between the two disciplines, and more in-depth learning. (Brogla-Krupke, 2003)

Can music be used to create a positive, brain-compatible environment (using a whole-brain strategy) that is more conducive to learning? Embellishing other content (e.g., reading or math), with music lessons adds meaning by providing a context for the information to be learned. Through the integration of music, concepts are brought to life in the minds of the learners, a practice which Caine and Caine (1991, 1997) call "orchestrated immersion". This multi-sensory approach gives students the opportunity to actively process the information, giving it personal meaning. Connections to music concepts can be made to reinforce reading concepts; e.g., the beginning or end of a musical movement represents a syllable. Another idea might be to enhance a music lesson with word recognition devices, such as magnetic flashcards. According to Caine and Caine (1991), teachers have the ability to immerse their students in a rich, contextual environment by weaving together experiences that contain relevancy, realism, authenticity, and challenge.

Novelty and Curiosity

"The brain is essentially curious" (Wolfe & Brandt, 1998; p. 11); it searches for meaning and ways to connect new ideas with prior knowledge. Novel approaches to learning naturally pique the curious brain, thereby engaging the learner. Jensen asserts that incorporating novelty in the classroom experience, "ensures attentional bias" (1998, p. 50). More neural connections and dendritic branching occur as a result of such experiences.

When learning and memory are prompted by a particular event or location, the episodic memory pathway is invoked. This system, known as the spatial, event or contextual recall process, is "motivated by curiosity, novelty and expectations" (Jensen, 1998, p. 106). Sensory input (sight, sounds, smells), awaken the episodic memory pathway. Our children today are growing up in an environment where the sensory and emotional input changes quickly. Their response is often to participate in activities that have a brief duration. Sousa (2001) concluded that because of an adaptation to this rapidly changing environment, "The brains of today's students are attracted more than ever to the unique and different – what is called novelty" (p. 16).

Essential ingredients for enrichment include novelty, challenge, feedback and time (Jensen, 2000). Novelty can have "elements of suspense, surprise, and disorder to keep learners engaged" (Roberts, 2002, p.284). A recommendation made by Roberts (2002), is for teachers to infuse the curriculum with novel activities about 40% of the time. Novel approaches might include bringing a guest musician into the classroom, graphing a melody, playing a surprising piece of music, or having students make music from objects they brought to class (Jensen, 1998; Perret & Fox, 2004).

Music can provide a novel context for learning new information while supporting concepts found in other subject areas. Bringing live musicians into the classroom is likely to pique the curiosity of students, engaging them as learners. Because it is unique and sensory in nature, this type of learning will quickly activate episodic memory pathways (Jensen, 1998). When we relate musical concepts to those found in reading (such as 'storytelling' and 'opposites'), we also engage the semantic memory system (processing of terms, stories, and facts).

Using the Rational-Scientific Mediating Model (R-SMM) to Examine Related Research

In the process of examining research that focuses on the concept of using music as a mediating stimulus for nonmusical behaviors, one might utilize the Rational-Scientific Mediating Model (R-SMM), as set forth by Thaut (2005). In this model, parallels are drawn between musical and nonmusical response models. Mediating models provide evidence for the influence of music on behavior; i.e., how music engages the brain through arousal, attention, and organization of information. The R-SMM serves as an epistemological model that can be used to explore the interaction between music and nonmusical brain functions, thereby building a rationale for its therapeutic application in classroom settings.

Musical Response Models

This phase of investigation is concerned with the physiological and psychological systems involved in music perception and performance (Thaut, 2005). Within the cognitive domain, relevant research would include studies that focus on memory and attention, cognitive information processing, auditory imagery, and multimodal sensory integration as they relate to learning and music.

Music which is a "rule-based sensory language" (Thaut, 2005, p. 33), taps into complex, widely distributed neural networks. According to Weinberger, an expert on the auditory cortex and its response to music, "our brains are specialized for music so that each of music's building blocks is processed by a different part of the brain" (1994, ¶ 2). Weinberger's research suggests that melodic contour is processed by individual neurons, and that pitch and tone (not just raw sound frequencies) activate the auditory cortex. A study conducted by Brattico, Tervaniemi, Näätänen, and Peretz (2006), demonstrated that "musical scale information is processed automatically by the human brain." Even more impressive, Brattico et al, found that "an early frontal negative neural response was elicited in nonmusicians to musical scale incongruities" (p. 168).

Research done by Alfred Tomatis, a French ENT (Ear, Nose and Throat specialist), showed that sound behaves like an electric charge that energizes the brain (Sollier, 2001-2003). The neural cells in the cortex are recharged at high frequencies, with the most advantageous frequency around 8000Hz. Tomatis deduced that frequencies in the range of 3000-8000Hz resonate in the brain, influencing cognitive functions. "All the early sounds shape the brain, even music and rhythm" (Jensen, 1998, p. 23).

In the *Cognitive Neuroscience of Music*, Zatorre & Peretz (2003) explain that changes in the brain (referred to as neuroplasticity), can occur as a result of musical training; that memorizing a simple tune can strengthen synaptic connections. Long-term changes are evidenced in the gross-anatomical differences between musicians and nonmusicians. G. Schlaug (2001) reports that musicians have a larger anterior corpus callosum (the bridge of nerve fibers between right and left hemispheres), increased cerebellar volume and regional differences in gray-matter volume. This may be due to increased communication between hemispheres that results from reading and playing music. Based on findings that the size of these effects correlates with early musical training, Schlaug concludes that there is substantial data to support the idea that musical training will induce brain plasticity.

Studies, such as those performed by Nakamura et al. (1999), provide evidence that listening to selected types of music activate the visual imagery and memory recall areas of the brain. Music evokes an emotional response; i.e., it has the power to arouse or relax, create a feeling of happiness or sadness, and even alter physiological states of heart rate and blood pressure (Giles, 1991). In particular, *sixty-beat music* has been shown to slow the heart rate and encourage relaxation, which may lead to better focus and concentration (Chalmers, Olson, & Zurkowski, 1999). It has been established that background music can improve attentiveness and focus when working with one's hands (Sousa, 2006).

The structure of music provides timing and sound patterns that can enhance effective memory formation (Thaut, 2005). Through association and the use of mnemonics in memory training, neurologic music therapy (NMT) can play a major role in enhancing memory function. Because of its temporal nature, rhythm not only has the ability to influence sensory memory, it also directs attention and focus to patterns and formations (Thaut). Due to rhythm, sounds get organized to create meaningful patterns and constructions. These "precisely patterned sequences of both movement and sound"

(Janata & Grafton, 2003, p. 682) engage the brain in multiple ways. Patterned temporal sequences, interwoven with other tasks, have been shown to improve spatial sequence learning (Janata & Grafton, 2003).

Brain research has shown that "neuronal oscillations, which build rhythmically synchronized firing patterns in network ensembles of neurons, form the neurobiological basis of perception and learning" (Thaut, 2005, p. 79). Specifically, the cerebellum may play a major role in the cognitive and perceptual processes involved with musical timing (Schmahmann, 1997). The processing of temporal information activates not only the auditory system, but parallel and adjacent brain areas as well. As explained by Thaut, these activations which span multiple neural networks bring about changes in the brain that are referred to as *plasticity*.

Nonmusical Parallel Models

In this stage, based on research findings, parallels are drawn between nonmusical and musical perception and behavior. For comparison purposes, we might look at proven nonmusical strategies for enhancing memory and attention, speech and language networks, and auditory-visual processes. Specific to the research question being posed, studies that relate to phonemic awareness and phonological decoding will be of particular interest.

Learning and retention transpire differently. Learning, which involves the brain, the nervous system, and the environment, is the process of acquiring new knowledge and skills through the interplay of these systems. Memory is the manner in which knowledge and skills are retained and retrieved at a later time. Retention of learning depends on sense (understanding), and meaning (relevancy). Through rehearsal, or continual reprocessing of information, students are able to attach sense and meaning, facilitating the transfer of learning from working memory to long-term storage (Sousa, 2001).

Affect definitely plays a role in the storage and retrieval of information (Ormrod, 1999). Other factors that influence the retrieval of information from memory include: the degree of student focus, emotional intensity, number of associations and pathways, length and type of rehearsal, context, learning style, any learning disabilities, and prior learning (Jensen, 1998; Sousa, 2001). According to Sousa, "Learning and retention are more likely to occur when students can observe, engage in, discuss, reflect upon, and practice the new learning" (p. 27).

Memory and Attention. Since attention is a critical element of the learning process, "helping students to focus their attention on important information is the first step in helping them learn it" (Ormrod, 1999, p. 199). A review by Zentall (2005) revealed that attention can be primed through classroom activities that incorporate active learning, attention training, practice (repetition), and cognitive behavioral modification. Attention training practice sessions involve finding objects or listening for sounds/words. Semrud-Clikeman et al. (1999) found that having children search for visual and auditory cues within contexts of similar and overlapping stimuli resulted in higher assessment scores. Use of a metronome as an auditory attention signal for students with ADHD produced greater gains in 40-53 of 58 measures of attention and reading than those in the control group.

Memory can be enhanced by chunking information. The 'chunking principle' described by Gobet (2005), refers to the learning process, where neural networks are built through the process of selection, thereby accessing long-term memory. By means of a computerized model, scientists simulate how the brain chunks, stores and retrieves information. There are three main elements of the model: STM which has auditory and visual components, LTM which includes semantic and procedural components, and a discrimination network that acts as an index to LTM. Using a sequence of perceptual tests, external stimuli get sorted to the appropriate node or chunk in the 'discrimination network'. Longer sequences of information are hierarchically organized using patterns of recurring sub-sequences, leading to additional chunking, with improvements in reaction time (Janata & Grafton, 2003).

Organization facilitates retrieval from LTM (Schenck, 2004); when organization is used as a tool, storage and recall become exponential. For example, if a concept is taught using four different techniques, there are 1x2x3x4 ways to retrieve it. More details can be recalled with the elaboration of concepts. Factors that influence LTM include: movement, motivation/attention, elaboration, review/repetition, and goal setting. Schenck advises teachers to reduce lecture and use instructional strategies that are 'hands-on', 'minds-on'. To help with attention, he suggests the following: use a language that fits students' level of learning, present an outline or concept map of the material to be discussed, and provide linkages to prior learning.

Language Networks. Reading is not a natural ability; in fact, it may be the most difficult task for the brain to learn. The neural networks stimulated by reading, the decoding of print, are widely distributed. Reading success depends in part on two phonological processing skills: phonetic recoding in working memory, and phonological recoding of sounds interpreted as words (Eden et al., 2004). "Learning to read successfully requires three neural systems and the development of specific skills that will work together to help the brain decode abstract symbols into meaningful language" (Sousa, 2006, p. 185). The visual system is engaged when the eyes scan printed letters/words, and signals are sent to the visual cortex situated in the occipital lobes. The decoding of those visual signals is done in the 'angular gyrus', which is responsible for breaking it down to phonemes (basic sounds). In the temporal lobe, the auditory processing system sounds out the phonemes in the brain while Broca's and Wernicke's areas provide information about the word from 'mental dictionaries'. By assimilating all the information, the frontal lobe attaches meaning to the word that was read.

The acquisition of reading skills occurs in stages, where decoding skills are continually acquired and applied (Turkeltaub, Gareau, Flowers, Zeffiro, & Eden, 2003). One learns to read through the process of adding decoding tools and strategies to one's collection, and practicing those skills. The development of proficient reading skills stems from the "integration of visual-graphic skills, such as letter identification, with sound-analysis skills, such as rhyme recognition" (Fischer & Rose, 2001, p. 9). In the beginning stages, the sight domain (letter identification) is independent of the sound domain (rhyme recognition). As students integrate sight with sound in the reading process (word recognition), dendritic branches from the two domains converge. Fisher and Rose go on to say that complex reading can be supported through contextual prompts.

Because of its complex multimodal nature, reading serves as a good model for general cognitive skill development. Based on this premise, reading programs have been developed to incorporate auditory, visual, and sensorimotor stimulation via a multisensory approach. Using this approach, researchers provide training in phonemic awareness, imagery strategies, and rules for letter-sound combinations. The outcome of studies that have adopted this method, such as those conducted by Torgesen et al. (2001), and Wise, Ring, and Olson (1999), have shown significant improvement in children's single-word reading skills as well as phonological processing skills.

Phonological processing involves 'phonological awareness'; i.e., an awareness of rhyming, intonation, syllabication, and alliteration. It is the recognition that language can be divided into smaller segments; e.g., words into syllables, sentences into words (Sousa, 2006). 'Phonemic awareness' refers to the skill of identifying individual sounds (phonemes) in words, and the ability to rearrange phonemes to create new words. To accomplish this, the student must be able to divide words into individual phonemes, and separate/delete a phoneme from the rest of the word. Phonemic awareness tasks "appear to involve a type of cross-modal representation that specifically stimulates the cross modal cortex" (Perret, personal communication, September 25, 2005). Teachers can assist in the honing of phonological skills by adding lots of practice with rhyming, word recognition and meaning. Their use of audiovisual aids, graphic organizers, and novel reading activities can stimulate auditory-visual cross-modal processing.

Mediating Models: The Influence of Music on Behavior

This phase of investigation explores research that shows a connection between musical and nonmusical behaviors. Specific to the cognitive realm, studies that concern the effect of music on attention, memory, and speech/language function will be examined. Of interest to my research question are the cognitive functions that involve patterning, attention training, chunking, and language development.

Music can have an arousal effect (Thaut, 2005), activating attention and memory systems. By nature, humans pay a lot of attention to music. This can be observed in infants' attention to human voices and music, and sensitivity to rhythm (Anvari, Trainor, Woodsider, & Levy, 2002; Beaton, 1995). In this state of attention, music acts as a primer, preparing the brain for new learning (Erlauer, 2003). Because most of us have been attending to music all of our lives, the music used as a stimulus doesn't require the subject to attend to it (Steven Pulos, personal communication, July 15, 2003). Instead, the attention can be focused on the material to be learned.

In a comparison study of 20 boys with attention deficit hyperactivity disorder and 20 nondisabled boys (grades 2-6), researchers assessed the effect that music had on arithmetic performance (Abikoff & Courtney, 1996). They tested the effect under three conditions: high stimulation (music), low stimulation (speech), and no stimulation (silence). While the children without disabilities performed similarly under all three auditory conditions, the children with ADHD scored somewhat better under the music condition (33% more correct answers) than under the speech or silence conditions (23% more correct answers). They concluded that the music may have acted as a stimulant for the children with ADHD.

In addition to being a natural attention-getter/stimulus, music provides more cues; thereby enhancing the retrieval of information from long-term memory (Erlauer, 2003). The short temporal duration of working memory requires students to code new information and transfer it quickly to long-term memory. Music can act as a carrier or vehicle of information (Erlauer, 2003), facilitating this transfer by providing more connections in long-term memory and cues from multiple modalities. Because music is used as a cue, the structure of the music plays an important role. One might expect that relatively simple songs that are common in the student's culture would provide structure through familiarity. With strong cultural ties, heritage folk songs can provide context in the acquisition of language skills (Beaton, 1995). Famous music educators, Carl Orff and Zoltan Kodaly, highly recommended the use of traditional folk music to teach language (as cited in Chen-Hafteck, 1996). Kolb (1996) adds that children's natural tendency toward melody and rhythm "makes music an ideal tool for assisting them with the interwoven facets of language: listening, speaking, reading, and writing. Through music, children experience the wholeness of language" (p. 76).

Recent studies have demonstrated that music instruction often has a positive impact on learning and memory (Rauscher, 2003; Shaw, 2000). Depending on the type of music used, its impact can be to: produce an arousal effect, promote long-term cortical change, enhance memory, or improve spatio-temporal reasoning (Jensen, 2000). An arousal effect is indicated by an increase or decrease of neurotransmitters in response to the music being played (Erlauer, 2003). Schellenberg (2005) notes though, that a musical impact on mood or arousal level will have only a short-term effect. After reviewing related studies, Schellenberg concluded that while "music listening (or singing) can lead to enhanced performance on a variety of tests of cognitive ability" (p. 319), these types of effect are "mediated by arousal and mood" and would be similar to those effects from nonmusical stimuli (e.g., coffee, candy) that produce similar emotions.

A meta-analysis of 36 studies using a variety of spatial measures (2,465 subjects), and 31 studies using spatial-temporal outcomes (2,089 subjects), found that there is a short-term effect of certain types of music (such as classical pieces composed by Mozart and Schubert), on the performance of specific types of spatial tasks (Hetland, 2000). It was also found that rhythm, regardless of how it is experienced, enhances the spatial task of mental rotation. These two findings suggest that the type of music that is likely to enhance performance has to do with its rhythmic elements. It is possible that this particular type of music primes areas in the cortex that process spatial tasks. The overall findings suggest that certain modules of the brain, used for processing space and music, may be interdependent.

Patterning. The patterns of neuronal firing that produce clear thinking depend on speed, sequence and strength of the connections (Jensen, 1998). A particular pattern can be 'primed' by certain music. Rhythm's temporal structure provides cues through its patterns, organization, and predictable nature (Thaut, 2005). According to Rauscher and Zuppan (2000), the cortical model presented by Leng and Shaw (1991) indicates that "neural firing patterns organized in a complex spatial-temporal code over large regions of cortex are exploited by both musical and spatial reasoning tasks". Rauscher et al. (1997) go on to say that these "highly structured, interconnected group of neurons have the built-in ability to recognize, compare and find relationships among patterns". Researchers like Rauscher and Shaw (2000) indicate that complex music may complement the complex neuronal patterns involved in higher level brain functions.

'Chunking' is a term that describes how the brain groups similar information to create meaning (Erlauer, 2003). Chunking is naturally found in the musical phrases of harmonies, rhythms, and melodies (Thaut, 2005). Use of musical rhythm provides a pattern as a means for organizing information for easy storage and retrieval. When it enters working memory again, each chunk of information will be treated as one unit or piece of information and can be integrated quickly with new information (Steven Pulos, personal communication, July 15, 2003). In a 1997 study, Clausson and Thaut demonstrated that grouping digits (chunking) using melody and rhythm, facilitates memory and recall of random digits and multiplication tables in children as young as 4 years. The melodic redundancy provides an avenue for chunking information into manageable units.

Attention Training. Parente and Herrmann (1996) have offered evidence for the use of music as an auditory stimulant in attention training. As pointed out by Janata and Grafton (2003), theories about how music motivates attention have evolved around the notion that the temporal structure of sensory input generates 'attending rhythms'. It is thought that attentional processes are neurally linked with these attending rhythms (oscillatory processes), "that entrain to rhythmic properties in one's environment" (Janata & Grafton, 2003, p. 684.

Language Facilitation. Several parallels can be found between music and language. Both are auditory-based systems, utilizing the same vocal apparatus to communicate (Anvari et al., 2002; Thaut, 2005). The structure of music and speech is built on combinations of elements by following rules; i.e., notes or phonemes are combined to generate meaningful phrases. Research conducted by Patel and Peretz (1998), points to new evidence that music and speech cross multiple areas and systems of the brain, making it plausible that music and language employ a similar learning process. Anvari et al. go on to speculate that the development of early music skills might improve reading skills since reading requires the same basic auditory analysis skills as speech and music.

In comparative research of music and language, Patel (2003) investigates overlaps in syntactic neural processing. Syntax refers to a "set of principles governing the combination of discrete structural elements (such as words or musical tones) into sequences" (p. 674). Neuroimaging research suggests that musical syntactic processing activates areas of the brain that have been identified with language. For example, complex sound processing (in the form of harmonics), has been shown to stimulate language areas known as Broca's and Wernicke's (Patel, 2003; Sousa, 2006).

While listening to music appears to produce therapeutic, short-term gains, creating music seems to enhance other cognitive development. Diamantes, Young and McBee (2002) examined music's effect on cognitive functioning, while focusing on the enhancement of reading, math and social studies curriculum. Using music to teach children encourages the growth of dendrites and stimulates neural connections. Music has the ability to facilitate necessary reading and writing skills (e.g., phrase reading; understanding opposites such as soft/loud and high/low; left to right progression; rhythmic eye movement). It can improve these skills through the enrichment of vocabulary, while focusing on pronunciation, articulation, and attention to detail (Perret, 2004).

Clinical Research Models

This phase of the R-SMM (Thaut, 2005) considered the systematic, practical application of music therapy to produce lasting change in behavior. Models within the cognitive domain might include the use of music: as a mnemonic device for memory training, as a cognitive organizing tool, or for attention training. Specific to language acquisition, models of interest are those that investigate the use of music in reading programs.

In a study conducted by Thaut, Peterson, and McIntosh (2005) music was used as a mnemonic device in memory and learning to explore neural plasticity as it pertains to 'oscillatory neural networks'. This group of researchers was interested in the question of whether the temporal structure of music could be infused with nonmusical learning stimuli to stimulate and enhance growth in the neural networks related to learning. Using the principle of chunking related information into manageable units, words were set to rhythmic phrases in a memorization and recall task. This research confirmed that not only is "temporal synchrony … a prerequisite for efficient network formation in memory" (p. 252), but that overlaying verbal learning with a musical template "induces cortical plasticity characterized by higher synchrony in learning-related networks" (p. 252).

Working with the hypothesis that classroom music lessons can have a positive effect on phonologic, reading, and spelling skills, Overy (2003) conducted three studies with dyslexic children. In two of the studies, phonologic and spelling skills improved significantly, but not reading skills. In the second study, there was also growth in rapid auditory processing and rhythm copying skills. A strong correlation was found between 'song-rhythm tapping' and spelling, which are reliant on syllable segmentation skills. She concludes that there is a potential relationship between musical training and improved language/literacy skills, and that temporal processing may be a major contributor to this transfer.

An ERIC Digest review of studies pertaining to the effects of music instruction on children's spatial-temporal, mathematical, and reading abilities was conducted by Francis Rauscher (2003), a leading researcher in this field. The outcome of extensive studies suggest that there is a relationship between music and spatial-temporal reasoning; that perhaps the music 'acts as a catalyst' in the development of cognitive competencies used in other disciplines. The Digest recommends, though, that further longitudinal studies are needed to determine transfer effects, and the duration of effects.

In 2003, Rauscher and LeMieux examined the effect of three separate types of music instruction (singing, keyboard, and rhythm) on the spatial-temporal abilities of economically disadvantaged children (ages 3-4). The children who received individual piano keyboard instruction and singing instruction scored higher on a standardized arithmetic test than children in control groups. Those who received instruction on rhythm instruments performed best on sequencing, arithmetic, and mathematical reasoning tasks. Interestingly, memory, matching, and verbal skills were not significantly improved, which might suggest that different types of music instruction affect different cognitive processes. This longitudinal research speculates on the durability of cognitive enhancements; i.e., the age at which music instruction begins and the length of time (at least two years) are factors that influence sustained improvement of cognitive and spatial abilities.

Transformational Design Model (TDM)

This model (Thaut, 2005), outlines five steps for translating the R-SMM, a scientific model, into practical application. Step 1, the diagnosis and functional assessment of the patient, would be conducted with a pretest. The study for this dissertation took place in a typical classroom environment, where many types of learners, including those with learning disabilities, were grouped. Step 2, which is interested in the development of therapeutic goals and objectives, was satisfied by the overall goal of improving academic reading scores, as determined by a pretest and posttest evaluation.

Of the five steps outlined in this model, steps 3, 4, and 5 are the most relevant for this type of intervention.

Step 3 develops the design of functional, nonmusical therapeutic exercises and stimuli. During this step, one question might be, "What is found in the literature regarding the types of reading exercises that arouse/engage the student, focus attention, or access multiple neural pathways?" As prescribed by Gobet (2005), presenting pieces of information in appropriate-sized chunks and directing learners' attention to main ideas, will support the attainment of perceptual chunks. Vocabulary is built on the expansion of syntax and familiar phrasing. When paired with 'extralinguistic support' such as actions, sign language, and illustrations, new vocabulary is more easily understood by the learner (Kennedy, 2005). Students become engaged through novel reading/writing activities such as creating plays, stories or songs (Sousa, 2006).

Step 4 (similar to Phase III of the R-SMM), is the process of translating these ideas into functional therapeutic music experiences. What has been found to be effective in the use of music to stimulate multiple neural networks? Examples from literature include the practice of chunking information using the principle of musical timing, to enhance memory and recall. Background music has been shown to arouse, engage, or relax students to improve the learning process. The use of a familiar tune would be an appropriate strategy for giving meaning to the new information. Story songs, which have become a part of language comprehension, can be used to reinforce vocabulary (Kennedy, 2005). According to Richards (1993), "singing and rhythm enhance the development of auditory discrimination skills, including integration of letter sounds, syllabication, and pronunciation of words" (p. 99).

In step 5 of this model, the researcher looks for ways to transfer the therapeutic learning to functional, nonmusical real-world applications. It is at this stage that we build the rationale for using music to reinforce reading concepts in the traditional classroom. Research indicates that music can be used to teach reading, which is a complex, multimodal task. For example, there is evidence that the use of background music as an intervention for 8^{th} and 9^{th} graders resulted in dramatic improvement in reading comprehension (Giles, 1991). A meta-analysis by Butzlaff (2000) of 24 correlation studies, found a strong and reliable association between music and reading test scores. A number of other studies have resulted in improved reading scores with some type of music intervention, but it is premature to conclude that it affects reading ability.

In a comparison study of the effects of a live music therapy intervention versus a televised children's program, researchers compared early literacy scores as well as student behavior (Register, 2004). The program was designed to enrich curricula for students with low socioeconomic backgrounds, while teaching pre-reading and writing skills. While the video-only group scored significantly better on phonemic segmentation, those groups receiving the live music intervention had higher increases in mean scores on 4 of the 7 subtests.

This followed an earlier study by Register (2001), that used two music interventions with different musical structure and components. The experimental group received music therapy with specific goals for reinforcing pre-reading and writing concepts. The control group received music therapy with no emphasis in those language skills. While both groups showed skill improvement in pre-writing and print concepts, the experimental group did significantly better on logo identification and word recognition tasks. This study offers evidence that music therapy sessions with specific academic goals are more effective than those sessions with just general music activities.

A 3-month music therapy intervention was given to ESL (English as a Second Language) middle school students to improve story retelling and speaking skills (Kennedy, 2005). Techniques such as rhythmic training, using music with movement, active music listening, lyric analysis, and musical games were used as supplemental activities to the ESL goals. Using contextual teaching, some songs were used to portray character, plot, and setting, while others were used as discussion items. Students in the experimental groups showed greater improvement on story retelling skills as well as English speaking and writing skills.

Rationale for Using Music to Teach Reading in Non-disabled Populations

Why does the music intervention work? Music therapy presents a holistic approach to instruction; the opportunity to develop language skills using a temporal structure found in a repeated rhythmic assignment of verbal and nonverbal information (Kennedy, 2005); i.e., rhythm can provide "structure, predictability and language cues" necessary for developing language skills (p. 246). Due to a musical link, information gets stored in multiple networks in long-term memory, with a much better chance of being retrieved. According to Jensen (1998), all recall is associative; therefore, the more ways that a student knows a concept, the easier the retrieval. Hart, Burts and Charlesworth (1997) tell us that when we integrate music into the curriculum we offer the learner "one more way to construct knowledge", while presenting the brain with "more data from which it will integrate internally" (p. 130).

Anderson, Henke, McLaughlin and Ripp (2000) designed a program to enhance retention of spelling words by using background music. In the spring of 1999, teachers in elementary schools located in the southwestern suburbs of Chicago, began using background music to increase academic achievement in spelling. Student behavior improved when teachers played classical music. Students with poor spelling retention showed positive gains in spelling test scores and report card grades as a result of the music intervention. According to the researchers, the background music "enabled the students to concentrate, relax and revisualize spelling words" (Anderson et al., 2000, abstract). This was also expressed repeatedly by the students.

Related studies (Anvari et al., 2002; Diamantes et al., 2002; Patel, 2003) indicated that some auditory analysis skills used in language processing (e.g., blending and segmenting sounds), are similar to those needed for music perception (rhythmic, melodic and harmonic discrimination). In 1993, Lamb and Gregory, from the University of Manchester, Department of Psychology, conducted a study on the relationship between reading performance and the ability to discriminate musical sounds. While only a subset of these auditory discrimination skills seem to aid the reading process, the results indicated measurable improvement in the overall reading progress of students. Specifically, they concluded that there is a correlation between pitch discrimination and phonemic awareness; i.e., children who scored well on one, scored well on the other.

Anvari et al. (2002) extended Lamb and Gregory's study to examine the links between music processing, phonemic awareness and reading skill acquisition. Using a larger sample, the researchers evaluated musical tasks that focused on rhythm, melody, and chord processing, phonemic awareness tasks, and early reading development in 4-

and 5-year-olds. The results "indicate that music perception skill is reliably related to phonological awareness and early reading development" (p. 126), suggesting that the utilization of these skills crosses auditory and cognitive systems. This study also revealed that music perception and phonemic awareness skills each tap into distinct auditory and cognitive processes.

Preliminary Studies of Music, Mind & Learning (MM&L)

That music might improve reading skills by stimulating the type of cross-modal mapping involved in reading, becomes more conceivable when we examine the parallel neural processing for both areas. For example, this might happen when multiple neural networks are activated by auditory events, such as "when melodies are perceived as a series of changes across dimension of high-low or up-down" (Peter Perret, personal communication, March 28, 2006). The preliminary studies described below, offer some evidence that music instruction can have an impact on the acquisition of reading skills. Each of these studies used a version of the Music, Mind & Learning (MM&L) curriculum.

The Bolton Project

The first study, an 8-year study involving an Arts-in-Education program, was implemented in 1994 at the Bolton Elementary School in Salem, Massachusetts, with a population, designated as 'at-risk'. Students, grades 1-3, received music instruction from a quintet, who visited the school twice a week (1/2 hour each time), for 12 weeks. The lessons were multi-sensory and interdisciplinary in nature, woven with mathematics and reading concepts. The lessons reinforced spatial-temporal, sequencing, ordering, planning, and abstract thinking skills. They enhanced the reading content with phonemic awareness (pitch), fluency, vocabulary, comprehension (Perret & Fox, 2004). In Table 2.1, a comparison was made between the 3rd Grade scores (1996 results) of students who received no music intervention, and the 3rd Grade scores (1997 results) of students who received the intervention for three years. As shown in Table 2.1, after three years, end-of-grade (EOG) mathematics and reading scores had risen.

Table 2.1

Bolton Elementary School End-of-Grade Test Results

Third Grade Scores	Math	Reading
1996 – No music residency	38.1%	36.5%
1997 – After three years of music residency	89.3%	85.7%

The Arts-Based Elementary School Study

A similar study was conducted at the Arts-Based Elementary School in Winston-Salem, North Carolina (Peter Perret, personal communication, May 18, 2005). As part of the curriculum, all students in this public charter school (grades K-5), were required to take piano lessons. The study was conducted over a three-year period with the first grade classes. Again, a quintet visited the classroom each week, for 8-12 weeks. Similar lessons were delivered, with a focus on musical opposites, musical writing, and distinguishing sounds (listening for legato versus staccato). Even though this particular study did not track math or reading gain scores, teachers reported that students were able to connect ideas being introduced by the quintet, with concepts taught in their classes.

The OMA Project

The OMA project (Opening Minds through the Arts), a whole school approach, used a similarly structured arts curriculum in twenty schools designated as 'at-risk'. Early findings from a three-year analysis of the program (Sobolew-Shubin, 2004), suggest significant improvement in reading, language, and mathematics skills, with the greatest increases for Hispanic-Latino children. The results of this intervention provide further evidence of the substantial impact that an arts-based curriculum has on learning.

Conclusion

There is much evidence in the literature that supports the use of brain-compatible teaching techniques to enhance the learning process. Some of these techniques include the incorporation of concepts found in an arts-based education. The sources detail the use of music in classroom activities with a variety of implementations.

This review also helps us understand the brain processes required in the acquisition of reading skills. It has highlighted studies that utilize music therapy techniques to assist in the learning process. Examples have been provided of research that studies the interaction between music and reading acquisition. Many of the examples found, though, are studies done with learners who have impairments, such as ADHD, or ESL learners. More research is needed that focuses on music interventions for non-disabled populations. This research adds to the body of knowledge about the use of music interventions with non-disabled populations, to improve academic achievement.

CHAPTER 3: METHOD

Research Design and Rationale

This study made use of a music intervention that had been utilized in previous studies. There were two major differences, though: (a) the curriculum was delivered via recorded DVD instead of by a live quintet, and (b) this research had a control group. Specifically, the research questions that were addressed by this study are:

1. Is there a difference between a music intervention and no intervention with regard to gains in reading achievement scores of traditional elementary students?
2. Is there a difference between Caucasian and Hispanic students with regard to gains in reading achievement scores?
3. Is there an interaction between the music intervention and ethnicity with regard to gains in reading achievement scores?

A quantitative method was used to represent and systematically summarize the data collected. The framework for this research was based on identifying a specific teaching technique to facilitate the acquisition of reading skills and the use of reading scores to predict academic success. To determine if this technique would make a difference, an experimental design was employed, with a measurement of growth rate in reading skills. The specific approach was quasi-experimental, with a control group used for comparison of pretest to posttest changes in reading scores. This design was selected to test the hypothesis that, relative to controls, the music intervention would improve the following: (a) response time and accuracy levels of auditory temporal task performance; (b) overall accuracy levels of auditory visual integration; (c) phonemic awareness; and (d) overall reading achievement. Some qualitative data was gathered at the end of the study, in the form of supporting statements and informal feedback obtained from the participating teachers.

Participants and Site

The target population being studied was elementary school students. Once schools were identified that fit the criteria, two were chosen for their ethnic diversity and their willingness to participate in the study. Early in the process, one of the schools was eliminated from the study because of complex schedules that could not accommodate the intervention. Thus, participants for this study were two second grade classes of one local district school that has a diverse population. A cover letter in English and Spanish was sent to the parents, informing them of their child's participation in this study as part of their daily curriculum (see Appendix A).

This age group was chosen because the lessons contained in the intervention and the reading skills being assessed by the instrument are targeted for K-2 grades. Diversity within the sample groups was needed to address research questions about the success of the intervention with students of particular ethnic backgrounds. Classroom diversity was also needed to develop generalizations and to predict some level of success in the implementation of similar programs nationwide.

Class sizes determined the sample size. The two participating second grade classes consisted of 20-25 students per class, for a total of 49 students with complete data. One class received the intervention, and one was designated as a wait-list control group which received the intervention during the second half of the semester (see Figure 3.1). This design allowed all students to receive the intervention and added to the overall sample size, thereby increasing the power of this research. All students in a particular class participated in the intervention (or lack, thereof) targeted for that class. Demographic differences between groups were intentionally minimized by school administration during the assignment of students to a particular class, at the time of enrollment.

<table>
<tr><td colspan="2" rowspan="2">Initial Intervention (Class 1)</td><td>Wk. 2</td><td colspan="2">Wks. 3-9</td><td>Wk. 10</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Pre-test</td><td colspan="2">7-week intervention</td><td>Post-test</td></tr>
<tr><td rowspan="2">Control / Wait-list (Class 2)</td><td>Wk. 1</td><td colspan="2">Wks. 2-8</td><td>Wk. 9</td><td colspan="2">Wks. 10-16</td><td>Wk. 17</td></tr>
<tr><td>Pre-test</td><td colspan="2">Wait period
Control group</td><td>Post/
Pretest</td><td colspan="2">Wait-list intervention</td><td>Post-test</td></tr>
</table>

Note: The posttest for Class 2 also served as the pretest for the wait-list intervention.

Figure 3.1. Timeline for pretest - posttest wait-list comparison group design.

Measures

The partnering research group at Wake Forest University, North Carolina, has conducted longitudinal studies that have included a heavy emphasis on testing in kindergarten and the early grades (Wood, 2005). Their data show that concurrent and future reading ability is highly predictable from a remarkably brief and highly focused set of tests. A meta-analysis of the longitudinal data has shown that four simple constructs (phonemic awareness measured through standard phoneme deletion tasks, vocabulary measured through picture naming, rapid naming of letters and digits, and single word reading) suffice for very strong predictions of reading achievement.

Development of PAR

Based on this information, the Wake Forest University researchers produced new tests of these four functions in an efficient format (taking 15 minutes) and field-validated the new test entitled Predictive Assessment of Reading (PAR). Various aspects of the PAR tests have been validated by finding relationships with a number of other tests, such as the Woodcock Johnson, Lindamood, and Peabody PPVT (Wood, 2005). The PAR tests, demonstrated to be culture-fair, have been nationally-normed using a geographically and ethnically representative sample of N=500. Alternate forms reliability (from these published tests of the same four functions) was $r = .92$. The four tested skills jointly predict concurrent Woodcock-Johnson III Broad Reading composite, returning a multiple regression validity coefficient of R=.91 (see Figure 3.2).

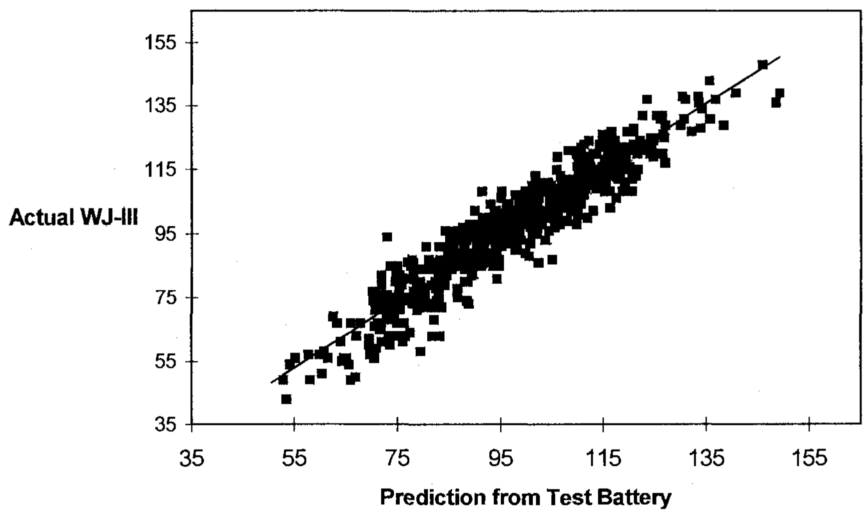

Figure 3.2. Prediction of W-J III from PAR, N=500, R=.91.

The PAR is a 15-minute test that can be administered by the teacher. The 22 items look at skills that quantitatively predict reading outcomes: single word reading (an indicator of reading disability), phonemic awareness, non-word decoding, vocabulary, and rapid naming (auto naming a string of words). The PAR predicts comprehensive reading outcomes by specific area (fluency, phonemic awareness, etc). Remediation codes, coupled with intensity codes are assigned to the predictive scores of students. This assists the teacher in creating individualized reading plans. PAR has an online scoring functionality, so upon the completion of each day's testing, the examiner is able to enter the test results and obtain immediate scoring of subtest performance against norms.

The item-based subtests have Cronbach's alpha reliabilities of at least .90; rapid naming subtests have a test-retest reliability also exceeding .90. An additional national norming trial of N=10,000, using an ethnically representative school population, was conducted, verifying the norms themselves. Wake Forest University Health Sciences now markets the test through a license to Child's Mind Publishing of Winston-Salem, NC. Field trials of the efficacy of the PAR test and intervention package have also been done.

Alternate Forms Reliability for PAR

Paired samples t tests were used to check for test-retest reliability of the alternate forms of the PAR instrument. The paired samples correlations were high for all subtests, ranging from r = .73 to r = .92, with a median correlation of r = .84. These correlations seem to provide support for test-retest reliability. They indicate that the PAR subtests are basically measuring the same thing on both forms of the instrument. This coincides with the statistics provided by Wake Forest University; i.e., test-retest reliability > .90 for all subtests as well as for the overall score.

Data Collection

The data collection strategy involved the administration of pretests and posttests for the 20-25 participants in each class, during the fall semester. A widely used standardized reading achievement test, the Predictive Assessment of Reading (PAR) was the primary instrument used to assess gains in reading achievement levels. The PAR was administered on a one-to-one basis, with no time limit imposed. On average, it took students about 17 minutes to complete the battery of tests. Verbal responses were recorded on individual score sheets. The researcher administered the assessment before and after each intervention (see Figure 3.1). Training for the administration of the PAR was provided by Dr. Frank Wood, from Wake Forest University.

In an effort to protect the privacy of the students being tested, an assigned code was used instead of their names. These codes, assigned by the school, were used to link the pretest scores with the posttest scores. The master list which links the student name with their assigned ID was kept by the school personnel. At the time of testing, the researcher was given the particular student's ID code (not name) when the student was sent from the classroom to her. The student, therefore, has remained anonymous to the researcher.

Testing Procedures

While introducing herself to the classes, the researcher explained the process of testing and the intervention to the 2^{nd} graders. Concerns that were addressed when administering subtests I and II included: making sure the student pronounced the items correctly, yet allowing for differences in dialect; and naming objects correctly (e.g. gavel or mallet, instead of hammer). Subtest III (Columns C & D) had its own set of rules: the student needed to answer 1 of 3 trials correctly before moving on; the student was to give the phonetic representation of the answer instead of saying the letter.

This researcher chose to wait until after the answer was given before looking at the scoring sheet so as not to accidentally 'cue' the subject. In the case of testing an ESL student, this researcher wondered if the Spanish version of words or the Spanish translation for a particular object (e.g., 'drinking gourd' instead of dipper) could be accepted. And did it matter if the student was given a correct response afterwards when he or she was curious about the answer? After discussing this with Dr. Frank Wood, this researcher decided to accept some Spanish translations for pictures, and to respond openly to students' questions.

Evaluation of Quality and Validity

The quality and validity of this research method would be evaluated as a strong quasi-experimental design. In this study, participants were assigned an intervention based on the class that they attended; i.e., one class received the intervention, and one was designated as a wait-list control group which received the intervention during the second half of the semester. All students in a class participated in the intervention (or lack, thereof) targeted for that class. This design allowed all students to receive the intervention and added to the overall sample size (49 students), thereby increasing the power of this research.

Internal validity would be rated as moderate to high (Morgan, Gliner, & Harmon, 2006). Assigning the intervention and control groups to classes within the same school helped to reduce extraneous variables, but there could have been some contamination if the two teachers or classes talked about the intervention during weeks 2-8. Demographic differences between groups were intentionally minimized by school administration during the assignment of students to a particular class at the time of enrollment. This was done to balance the load for all classroom teachers; therefore, classes were likely to be similar. There was the threat of repeated testing since the pretest and posttest were similar. But due to the nature of the test and the time span between tests, this probably would have a minimal impact on outcomes.

Music as an Intervention

The intervention used in this study involved the use of recorded lessons on DVD, of both the instrumental music performances and the accompanying teaching segments. This intervention has been pilot-tested a number of times, where the lessons were delivered by a live quintet who has been working with students for the past 9 years. These pilot tests did not have control groups, though. During a summer camp in 2005, the lessons were recorded on DVD format, with the hope of making this intervention more accessible to schools. The intervention for this study utilized 12 of the 15 recorded (DVD) lessons delivered by this same quintet.

Each recorded lesson was about 30 minutes long, with extra time added for the classroom teacher to facilitate the lesson where appropriate. The classroom teacher who implemented the curriculum provided illustration and commentary. For example, it was necessary to pause the DVD to allow students in the classroom time to respond to what was being presented in the lesson. Thus, approximately 45 minutes was needed for each of the lessons. The regular classroom teacher delivered one to two lessons per week, over the span of 7 weeks.

The lessons were multi-sensory and interdisciplinary in nature, woven with reading concepts (and a few mathematical ones). The lessons enhanced the reading content with phonemic awareness (pitch), fluency, vocabulary, and comprehension (Perret & Fox, 2004). For example, lessons focused on musical opposites, musical writing, and distinguishing sounds (listening for legato versus staccato). The classroom teacher took time throughout the lessons to help students connect ideas being introduced by the quintet, with concepts taught in their classes.

One advantage to using recorded lessons is the consistency of the music performance and the explicit teaching, which reduces variance due to differences in teaching styles and delivery of lessons. A possible disadvantage is that some portions of the lessons require interaction with the performer; e.g., the "young composer" procedure, in which children imagine and then produce on paper a melody or rhythm they would like performed. The reproduction of these activities did not seem to have the richness or complexity of a live quintet working with the students on their compositions.

First Group Intervention

The first intervention, delivered two mornings each week, encountered difficulties; i.e., the audio portion of the DVDs was inconsistent and had very poor quality of verbal exchanges. The recorded music was much louder than the rest of the lesson. Because of this low tonal quality, the initial intervention experienced a one-week pause after the first few lessons. The concern was that students would quickly become disengaged if they couldn't hear very well.

The investigator worked with school staff to come up with an alternate delivery mechanism. The research team had to locate and test alternate systems (speakers with more amplitude), in order to maximize the volume. A speaker system that could produce higher quality output, was set up in the classroom. To some extent, this improved the volume enough so that students from all sides of the room could hear the verbal exchange. Even so, the dialogue in the first few DVD's was difficult to hear. The teacher moved the children closer to the speakers so as to improve hearing levels and keep their attention.

The rest of the lessons seemed to go much more smoothly. There was quite a bit of student transition in this first intervention class, with 5 students transferring to other schools and 5 new enrollments during the intervention timeframe. A couple of the 'special needs' students did not attend the lessons regularly.

While she was interested in the technique and cooperative throughout the project, this teacher was not as engaged in the project as the other teacher (wait-list group). She did not review the lessons ahead of time, so was not always prepared to facilitate the lesson (such as pausing the DVD at appropriate times and handing out needed materials).

Wait-list Group Intervention

The second intervention (wait-list group), was delivered at alternate times, both morning and afternoon. This teacher extended many of the lessons, using a debriefing method for comments and questions. She made connections to other class activities, and often supplemented the lesson with materials borrowed from the library (such as recordings and books that related to the lesson). For example, after students heard the piece titled, "Baba Yaga" in one of the lessons, she read the story of "Babushka: Baba Yaga" by Patricia Polaco, and entertained questions about the story and its meaning.

She often asked students to create an entry in their journals that related to the intervention. For example, at the end of the third lesson, she solicited follow-up questions and comments about what students saw or heard in the lesson. She reinforced the movement for high notes and low notes. The teacher embraced the lesson, extending this one by playing the piece, "I Ride an Old Paint" at the end of the lesson and having students identify highs and lows through movement. When reinforcing the idea of *soundscapes*, she brought in the audio recording of "Peter and the Wolf" for children to identify characters through special sounds. She also added lessons that reinforced the concept of setting, characters, problem identification, and solutions. The researcher's notes for each lesson can be found in Appendix B.

Data Analysis

Quantitative methods have been used to represent and systematically summarize the data collected. There were two independent variables to be considered. The main independent variable (an active variable), was the type of treatment with two levels: recorded music intervention and no intervention (control). Ethnicity was a second independent variable with several levels: Caucasian and Hispanic being the most prominent. The dependent variable, gain scores on the PAR between the pretests and posttests, was ordered, with many levels.

Before doing statistical analysis of the data, some participants' data was excluded. Participants were excluded if there was either a pretest or posttest score missing. In addition, those participants who missed one-third or more of the treatment were excluded. What remained was a total sample size of $N = 56$, down from 70.

An independent samples t test was selected for a between groups analysis of gain scores, with two levels (control versus combined intervention groups). Given a directional hypothesis, Gliner and Morgan recommend a t test "because t gives the researcher more power (probability of rejecting a false null hypothesis)" (2000, p. 222). Gain scores were analyzed to see if there were significant differences between the intervention and control groups with respect to: (a) response time and accuracy levels of auditory temporal task performance; (b) overall accuracy levels of auditory visual integration; (c) phonemic awareness; and (d) overall reading achievement. In addition, paired (correlated samples) *t*-tests were computed to see if students in the intervention groups scored significantly higher on the posttest than on the pretest.

Because there were essentially two intervention groups (initial and wait-list), the researcher was interested in differences among the three groups: i.e., the two intervention groups and the control group. A One-Way ANOVA (Analysis of Variance) was conducted, comparing the three levels of treatment. Tukey HSD tests were used for post hoc analysis.

Hispanic and Caucasian groups had a somewhat similar proportion of students, so it was possible to compare gain scores for these ethnic groups. Differences between these groups were analyzed using a 2-way factorial ANOVA. This allowed the researcher to look at the interaction between treatment and ethnicity. Simple effects post hoc analysis was conducted using the Tukey HSD.

CHAPTER 4: RESULTS

Quantitative data was analyzed using several methods to answer the research questions about advances in academic achievement. Descriptive statistics revealed that of the total sample, $N = 56$, females represented 45% of the population studied, (males represented 55%). About one out of three participants (35%), played a musical instrument. For 82% of this population, English was the first language. This was an interesting statistic, given that 37.5% of the students were Hispanic, with most of them reporting that at least one parent speaks Spanish. The majority of the students participating in the study were either Caucasian (50%) or Hispanic (37.5%). This was advantageous, allowing the researcher to ask questions about differences between these two ethnicities. Figure 4.1 shows the ethnic diversity found in these 2nd grade classes. Even though it was of interest to the researcher, data regarding socio-economic status was not collected, as this school district no longer makes this information available.

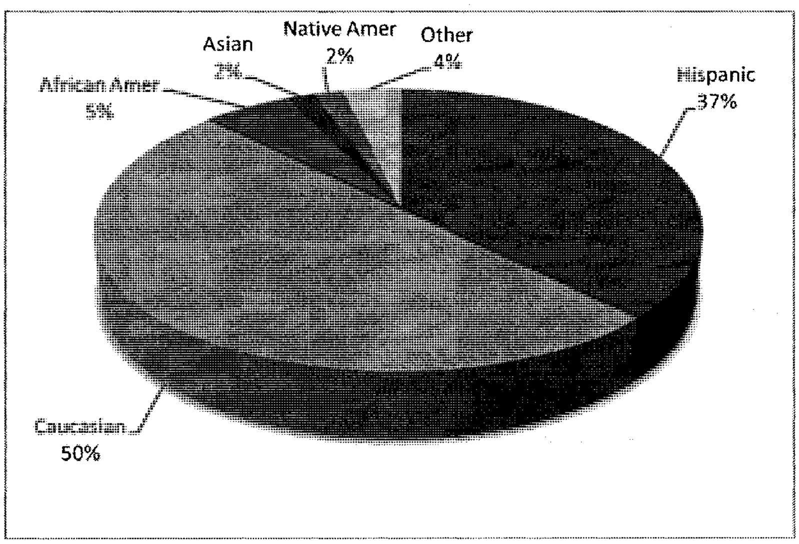

Figure 4.1. Ethnic diversity found in participating 2nd graders.

Further statistical analysis was based on questions addressed by this research:

1. Is there a difference between a music intervention and no intervention with regard to the reading achievement gain scores of traditional elementary students?
2. Is there a difference between Caucasian and Hispanic students with regard to reading achievement gain scores?
3. Is there an interaction between the music intervention and ethnicity with regard to reading achievement gain scores?

Research Question #1: Differences between Treatment Groups

Regarding the first research question, Table 4.1 shows that there was a statistically significant difference between the control group and the intervention groups on *picture recognition gain scores*, (p = .017). Inspection of the two group means indicates that the average picture recognition gain score for the control group (M = -.19) is significantly lower than the gain score (M = 1.06) for the intervention groups. The difference between the means is 1.25 points on a 36-point test. The effect size d is approximately .62, a medium to large effect. The control group did not differ significantly from the intervention groups on word recognition gain scores (p = .475), Phonemes I gain scores (p = .467), rapid naming digits gain scores (p = .107), or rapid naming letters gain scores (p = .345). But, there was a nearly significant difference between the control group and the intervention groups on Phonemes II gain scores (p = .056).

Table 4.1

Comparison of Second Graders on Predictive Assessment Reading Subtests (n = 21 Students in the Control Group and 35 Students in the Intervention Groups)

Variable	*M*	*SD*	*t*	*df*	*p*
Word Recognition			0.06	54	.475
Control	1.57	3.79			
Intervention	1.51	2.95			
Picture Recognition			-2.19	54	.017
Control	-.19	1.81			
Intervention	1.06	2.21			
Phonemes I			-0.09	54	.467
Control	1.24	2.00			
Intervention	1.29	2.21			
Phonemes II			-1.62	54	.056
Control	0.90	2.39			
Intervention	1.86	1.97			
Rapid Naming Digits			1.26	54	.107
Control	9.10	8.22			
Intervention	5.97	9.43			
Rapid Naming Letters			0.40	54	.345
Control	9.24	8.91			
Intervention	7.71	15.91			

Paired or correlated samples *t* tests indicated that the students in the intervention groups, on average, scored significantly higher on the reading posttest for all six subtests, than on the pretest. The students who did well on the pretest also did well on the posttest. Effect size for each subtest, using Cohen's (1988) guidelines, ranged from small to medium (see Table 4.2). Two of the six subtests (Phonemes I and Phonemes II), had medium effect sizes, $d = .49$ and $d = .58$, respectively.

Table 4.2

Comparison of Pretest and Posttest Scores for the Intervention Groups (n = 35 Students), Using Paired Samples t Tests

Variable	*r*	*t*	*df*	*p*	*d*
Word Recognition	.88	-3.03	34	.005	.28
Picture Recognition	.87	-2.83	34	.008	.25
Phonemes I	.69	-3.68	34	.001	.49
Phonemes II	.81	-5.57	34	<.001	.58
Rapid Naming Digits	.93	3.75	34	.001	.29
Rapid Naming Letters	.82	2.87	34	.007	.39

One-Way ANOVAs (Analysis of Variance), comparing the two intervention groups separately with the control group, showed that the overall *F*'s for two of the six PAR subtests were significant. A statistically significant difference was found among the three levels of treatment (control, initial intervention, and wait-list intervention), on *picture recognition gain scores,* $F\ (2, 53) = 7.83$, $p = .001$, and on *rapid naming digits gain scores,* $F\ (2, 53) = 6.55$, $p = .003$. Table 4.3a shows that the mean *picture recognition gain score* is -.19 for students in the control group, -.06 for students in the initial intervention group, and 2.00 for students in the waitlist intervention group. The mean *rapid naming digits gain score* is 9.10 for students in the control group, 11.06 for students in the initial intervention group, and 1.68 for students in the wait-list intervention group. A larger gain score for this subtest indicates that the student performed the test faster than the last time; thereby increasing his or her skill level. This does not necessarily mean that a student with small gains is not as skilled, though. For example, a student who scores low on this subtest (performs it quickly with no errors) the first time, may not have much more room for improvement. Table 4.3b presents a summary of the ANOVAs.

Table 4.3a

Means and Standard Deviations of Gain Scores, Comparing Three Levels of Treatment

PAR subtest	Control (*n* = 21)	Initial Intervention (*n* = 16)	Wait-list Intervention (*n* = 19)
Word Recognition			
M	1.57	2.50	.68
SD	3.79	2.71	2.96
Picture Recognition			
M	-.19	-.06	2.00
SD	1.81	2.24	1.73
Phonemes I			
M	1.24	.69	1.79
SD	2.00	2.09	1.96
Phonemes II			
M	.90	2.25	1.53
SD	2.39	1.81	2.09
Rapid Naming Digits			
M	9.10	11.06	1.68
SD	8.22	9.17	7.45
Rapid Naming Letters			
M	9.24	9.75	6.00
SD	8.91	17.84	14.36

Note: Rapid naming scores are recorded in seconds, so one would expect large gain scores.

Table 4.3b

One-Way Analysis of Variance Summary Table Comparing Gain Scores for Three Treatment Groups on All PAR Subtests

Source	*df*	*SS*	*MS*	*F*	*p*
Word Recognition					
Between groups	2	28.68	14.34	1.37	.263
Within groups	53	555.25	10.48		
Total	55	583.91			
Picture Recognition					
Between groups	2	57.38	28.69	7.83	.001
Within groups	53	194.18	3.66		
Total	55	251.55			
Phonemes I					
Between groups	2	10.58	5.28	1.31	.279
Within groups	53	214.41	4.04		
Total	55	224.98			
Phonemes II					
Between groups	2	16.45	8.23	1.81	.174
Within groups	53	241.55	4.56		
Total	55	258.00			
Rapid Naming Digits					
Between groups	2	892.01	446.00	6.55	.003
Within groups	53	3610.85	68.13		
Total	55	4502.86			
Rapid Naming Letters					
Between groups	2	152.62	76.31	.40	.671
Within groups	53	10072.81	190.05		
Total	55	10225.43			

Post hoc analysis, using the Tukey HSD Tests, indicated that there were significant mean differences on *picture recognition gain scores* between the waitlist intervention group, and both the control group ($p = .002$, $d = 1.24$) and the initial intervention group ($p = .007$, $d = 1.04$). Thus, the gain scores of students in the waitlist intervention group are significantly higher on the picture recognition subtest than those in either the control or the initial intervention groups. The effect size *d* is very large. Likewise, there were also significant mean differences on *rapid naming digits gain scores* between the waitlist intervention group and both the control group (p = .017, d = .95), and the initial intervention group (p = .004, d = 1.13). Thus, for the rapid naming digits subtest, the gain scores of students in the control and initial intervention groups are significantly higher than those in the waitlist group. Again, the effect size *d* is large.

Research Questions #2 & #3: Differences between Ethnicities and Interactions

To test research questions #2 and #3, Hispanic and Caucasian students were compared, using a factorial ANOVA analysis. The assumptions of independent observations, homogeneity of variances, and normal distributions of the dependent variable for each group, were not violated. In response to research question #2, the factorial ANOVA showed a significant difference exists between groups only on *picture recognition gain scores.* While no overall difference was found between Caucasian and Hispanic students, $F\,(1, 45) = .02, p = .90$, Table 4.4 shows again that the difference between treatment types is significant, $F\,(1, 45) = 7.89, p = .007$.

Table 4.4

Two-Way Analysis of Variance for Picture Recognition Gain Scores

Variable and Source	*df*	*MS*	*F*	η^2	eta
Picture Recognition					
Treatment Type	1	30.32	7.89*	.15	.39
Ethnicity	1	.06	.02	<.01	
Treatment * Ethnicity	1	18.94	4.93*	.10	.32
Error	45	3.84			

*$p < .05$

In response to question #3, Table 4.4 also shows that there was a significant interaction between treatment type and ethnicity on *picture recognition gain scores,* F (1, 45) = 4.93, p = .032, eta = .32 (a medium effect size). A plot of the data points clearly shows this interaction in Figure 4.2. The number of subjects, the mean, and standard deviation of *picture recognition gain scores* for each cell is represented in Table 4.5.

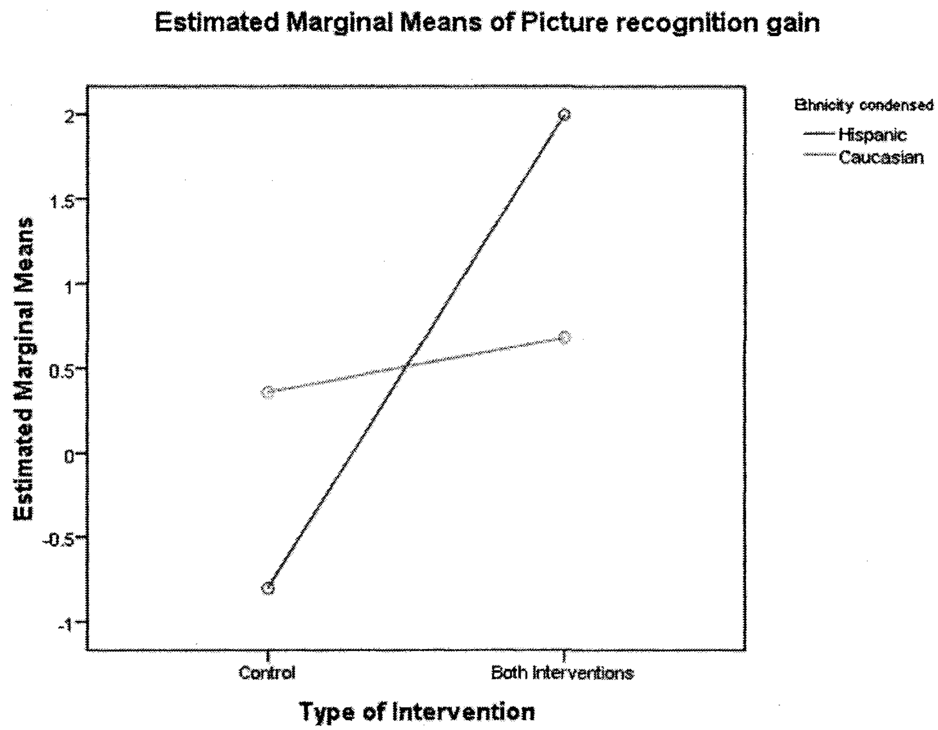

Figure 4.2. Interaction between treatment type and ethnicity on picture recognition gain scores.

Table 4.5

Means, Standard Deviations, and n for Picture Recognition Gain Scores as a Function of Ethnicity and Treatment Type

	Control			Intervention			Total	
Ethnicity	*n*	*M*	*SD*	*n*	*M*	*SD*	*M*	*SD*
Hispanic	8	-1.0	1.60	13	1.92	1.61	.81	2.14
Caucasian	11	.36	1.75	17	.71	2.42	.57	2.15
Total	19	-.21	1.78	30	1.23	2.16	.67	2.13

Simple effects post hoc analyses revealed that Hispanic students in the intervention groups had significantly higher picture recognition gain scores than Hispanic students in the control group, $MD = -2.92$, $p = .002$. The *d* effect size is approximately 1.6, a very large effect according to Cohen's (1988) guidelines. Caucasian students in both the control and intervention groups had similar picture recognition gain scores ($p = .654$).

Qualitative Data -- Anecdotal Comments

Anecdotal information was collected by the researcher as well as the teachers who facilitated the interventions. Teachers made notes of absences, dates and times of the interventions, reactions of students, and places where the DVDs were paused to solicit responses or interject comments.

Student Comments

Throughout the intervention, the researcher made note of unsolicited comments from students, either during the testing or during the intervention. For example, when the quintet asked students to choose a musical instrument with which to play the graphed notes on the board, some students noticed that "all the boys are picking Bob" (the French horn player), and "the girls are picking the girls" (female musicians). During the second lesson, one student showed recognition of the song being played when he commented, that "song sounds like Spongebob!" Both teachers reported that even after the intervention ended, students would sometimes comment, "I heard that song before on …"

After the third lesson, one particular student who had displayed signs of ADHD (Attention Deficit Hyperactive Disorder), enthusiastically proclaimed, "I love these videos!" This student tended to sit next to me during the intervention, often verbalizing his observations. He was reportedly much more attentive during the intervention and asked reflective questions such as, "Are those Spanish words?" He was referring to the music terms, *staccato*, *forte* and *piano*.

Teacher Interviews

After the first couple of videos, the teacher in the initial intervention group was ready to abandon the project because of the poor quality of the first DVD's (one can't hear the verbal interchange very well). Near the end of the intervention, she remarked, "I just need this to be finished and move on". Her feedback about the content was positive, though, and she often provided examples of student learning.

A couple of months after the intervention, the researcher conducted a follow-up interview with the two classroom teachers to solicit the following: overall impressions; new insights; further extensions of lessons; and recommendations for future research and implementation. It was during this interview that both expressed their frustration with the poor sound quality of the DVDs and thought that this aspect really detracted from the overall success of the intervention. They also thought that it would have been better if the recording had been done from a different viewpoint; i.e., the camera needs to be moved to the back of the room to gain a better vantage point. Even though there were some problems to overcome, they both thought that the intervention was a positive addition to the curriculum and that students benefited from the integrated lessons and activities.

While the teachers have not continued to make any conscious extensions to the lessons presented during the intervention, they report that there are often times that students will comment on music heard during the lessons or use some of the musical terms (staccato, piano, forte, etc.). Both teachers expressed surprise that students were still able to remember the names of the instruments used in the lessons. They were especially impressed with a couple of the lessons that had students graphing notes ("Great lesson!"), and creating pictures while listening to a musical piece. Based on their training and experience, they understand that an important part of reading skills is the ability to "create visual images based on what you hear".

According to the teachers, another of the outstanding lessons was the one that presented the sonata (story) form. While reading the story, "Harriet and the Garden", Bob (the French horn player) provides a story map, making connections to reading concepts such as introduction, characters, and plot. The quintet then plays a sonata that resembles the storyline and Bob reviews the ideas afterward. That lesson "made an impression on me," stated one of the teachers. In language arts, children "need to listen to stories to hear the language". She thought this lesson did a beautiful job of constructing a meaningful framework for students, and commended the person(s) who had developed the idea.

When asked about the tests that were given, these two teachers thought that some of the subtests could be eliminated or replaced by more relevant ones. They commented that the picture recognition subtest might be experientially-biased, which might also make it culturally-biased. This echoes comments made by the teachers involved in the Music, Mind and Reading summer camp, where kindergarten through 3rd-grade students received a similar intervention and series of tests. For example, one of the pictures was of a sundial. This was recognized by perhaps one of the students (out of the 70 tested). Another picture was of the Eiffel Tower in Paris. The assumption is that avid readers will recognize these pictures, but in fact, students who had seen it in a movie or travelled to Europe could identify this as well.

CHAPTER 5: DISCUSSION

There are anomalies in the study that might make for interesting case studies. For example, one of the Hispanic boys who displayed gang signs and was not very motivated in the beginning of the school year, was very animated and engaged by the time the third set of tests were administered in December. He made huge gains over the semester, both in testing as well as within the classroom. It is probable that there are factors other than the intervention, which influenced this child's shift in behavior as well as learning. There's another notable instance when a girl with special needs commented on the rapid naming digits subtest, "there's no 2's in there, no 7's or 9's". This was a timed test, so it is very likely that her score was impacted by her distraction of looking for a pattern in the series. Aside from these anomalies, this section focuses on generalizations that might be drawn from the results of this study.

Comments on Demographics

The sample was second graders in a traditional school setting. Research shows (Sousa, 2001; Wolfe & Brandt, 1998) that for this age group, 6-8 year olds, this is an optimal period for linking sensorimotor with cognitive functions. It is during this time that children enter the critical period for reading. Therefore, the researchers believed that this type of intervention, that integrates music with reading concepts, would have a major impact on early reading achievement.

For 82% of this population, English was a first language. This was a notable demographic, given that 37.5% of these students were Hispanic; with most reporting that at least one parent speaks Spanish. It is possible that some of these children learned to speak two languages at the same time; i.e., English and Spanish. Also of interest, about 35% of the children studied, played an instrument. However, this was not surprising given that this school has implemented a violin program that is free to anyone wishing to participate; i.e., they have 60 violins available for use. It is possible that this factor influenced the outcome of the test results; other studies (Rauscher, 2003; Shaw, 2000) have shown that students who play an instrument tend to do better on Math and Reading achievement tests. This was not one of the research questions, though, and further analysis would be needed to determine if these children tended to do better on the tests than other children.

Research Questions Addressed

Because the literature includes studies that show strong support for the use of music to enhance learning (Anderson et al., 2000; Giles, 1991; Lamb & Gregory, 1993; Rauscher, 2003; Shaw, 2000), the researcher expected there to be more significant improvement in gain scores for the intervention groups. One example is the study by Kennedy (2005), which utilized story songs, a part of language comprehension, to reinforce vocabulary. Another example is found in the study by Register (2001), who effectively used music therapy concepts to reinforce pre-reading and writing skills.

Research Q1: Differences between Control and Intervention Groups

So, where were the most gains made? This study concluded that the only assessment that showed a significant difference in gain scores between the two major groups was the Picture Recognition subtest. But the two assessments, Phonemes I and II subtests, were the ones where the researchers expected to see differences in gain scores.

These assessments include listening exercises, and more closely match the intervention than the others. The specific skills that translate to reading are listening, syllable segmentation, and differentiating sounds (Fischer & Rose, 2001; Overy, 2003; Sousa, 2006). While there was a nearly significant difference on the Phonemes II subtest (p = .056), there were no significant differences between groups on either of the phonemes subtests. These results indicate that the intervention may not have an effect on the gain scores for this particular set of tests.

There are considerations, though. The intervention was short, only 6 ½ weeks long for each treatment group. And only 12 of the 15 lessons could be delivered in this timeframe. The musicians presenting the lesson were recorded, not live. It is believed by this and other researchers on this team, that live musicians would have a greater impact on students, gaining their attention and engaging them more in the learning process. This idea is supported by a study done by Register (2004), who reports that groups receiving a live music intervention had higher increases in mean scores on 4 of the 7 subtests than the video-only group. The video-only group did score significantly better on phonemic segmentation.

Separating the intervention groups and looking at three levels of treatment (control, initial intervention and wait-list intervention), presents some interesting insights into the data. On two of the subtests, the wait-list intervention group differed significantly. The gain scores of students in the wait-list intervention group are significantly higher on the picture recognition subtest than those in either the control or the initial intervention groups. What might account for this? This may be due to the wait-list group having more practice sessions; i.e., they were tested three times instead of two and their third test was given 6-7 weeks after the second round of tests. Perhaps the scores on this subtest improve with more practice, more so than the other subtests. An interesting side note is that the posttest for this intervention group was administered just a few days prior to Christmas break, making for a lot of excitement, absences, and noise in the hallways. If this series of posttests had been given during a more 'normal' time, would there have been significant differences found between the groups on more of the subtests? Also, did the five participants who were absent from school during this time, contribute to the differences, or lack thereof?

On a subtest such as the rapid naming digits, though, the Wait-list Intervention group had much lower gain scores than either the Control or the Initial Intervention group. Rapid naming scores are recorded in seconds, so one would expect large gain scores. An alternate forms test would not affect the outcome of either the rapid naming digits or the rapid naming letters since these assessments are basically the same for all forms of the instrument. Given that the Wait-list Intervention group had an additional round of tests, they would have had more practice in taking the test; thereby, reducing their time on task each round, and getting closer to a minimal amount of time needed to complete the task. This group also experienced high levels of noise in the hallways and chaotic activity during their posttest, which may have caused difficulty focusing on this type of subtest.

Research Q2 & Q3: Differences between Hispanic and Caucasian Students

Based on readings, the researcher expected more significant gains for the Hispanic children. The literature reviewed, suggests that strong cultural ties to music tends to influence the outcome of a music-based intervention (Beaton, 1995; Chen-

Hafteck, 1996). Yet, this study showed that, overall, there were no differences in reading gains between the Hispanic and Caucasian groups. The only big revelation was that the significant difference between groups on the picture recognition gain scores was due to the Hispanic students making such large gains. It is interesting though, that this is the subtest that Hispanic children excelled in, since the teachers involved in this study (as well as the ones involved in the summer camp), thought that this subtest might be experientially-biased. One possible reason for better scores on the picture recognition subtest is that pictures (nonlinguistic representations), tend to cross language barriers and might make it easier to assimilate a new language; thereby, enhancing student achievement. Marzano, Pickering, and Pollock (2001) report that the average effect size of using nonlinguistic representations (based on 246 studies), was .75, with a 27% gain in achievement scores.

Implications for Practice

The intervention used in this study, which integrates music and reading curriculum, contained many of the facets, identified by researchers, that tend to enrich the environment (Diamond, 2001; Ramey & Ramey, 2003; Wolfe & Brandt, 1998); a practice shown to stimulate brain growth and engage learners. First of all, it was a novel approach to teaching reading concepts, which is a brain-compatible method of learning (Diamond, 2001; Wolfe & Brandt, 1998; Jensen, 1998; Sousa, 2001). Jensen asserts that incorporating novelty in the classroom experience, "ensures attentional bias" (1998, p. 50). This type of intervention invites students to participate because of its novelty or uniqueness (Sousa, 2001).

The very fact that it is contextual in nature, engages students (Gardner, 1993). This intervention allowed students to connect new ideas borrowed from the music world, with concepts taught in reading, such as opposites. In this situation, the episodic memory pathway was being invoked through sensory input (sight, sounds), arousing the event and contextual recall process (Jensen, 1998; Ormrod, 1999). Because the intervention lessons related musical concepts to those found in reading (such as 'storytelling' and 'opposites'), the semantic memory system (processing of terms, stories, and facts) was also being engaged (Jensen, 1998).

This intervention is a good example of 'orchestrated immersion' (Caine & Caine, 1991, 1997), whereby concepts are brought to life in the minds of the learners through the integration of music. It presents the information in a relevant way, calling upon the process of 'elaboration' (Jensen, 1998), which allows students to sort, integrate, expand, and synthesize ideas. This type of experience fulfills the brain's search for meaning through 'patterning', the meaningful organization of information (Nummela & Rosengren, 1986). This aspect of critical thinking also invites students to compare and contrast the ideas found in both music and reading (Elster, 2001; Perret & Fox, 2004).

This integrated intervention employed a multiple intelligence approach (Gardner, 1993; Hatch & Gardner, 1996), thereby engaging the students in a holistic fashion. Musical intelligence not only includes the ability to play music; it also involves an appreciation of musical patterns. It is in fact, "almost parallel structurally to linguistic intelligence" (Gardner, 1999, p. 42). During this intervention, music crossed many learning systems (Gardner, 1999; Given, 2002; Jensen, 1998), while adding an emotional component to compel attention and direct learning (Sylwester, 1995). It became the entry point to other subject areas, such as mathematics and reading; for example, in this intervention, music used rhythm to improve skills used in reading, such as listening, syllabication, and phonemic awareness.

As for future implementations, the researcher and teachers involved in the study thought that using live musicians would be better than having a recorded version of the lessons. This would increase the novelty aspect through the interaction of live musicians and students; musicians could directly answer questions from individuals and tailor the lesson to meet the needs of the class. But, if continuing the use of DVDs, an improvement would be to limit the filming of students in the recording studio, since this detracted from the realism. In support of this idea, the facilitating teachers commented on how students "started responding to the musicians" as if they were in the room. They "would raise their hands and wait for the quintet to call on them". They also thought that adding movement would enhance the lessons; perhaps reinforcing the vocabulary terms with matching movements. This idea had already been implemented in the live lessons delivered during the summer camps in North Carolina.

The sound quality of the DVDs could be improved by retaining the musical pieces to be inserted in newly recorded lessons. The lessons might be structured differently, providing more interaction with actual classroom students. I think it was surprising to all of us involved, to see the children interacting with the musicians as if they were present in the room. This seems to be a phenomenon shared by children in this age group; the ability to combine realities. It is feasible that an interactive DVD would be much more successful in terms of improving reading skills.

The teachers concur with the researcher, anticipating that an 8-week intervention, utilizing all 15 lessons, would have greater impact. They indicated that delivering two lessons per week would probably provide the continuity needed in this type of intervention. [Note: this is how the intervention was implemented in prior studies.] One of the teachers suggested using a "Smartboard" to engage students with a more hands-on approach, and to record responses. Elementary schools in this district are beginning to use more technology of this type in their teaching techniques.

The discussion came full circle to strengthening the intervention, thereby strengthening the study. All those involved agreed that more student interaction would be more beneficial, engaging the learners in a number of activities that either support or extend the current lessons. Some good examples of the lesson extensions were implemented by the facilitator of the wait-list group. The researcher intends to create a teacher manual, including and expanding on those extensions by providing one to two examples for each lesson.

Another suggestion made by the teachers was to add more movement to the lessons, such as the drama activities embedded in the Music, Mind and Reading summer camp. This is supported in the literature on movement and its impact on learning (Greenleaf, 2003; Jensen, 1998; Sousa, 2001). The music therapy intervention that Kennedy (2005) successfully implemented with ESL students, included movement, active music listening, and musical games. In essence, the intervention might be expanded to include other arts, such as those found in Learning Through the Arts programs (Grauer et al., 2001; Upitis et al., 2001).

Future Research

A stronger experimental study could be achieved by having larger sample sizes, and involving live musicians. Major improvements to the research could be accomplished by adding resources such as time, money, assistants, and more participant classes. For example, a study with three distinct levels of treatment type (control, live music, recorded music), all receiving the prescribed treatment at the same time, would be much more powerful. Because the objectivity of the tests was in question, another improvement to the study would be to utilize test instruments that better match the intervention; i.e., ones that test those skills that are supposedly being strengthened by the intervention. Those might include phonemic awareness and word analysis tests. Results might also be compared to similar studies, focusing on major findings, such as *average* improvement in phonemic awareness, *average* improvement in fluency, and correlations between pitch prediction and phonemic awareness (Wood, 2005).

All involved in the study agree that having live musicians perform during the intervention would strengthen the study; therefore, more cost-effective methods for delivering the live music would need to be explored. Hiring a live quintet to come into the school for 16 lessons is expensive, and schedules are very hard to coordinate. For example, one might utilize a television studio and televise the music portion, using a 2-way interactive connection with the classroom teacher and students. Or having college students who are studying music, perform the pieces; this would work well with music therapy practicum students.

When discussing future research, the teachers expressed a continued interest in participating, but preferred a spring implementation. This would circumvent the many transitions experienced at the beginning of the school year, and would give students a chance to "settle in" and establish a routine. Since second-graders do not have to take the Colorado standardized tests given in the spring, it would be feasible to make use of this time, with fewer interruptions (often occurring during winter holidays). It would also be possible to utilize some of the reading tests already given at the end of the school year, as posttests for the intervention. This would reduce the duplication of testing, experienced in this last study. Only one additional set of tests would need to be purchased and administered as pretests.

Thinking about future research, questions that arise for the researcher include: Does the music affect students in different ways; e.g., by relaxing them, getting their attention; engaging other brain areas, exciting neurons. What effect is the music having on learners with disabilities (such as ADD or dyslexia)? Do learners with disabilities have more acute listening skills? Do learners with disabilities benefit from the music in different ways? Do different types of learners benefit from different types of music?

Summary

As mentioned in the Methods Section, this is a holistic approach to education; one that is contextual, experiential, and rich with connections. This practice, termed brain-compatible teaching, engages students through novel approaches, arousing their curiosity, and providing meaningful connections to the 'real world'. It meets the brain's requirements for interaction, involvement, proximity, novelty (Sylwester, 1995; Sousa, 2001). More neural connections and dendritic branching occur as a result of such experiences (Jensen, 1998).

It is therefore advantageous to include qualitative, anecdotal data in the mix. The qualitative data collected, suggests that overall, there were positive gains from the intervention. Teachers reported that the students were engaged in the process, and found it memorable. This is substantiated by the finding that gains were made by the intervention groups on all subtests.

REFERENCES

Abikoff, H., & Courtney, M. E. (1996). The effects of auditory stimulation on the arithmetic performance of children with ADHD and nondisabled children. *Journal of Learning Disabilities, 29*(3), 238-246.

Anderson, S., Henke, J., McLaughlin, M., Ripp, M., & Tuffs, P. (2000). *Using background music to enhance memory and improve learning*. (Master's Action Research Project). Chicago, Illinois: Saint Xavier University & IRI/Skylight. (ERIC Document Reproduction Service No. ED437663)

Anvari, S., Trainor, J., Woodsider, J., & Levy, B.A. (2002). Relations among musical skills, phonological processing, and early reading ability in preschool children. *Journal of Experimental Child Psychology, 83*(2), 111-130.

Beaton, P. (1995). The importance of music in the early childhood language curriculum. *International Schools Journal, 15*(1), 28-38.

Berninger, V., & Richards, T. (2002). *Brain literacy for educators and psychologists*. San Diego: Academic Press.

Black, S. (1997). The musical mind. *The American School Board Journal, 184*(1), 20-22.

Brattico, E., Tervaniemi, M., Näätänen, R., & Peretz, I. (2006). Musical scale properties are automatically processed in the human auditory cortex. *Brain Research, 1117*(1), 162-174.

Brogla-Krupke, C. (2003). Improving student achievement through the use of music strategies. Unpublished master's thesis, St. Xavier University and Skylight Professional Development, Chicago, Illinois.

Brooks, R. B. (2004, November). *To touch the hearts and minds of students with learning disabilities: The power of mindsets and expectations.* Proceedings of the 2004 Learning & the Brain Conference sponsored by Public Information Resources, Inc., Cambridge, MA (pp. 33-51).

Butzlaff, R. (2000). Can music be used to teach reading? *Journal of Aesthetic Education, 34*(3-4), 167-178.

Caine, G., & Caine, R.N. (1991). *Making connections: Teaching and the human brain.* Alexandria, VA: Association for Supervision and Curriculum Development.

Caine, R., & Caine, G. (1997). *Unleashing the power of perceptual change: The potential of brain-based teaching.* Alexandria, VA: Association for Supervision and Curriculum Development.

Caine, R.N. (2000, November). Building the bridge from research to classroom. *Educational Leadership 58*(3), 59-61.

Chalmers, L., Olson, M. R., & Zurkowski, J. K. (1999). Music as a classroom tool. *Intervention in School & Clinic, 35*(1), 43.

Chen-Hafteck, L. (1996). Music and language development in early childhood: Integrating past research in the two domains. *Early Child Development and Care, 130*, 85-97.

Clausson, D. W., & Thaut, M. H. (1997). Music as a mnemonic device for children with learning disabilities. *Canadian Journal of Music Therapy, 5,* 55–66.

Deutsch, D. (1982). *The psychology of music.* New York: Academic Press.

Diamantes, T., Young, K., & McBee, K. (2002). An analysis of reading and content area skills improvement through music instruction. *Reading Improvement, 39*(3), 114-118.

Diamond, M. (2001). Response of the brain to enrichment. *An. Acad. Bras. Cienc., 73* (2), 211-220. Retrieved May 3, 2006, from http://www.scielo.br/cgi-bin/wxis.exe/iah/

Diamond, M., & Hopson, J. (1998). *Magic Trees of the Mind.* New York: Dutton Books, Penguin-Putnam Group.

Edelman, G. M. (1992). *Bright air, brilliant fire: On the matter of the mind.* New York: Basic Books.

Eden, G.F., Jones, K.C., Gareau, L., Wood, F.B., Zeffiro, T., Dietz, N., Agnew, J., & Flowers, L. (2004). Neural changes following remediation in adult developmental dyslexia. *Neuron, 44*, 411-422.

Elster, A. (2001). Learning through the arts: Program goals, features, and pilot results [electronic version]. *International Journal of Education & the Arts, 2*(7). Retrieved March 17, 2004, from http://ijea.asu.edu/v2n7/

Erlauer, L. (2003). The brain-compatible classroom: Using what we know about learning to improve teaching. Alexandria, VA: Association for Supervision and Curriculum Development.

Fischer, K. W., & Rose, T. (2001). Webs of skill: How students learn. *Educational Leadership, 59*(3), 6-12.

Fuster, J. (2003). *Cortex and mind: Unifying cognition.* Oxford: Oxford University Press.

Gardner, H. (1993). *Multiple intelligences: The theory in practice.* New York: Basic Books.

Gardner, H. (Speaker). (1996). Intelligence, understanding, and the mind: An illustrated presentation (Videorecording). Los Angeles, CA: Into the Classroom Media.

Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st century.* New York: Basic Books.

Giles, M.M. (1991, November). A little background music please. *Principal Magazine,* 41-44.

Given, B. (2002). *Teaching to the brain's natural learning systems.* Alexandria, VA: Association for Supervision and Curriculum Development.

Gliner, J., & Morgan, G. (2000). *Research methods in applied settings: An integrated approach to design and analysis.* Mahwah, NJ: Lawrence Erlbaum Associates.

Gobet, F. (2005). Chunking models and education. *Applied Cognitive Psychology, 19,* 183-204.

Grauer, K., Irwin, R., deCosson, A., & Wilson, S. (2001). Images for understanding: Snapshots of learning through the arts [electronic version]. *International Journal of Education & the Arts, 2*(9). Retrieved March 17, 2004, from http://ijea.asu.edu/v2n9/

Greenleaf, R. (2003). Motion and emotion. *Principal Leadership, 3*(9), 14-19.

Hanshumacher, J. (1980). The effects of arts education on intellectual and social development: A review of selected research. *Bulletin of the Council for Research in Music Education, 61*(2), 10-28.

Hart, C., Burts, D., & Charlesworth, R. (1997). *Integrated curriculum and developmentally appropriate practice: Birth to age eight.* Albany: State University of New York Press.

Hatch, T., & Gardner, Howard. (1996). If Binet had looked beyond the classroom: The assessment of multiple intelligences. *NAMTA Journal, 21*(2), 5-28.

Hetland, L. (2000). Listening to music enhances spatial-temporal reasoning: Evidence for the "Mozart effect." *Journal of Aesthetic Education, 34*(3-4), 105-148.

Immordino-Yang, M. (2001). When 2 + 2 makes kids trip: Making sense of brain research in the classroom. *Basic Education, 45*(8), 16-19.

Janata, P., & Grafton, S. (2003). Swinging in the brain: Shared neural substrates for behaviors related to sequencing and music. *Nature Neuroscience, 6*(7), 682-687.

Jensen, E. (1998). *Teaching with the brain in mind.* Alexandria, VA: Association for Supervision and Curriculum Development.

Jensen, E. (2000). Brain-based learning: A reality check. *Educational Leadership, 57*(7), 76-80.

Kennedy, R. (2005). A pilot study: The effects of music therapy interventions on middle school students' ESL skills. *Journal of Music Therapy, 42*(4), 244-261.

Kessler, R. (2000). *The soul of education.* Alexandria, VA: Association for Supervision and Curriculum Development.

Kolb, G. (1996). Read with a beat: Developing literacy through music and song. *The Reading Teacher, 50*(1), 76-79.

Lamb, S. J., & Gregory, A. H. (1993). The relationship between music and reading in beginning readers. *Educational Psychology, 13*, 13-27.

Leng, X. & Shaw, G.L. (1991). Toward a neural theory of higher brain function using music as a window. *Concepts in Neuroscience, 2*, 229–258.

Marzano, R., Pickering, D., & Pollock, J. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Morgan, G., Gliner, J., & Harmon, R. (2006). *Understanding and evaluating research in applied and clinical settings.* Mahwah, NJ: Lawrence Erlbaum Associates.

Nakumura, S., Sadato, N., Oohashi, T., Nishina, E., Fuwamoto, Y., & Yonekura, Y. (1999). Analysis of music-brain interaction with simultaneous measurement of regional cerebral blood flow and electroencephalogram beta rhythm in human subjects. *Neuroscience Letters, 275*(3), 222-226.

Nummela, R., & Rosengren, T. (1986). What's happening in students' brains may redefine teaching. *Educational Leadership 43*(8), 49-53.

Oddleifson, E. (1994). What do we want our schools to do? *Phi Delta Kappan, 75*(6), 446-448, 450-452.

Ormrod, J. E. (1999). *Human learning. (3rd ed.).* Upper Saddle River, N.J: Merrill.

Overy, K. (2003). Dyslexia and music: From timing deficits to musical intervention. *Annals of the New York Academy of Sciences, 999*, 497-505.

Parente, R., & Herrmann, D. (1996). *Retraining cognition: Techniques and applications.* Gaithersberg, MD: Aspen Publishers.

Patel, A. (2003). Language, music, syntax and the brain. *Nature Neuroscience, 6*(7), 674-681.

Patel, A., Peretz, I., Tramo, M., & Labrecque, R. (1998). Processing prosodic and musical patterns: A neuropsychological investigation. *Brain and Language 61,* 123–144.

Perret, P., & Fox, J. (2004). *A well-tempered mind: Using music to help children listen and learn.* New York: Dana Press.

Ramey, C. & Ramey, S.L. (2003, May). *Preparing America's children for success in school.* Paper presented for Invited Address, White House Early Childhood Summit on Ready to Read, Ready to Learn. Denver, CO.

Rauscher, F. H. (2003). *Can music instruction affect children's cognitive development?* (071 Information Analyses--ERIC IAPs No. EDO-PS-03-12). Champaign, IL: ERIC Clearinghouse on Elementary and Early Childhood Education.

Rauscher, F. H., & LeMieux, M. T. (2003). *Piano, rhythm, and singing instruction improve different aspects of spatial-temporal reasoning in Head Start children.* Poster presented at the annual meeting of the Cognitive Neuroscience Society, New York.

Rauscher, F. H., Shaw, G. L., Levine, L. J., Wright, E. L., Dennis, W. R. & Newcomb, R. L. (1997). Music training causes long-term enhancement of preschool children's spatial-temporal reasoning. *Neurological Research 19*(1), 1–8.

Rauscher, F. H., & Zupan, M. A. (2000). Classroom keyboard instruction improves kindergarten children's spatial-temporal performance: A field experiment. *Early Childhood Research Quarterly 15*(2), 215-228.

Register, D. (2001). The effects of an early intervention music curriculum on prereading/writing. *Journal of Music Therapy, 38*(3), 239-248.

Register, D. (2004). The effects of live music groups versus an educational children's television program on the emergent literacy of young children. *Journal of Music Therapy, 41*(1), 2-27.

Richards, R. G. (1993). *Learn: Playful techniques to accelerated learning.* Tucson, AZ: Zephyr Press.

Roberts, J. (2002). Beyond learning by doing: The brain compatible approach. *Journal of Experiential Education, 25*(2), 281-285.

Schellenberg, G. (2005). Music and cognitive abilities. *Current Directions in Psychological Sci, 14*(6), 317-320.

Schenck, J. (2004, November). Presentation at the 2004 Learning & the Brain Conference sponsored by Public Information Resources, Inc., Cambridge, MA.

Schlaug, G. (2001). The brain of musicians: A model for functional and structural adaptation. In R. J. Zatorre and I. Peretz (ed.) *The Biological Foundations of Music, 930*, 281-299. New York: Annals of the New York Academy of Sciences.

Schmahmann, J. D. (1997, ed). *The cerebellum and cognition.* San Diego: Academic Press.

Semrud-Clikeman, M., Nielsen, K.H., Clinton, A., Sylvester, L., Parle, N., & Conner, R. (1999). An intervention approach for children with teacher- and parent-identified attentional difficulties. *Journal of Learning Disabilities, 32*, 581–590.

Shaw, G.L. (2000). *Keeping Mozart in mind.* [S.T.A.R. Software concept and design by Matthew Peterson]. San Diego, CA: Academic.

Sobolew-Shubin, S. (2004). *OMA Research Evaluation.*

Sollier, P. (2001-2003). Dr. Alfred Tomatis. [Retrieved November 24, 2007 from http://www.sound-remedies.com/alfredtomatis.html

Sousa, D. (2006). *How the brain learns* (3rd ed.). Thousand Oaks, CA: Corwin Press.

Sousa, D. (2001). *How the special needs brain learns.* Thousand Oaks, CA: Corwin Press.

Sylwester, R. (1995). *A celebration of neurons: An educator's guide to the human brain.* Alexandria, VA: Association for Supervision and Curriculum Development.

Thaut, M. (2005). *Rhythm, music and the brain: Scientific foundations and clinical applications.* New York: Routledge.

Thaut, M., Peterson, D., & McIntosh, G.C. (2005). Temporal entrainment of cognitive functions: Musical mnemonics induce brain plasticity and oscillatory synchrony in neural networks underlying memory. *Annals of the New York Academy of Sciences, 1060*, 243-254.

Thayer, R. E. (1989). *The biopsychology of mood and arousal.* New York: Oxford University Press.

Torgesen, J.K., Alexander, A.W., Wagner, R.K., Rashotte, C.A., Voeller, K.S., and Conway, T. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and longterm outcomes from two instructional approaches. *Journal of Learning Disabilities 34*(1), 33–58, 78.

Turkeltaub, P.E., Gareau, L., Flowers, D.L., Zeffiro, T.A., & Eden, G.F. (2003). Development of neural mechanisms for reading. *Nature Neuroscience, 6*(7), 767-773.

Upitis, R., Smithrim, K., Patteson, A., & Meban, M. (2001). The effects of an enriched elementary arts education program on teacher development, artist practices, and student achievement: Baseline student achievement and teacher data from six Canadian sites [electronic version]. *International Journal of Education & the Arts, 2*(8). Retrieved March 17, 2004, from http://ijea.asu.edu/v2n8/

Weinberger, N. M. (1994, Fall). Musical building blocks in the brain. *Musica Research Notes, 1*(2). Retrieved November 29, 2007, from http://www.musica.uci.edu/mrn/V1I2F94.html#building

Wise, B.W., Ring, J., and Olson, R.K. (1999). Training phonological awareness with and without explicit attention to articulation. *Journal of Experimental Child Psychology, 72*, 271–304.

Wolfe, P. & Brandt, R. (1998). What do we know from brain research. *Educational Leadership, 56*(3), 8-13.

Wood, F. (2005, August). *Technical manual for Predictive Assessment of Reading (PAR).* Winston-Salem, NC: Wake Forest University Health Sciences.

Zatorre, R.J., & Peretz, I. (2003). *The cognitive neuroscience of music*. Oxford: Oxford University Press.

Zentall, S. (2005). Theory- and evidence-based strategies for children with attentional problems. *Psychology in the Schools, 42*(8), 821-835.

APPENDIX A: PARENT COVER LETTER

Parent Information Letter

Dear Parent(s);

Your child's school has agreed to participate in a research project this year. Your son or daughter is being invited to participate in this project as part of their classroom experience. This project is designed for elementary students in first and second grades. The research is being conducted by Linda Lyons, a Ph.D. student at CSU, as the final part of a doctoral program.

The purpose of this study is to research the effect of music on the learning process. This program has been used in other schools for about 8 years, and has been found to help students with reading. For 6-8 weeks, your child will participate in lessons that use music to teach concepts similar to those found in reading, such as opposites and parts of a story. The 30-minute lessons will be part of the regular school day, delivered in your child's classroom by his or her teacher. At the beginning of the study, students will be given a 15-minute reading exercise to determine reading skill levels. At the end of the study, the same exercise is given to determine changes in skill levels. The results of this exercise will not be used to determine your child's grade.

Benefits: Music has been found to engage people of all ages, thereby acting as an attention getter or catalyst for learning new information. This research benefits all students by presenting reading concepts in a meaningful way.

Confidentiality and Risks: Students will be given a numerical code to maintain confidentiality. Your child's name will not be shared with the researchers; therefore, research records will not contain your child's name. Your child's information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. Your child will not be identified in these written materials.

There are no known risks associated with the procedures described above. While it is not possible to identify all potential risks in research procedures, the researcher(s) have taken reasonable safeguards to minimize any potential, but unknown risks.

Questions:

If you have questions about this study, you are welcome to contact the researcher, Linda Lyons, at 970-491-6867, or contact Janell Barker, Human Research Administrator at 970-491-1655.

Sincerely,

Don Quick, Ph.D.,Principal Investigator

Linda Lyons, M.Ed., Co-Investigator

Carta de Información para Los Padres

Estimados Padres:

La escuela de su hijo(a) ha aceptado participar en un proyecto de investigación este año. Su hijo o hija es invitado(a) a participar en este proyecto como parte de su experiencia educativa. Este proyecto está diseñado para estudiantes de escuela primaria del primer o segundo grado. La investigación es realizada por Linda Lyons, una estudiante de doctorado en CSU, como parte de su programa de estudio.

El propósito de este estudio es investigar el efecto de la música en el proceso de aprendizaje. Este programa ha sido usado en otras escuelas por aproximadamente 8 años, y se ha encontrado que ayuda a los estudiantes en la lectura. Por 6-8 semanas, su hijo o hija participará en lecciones que utilizan música para enseñar conceptos similares a los de la lectura, como, por ejemplo, los opuestos y las partes de una historia. Las lecciones de 30 minutos serán parte del día regular de enseñanza escolar, y serán presentadas en el aula de su hijo o hija por el maestro o la maestra. Al principio del estudio, los estudiantes harán un ejercicio de lectura de 15 minutos para determinar su nivel de destreza en la lectura. Al final del estudio, el mismo ejercicio será administrado para determinar cambios en los niveles de destreza. Los resultados del ejercicio serán usados para determinar la nota de su hijo o hija.

Beneficios: Se ha encontrado que la música beneficia a personas de todas las edades; de hecho, actúa como una atracción de aprendizaje para aprender nueva información. Esta investigación beneficia a todos los estudiantes al presentar conceptos de lectura en una manera significativa.

Confidencialidad y Riesgos: Los estudiantes recibirán un código numérico para mantener la confidencialidad. El nombre de su hijo o hija no será compartido con los investigadores; así, los resultados de la investigación no incluirán el nombre de su hijo o hija. La información de su hijo o hija será combinada con información de otros participantes en el estudio. Cuando escribamos sobre el estudio para compartir los resultados con otros investigadores, escribiremos sobre la información combinada que hayamos compilado. Su hijo o hija no será identificado en estos documentos escritos.

No hay riesgos conocidos asociados con el procedimiento descrito aquí. Si bien no es posible identificar todos los riesgos potenciales, los investigadores han tomado medidas razonables para minimizar cualquier riesgo potencial aunque desconocido.

Preguntas:

Si tiene alguna pregunta sobre este estudio, favor de contactar a la investigadora, Linda Lyons, al 970-491-6867, o a Janell Barker, Administradora de Investigación Humana, al 970-491-1655.

Cordialmente,

Dr. Don Quick, Investigador Principal

Linda Lyons, Co-Investigadora

APPENDIX B: FIELD NOTES

Lesson Notes

Lesson 1

<u>Wait-list Intervention: Oct. 30, 2007</u>

Teacher clarified what was said when dialogue was too soft to hear;
Pauses: name of instrument, differences between instruments;
Question words (too fast on screen)
Disconnect: interviewer asks questions (nothing is done with this idea)

Extensions:
Check for understanding; review terms;
What was one thing you learned today? Make connections.
What questions would you have for the quintet? (Could do an online response!) 

Lesson 2

<u>Initial Intervention: Sept. 20, 2007</u>

Vocals are soft; you can barely hear at the back of the room. Teacher turns down volume for song #1, but then forgets to turn up again.
Teacher questions include: "Was it hard to hear which one was playing?" and "What happened when 2 or more instruments played?"
Student comment: "song sounds like Spongebob!"
Teacher prompts: "Song is about a sailor"; "good listening", "sounds like chatter" (word from story).

Lesson 3 -- Opposites

<u>Wait-list Intervention: Nov. 6, 2007</u>

'Ballet of Chicks in Shells' – first piece
Pauses: "What did you picture during this tune?"
Pair of opposites; What is up high? What parts of the body are low? Difference between slow and fast playing (flute)?

DVD vocals are very soft;
Comment from a student who appears to be ADHD (he just took his medication), "I love these videos!"

 Teacher embraces the lessons, extends each one;
borrowed same music pieces from the library;

Debriefing: questions or comments about what you saw or heard? Move a high body part, now a low body part;
Replay piece: Identify the highs/lows in "I Ride an Old Paint".

Lesson 4 – Opposites, cont.

<u>Wait-list Intervention: Nov. 13, 2007</u>

'Menuetto' – long piece

Paused to ask: "Highest note you can sing?" "Lowest note?"
Which instrument is playing when you move the middle body parts? – clarinet
Staccato / legato – bumpy / smooth
Forte / piano – loud / soft
Student question: "Are those Spanish words?"

Debriefing: How did the music make you feel? Staccato or legato?
What connections did you make with the music?

Lesson 5 – Sounds of Silence [short lesson]
<u>Initial Intervention: Oct. 3, 2007</u>
Good volume on vocals; more interaction from musicians than initial lessons.
Teacher facilitation: introduced concept, asked questions, embedded pauses, reviewed terms at end of session. Paused for 1 minute to listen to environmental sounds; solicited responses and wrote on the board. Mimicked hand movements to accompany musical opposites.

Improvements: Intro musical piece – shorten or eliminate (show relevance); consistent subtitles; create interactive DVD to increase brain-compatible learning – movement in every lesson, cues for live facilitator such as boardwork

<u>Wait-list Intervention: Nov. 16, 2007</u>
Paused to ask: "What did you hear?"
'Pastorale' – move body parts, one instrument or more

Extension:

'Thinking Journal' – for 1 minute, write down things you hear (does not have to be perfect; practice with examples); share those things with the class
When would you need to pay attention with your ears? Give an example!
Give directions for next activity in a piano voice.

Lesson 6 – Sounds in My Head
<u>Wait-list Intervention: Nov. 20, 2007</u>
Staccato vs. legato; forte vs. piano; fast or slow; hi / low
'Entry of the Gladiator's March' by Julius Fucik
'Row Your Boat' – make distinctive hand gestures
Melody; rhythm (no vowels in this word)
Clapping rhythms


Extension:
'Clapping charades' –

[Note: 013 missed three lessons (good reader)]

Lesson 7 -- Soundscapes
<u>Initial Intervention: Oct. 10, 2007</u>

Facilitator passes out supplies: paper, crayons, pencil.
"What sounds would you hear in the woods?" Lots of hands go up – pause needed!
What instruments match the nature sounds? What do you hear in a storm?

Two students (#5, #8?) are not engaged at all; one is writing/working on something else, one is being tutored in the hall.

Suggestions:
Camera needs to focus on board when reading list of instruments (matching activity)
Facilitator needs to set up activity in classroom to mimic sounds made during the storm (section the class for different sounds: chair tapping, wind, dogs, cabinet banging).
Boure piece – needs tie-in to activity or else eliminate. Maybe ask, "What was happening in this piece?"
Get paper ready for tomorrow's lesson.

Wait-list Intervention: Nov. 27, 2007
'Scarf Dance'
Pause: defn of landscape
Out west, what would you see?
Clarify picture
Definition of 'soundscape': picture with sounds
Match instruments with sounds [see suggestion above]
Transfer: New soundscape for storm – [need more vocals]

Extension: teacher previewed some/all of DVD to prepare this extension
List outside sounds on board; describe those sounds

Create story with parts;
Peter and the Wolf – listen for instruments and sound parts (oboe – duck; clarinet – cat; bassoon – grandpa; French horn – wolf; kettle drums – guns; strings – Peter; flute – bird)

Lesson 8 (not observed)

Lesson 9 – Story Writing
Wait-list Intervention: Dec. 4, 2007
Intro: connections to words in lesson
'Allegro Molto' by Mozart

'Harriet and the Garden' – reading by Bob
Checks for understanding: 'prized dahlia', 'confessed'
Define parts of the story: beginning, …
Pause to ask: where, when, etc is called *setting*
The people are called *characters*.
'Sonata form' – has an intro (setting), characters (theme), plot (problem), solution

Define: 'recapitulation', 'coda'

Lesson 10 – Rondo Form
Initial Intervention: Oct. 17, 2007
DVD vocals are soft;
'Peanut Butter and Jelly' song – snap fingers with the chorus ("refrain");
Pause to make up another verse;

'Bonnie Lies Over the Ocean' – *suggestion*: print refrain on screen;
Pause to ask, "What is the song about?"
Facilitator relates idea – 'student's aunt lives in Scotland, across the ocean'

Listening for repetition:
'Rondeau' by Haydn
"Hold up your hand when you hear the refrain";
Extension: "Hum the refrain (that which is repeated)."

[Note: two absentees]

Lesson 11 – Young Composers
Wait-list Intervention: Dec. 11, 2007
'Baba Yaga' (bony legs)
Pause: What did you think of when you heard this piece? – danger, Indians, staccato

Suggestions: need to see the marks on the board in order for students to match the sound (remove panning)

Defn of 'composer' – what does *she* do?
Review 'forte', 'piano'
'Pastorale' by Gabrial Pierne
[sound is very diminished – can't hear Lisa]

Connections: legato goes with piano

Extension: read book, "Babushka: Baba Yaga" by Patricia Polaco
What is a babushka? Grandmother or grandmother's scarf
From Mexico, "La Yrona" has similar themes

Lesson 12 -- Composing
Initial Intervention: Oct. 25, 2007
'Minuet' – opposites;
Pause to review instruments
Graphing the melody; singing what's been graphed;
Draw a graph of your own (good activity, but didn't do);
Performed by musician (how to do that in the classroom? Maybe sing what's been graphed!)

When choosing a musical instrument to play the graph, students notice that "all the boys are picking Bob … the girls are picking the girls".

Closing piece – 'Eight Russian Folk Dances' by Lidov

Suggestions:
Focus camera on whole board; need to see DVD graphs better! Shorten this part – student comment, "Is this almost over?"
Maybe post sound graphs on board or zoom in.
Sing what's been graphed.