

THE EFFECT OF TONALITY AND RHYTHM ON MEMORY RECALL IN  
ELEMENTARY GENERAL EDUCATION CLASSROOMS:  
A QUASI-EXPERIMENTAL STUDY

by

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Abstract

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The purpose of this study was to evaluate the effect of rhythm and melodic rhythm on an academic memory task by comparing three different treatment conditions: a poem, a rhythmic chant (or rap), and a melodic rhythm (or song). A quasi-experimental experiment was designed and implemented, specifically a pretest-posttest-posttest control-group design. This study took place in the North Texas area in an urban school district on four campuses that were minimally 50 percent economically disadvantaged.

The study included 139 second-grade students who gave consent and fully participated in the research study. Data were obtained through pretesting students' knowledge of the countries of the world. Treatment conditions were implemented over a three-week period in 12 sessions. A posttest measured change in the knowledge of the countries. A three-week period of non-treatment followed by a retention test discerned the effect of retention. Following retention testing, focus groups with teachers were conducted to uncover any anomalies that may have affected results.

Independent variables for this study were ethnicity and treatment type and dependent variables were memory (posttest) and retention (final posttest). Differences between all treatment types were significant. For the memory test, main effects were found for both treatment group ( $p = 0.001$ ) and ethnicity ( $p = 0.006$ ). Memory test post hoc testing revealed significance between the melodic rhythm treatment and poetic treatment for memory and retention. Post hoc testing also revealed that Asian / P. I. students responded significantly better to these treatments than other ethnicities.

Discussion of findings highlights that increasing complexity of the treatment correlates to increasing task performance, suggesting that the addition of musical elements to an academic memory task improves memory of the content. A discussion of the performance differences with African American males is discussed indicating possible learning differences. Implications and limitations are discussed and recommendations for future research include extending this study into different age groups, into different economic settings, and over longer periods of time, as well as investigating the effects of musical preference on studies like this one.

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## Chapter 1

### Introduction

Since the 1965 dawn of federal accountability, American school children's performance has declined in world rankings in virtually every academic area. This three-decade decline may be largely attributed to the failure of the educational system to close racial and economic performance gaps in its school-age children. The achievement gap between white student performance and economically disadvantaged students, African-American students, and Hispanic students is well-documented in assessment scores at the national level (Darling-Hammond, 2010; National Center for Educational Statistics, 2011).

Results from the 2009 National Assessment of Education Progress (NAEP) assessment reveal that among American fourth-grade students, the white students outscored black students in math achievement by 26 points in 2009. Similarly, fourth-grade Hispanic students scored 29 points below white students on the NAEP math assessment (National Center for Educational Statistics, 2011). The performance gaps in eighth-grade math are also troublesome with a 32-point differential between black students and their white counterparts and a 26-point gap between Hispanic and white students (National Center for Educational Statistics, 2011). Sadly, the trend continues as students approach their graduation dates. In 12<sup>th</sup>-grade math, the differential between white students and Hispanic students is 23 points, and the difference between white students and black students is 30 points (Aud & Hannes, 2011).

On the 2009 NAEP reading assessment, the story is not much different. White fourth-grade students outscored black students and Hispanic students by 25 points. These

achievement differentials have remained statistically the same as they were in 1992. The trends hold form in reading scores, too, at least 22 point achievement gaps between whites and Hispanic and black students in eighth- and 12<sup>th</sup>-grades (Aud & Hannes, 2011). Of the 34 countries participating in a 2011 Organization for Economic Co-operation and Development (OECD) study, the United States ranked 26<sup>th</sup> in high school graduation rate.

Research not only highlights the racial gaps in achievement, it also indicates a gap based on students' socioeconomic status (Aud & Hannes, 2011). Smith, Brooks-Gunn, and Klebanov (1997) found that children from poverty averaged 23 points lower on assessment than children not in poverty. Marzano (2004) highlights the relationship between poverty and ethnicity noting that 21.4 percent of Hispanics and 22.7 percent of African-Americans live below the poverty line while only nine percent of whites are below the poverty line. In short, "if you are born African-American or Hispanic in the United States, you have twice the chance of living in poverty as if you are born white" (Marzano, 2004, p. 11).

These gaps in achievement speak to the inadequacy of the K-12 public education system to address the needs of all learners. In fact, the decline in educational ranking continues into higher education where although the United States has remained relatively constant in its college graduation rates, other countries are rapidly increasing. As a result, the United States has slipped from second place to 13<sup>th</sup> place among the OECD countries over the 13-year period ending in 2008. Among those who enrolled in higher education full time in 2002, 67 percent of white students graduated within a six-year time period, while only 49 percent of Hispanics and 40 percent of blacks did so (Aud & Hannes, 2011). The Program for International Student Assessment (PISA) suspects that

“these developments will be amplified over the coming decades as countries such as China and India raise their educational output at an ever-increasing pace” (Organisation for Economic Co-operation and Development, 2011, p. 15).

Considering the relatively constant divide in the performance of American student subpopulations, researchers are looking at new ways of enhancing academic achievement of all students by studying the work that is happening inside classrooms (Fullan, 2008; Marzano, Pickering, & Heflebower, 2011; Schlechty, 2002). According to Marzano (2004), background knowledge, what an individual already knows about a topic, is a vital component for academic achievement and a strong predictor of how well students will learn new information. Other research has confirmed this relationship between background knowledge and academic achievement (Alexander, Kulikowich, & Schulze, 1994; Dochy, Segers, & Buehl, 1999; Schiefele & Krapp, 1996; Tobias, 1994). This research suggests that increasing background knowledge often leads to improvements in academic achievement.

In order for students to apply background knowledge and experiences, knowledge must be stored in memory. Though there is some debate about how the brain processes new information, scholars agree on three phases of memory: short-term, working, and long-term (Baddeley & Hitch, 1974; Cowan, 1995; Dehn, 2008). The main distinction between short-term memory (STM) and working memory (WM) is that STM passively holds information while WM actively processes it (Dehn, 2008). Though WM has been found to have stronger connections with academic learning than STM, “predominant theories of working memory incorporate STM as a subsidiary system” within WM (Dehn, 2008, p. 4).

To increase students' background knowledge and memory, researchers are focusing on benefits of interconnected strategies for learning between seemingly unconnected fields (Costa-Giomi, 2004; Geake, 1996). For example, a positive correlation has been established between music education and academic performance (Butzlaff, 2000). The use of music in early childhood and elementary school general populations as a learning aid has been an effective strategy for improving academic achievement (Bilhartz, Bruhn, & Olson, 2000; Butzlaff, 2000). Some studies have pointed to higher spatial-temporal abilities for children after receiving music instruction (Costa-Giomi, 2004; Geake, 1996; Rauscher, Shaw, Levine, Wright, Dennis, & Newcomb, 1997; Rauscher & Zupan, 2000). Other research has found that students who study a musical instrument have higher academic achievement (Grandin, Peterson, & Shaw, 1998; Graziano, Peterson, & Shaw, 1999; Leng & Shaw, 1991; Trent, 1996; Zanutto, 1997). Still, others found that students who listen to music without lyrics while studying have increased academic performance (Hallam, Price, & Katsarou, 2002; Rauscher, Shaw, Levine, Wright, Dennis, & Newcomb, 1997; Sims, 1986). While correlations are clear, research has not established the causal connection between music and academics. Existing research completed with general education students has focused on the effect on achievement when students listen to music, but the results are often inconclusive or conflicting (Anderson & Fuller, 2010; Hallam, Price, & Katsarou, 2002; Pool, Koolstra, & Van Der Voort, 2003; Sims, 1986). This suggests that multiple factors may be involved in the effects of music on memory and learning.

While some researchers have focused on the benefits of using musically interconnected strategies in general education settings, music therapy research has sought

to address the behavioral and academic deficits of disabled children and adults (Atterbury, 1985; Berger et al., 2004; Chang, Huang, Lin, & Lin, 2010; Fischer-Terworth & Probst, 2011; Paul & Ramsey, 2000). Music therapists and cognitive psychologists have investigated the connections between cognition, memory, and music, primarily with the elderly and special education students. In studies with dementia and Alzheimer's patients, as well as with disabled children, research has found that music therapy can improve knowledge and skills, both academic and behavioral (Chang, Huang, Lin, & Lin, 2010; Clair, Bernstein, & Johnson, 1995; Rickard, Toukhsati, & Field, 2005).

As neuroscience continues to build a case for the enhancement of cognitive interconnectivity with the study of music, there is a need for research that identifies how this cognitive connectivity can be applied to academic general education classrooms (Butzlaff, 2000; Geake, 2009). Although music cognition research has established correlations between music and academic performance, causation remains elusive (Butzlaff, 2000). It is possible that effects of music on memory and learning are difficult to evaluate because of the complex nature of music. Studying separate elements of music and their effects on academic memory may provide new insight into how music affects memory. Gordon's (1989) music learning theory proposes that the rhythm and tonality of music function as components of a musical vocabulary. Gordon's (1989) theory provides a framework for the separation of musical elements, specifically tonality and rhythm that may be able to confirm or reject the application of music as an instructional tool to increase background memory. Additionally, the concept of audiation, or being able to hear sound that is not physically present (Gordon, 2007), may provide an explanation for how music affects the memory of academic content. Though anecdotal, some teachers



report the benefits of chant and song as instructional strategies (Mathews, 2009); however, research is needed to measure the effectiveness of these tools as academic strategies.

### Background Information

To understand how music may effect memory, this section will begin with a discussion of memory systems. It will continue with a discussion of current research in music therapy. Finally, music cognition research with more generalized populations will be reviewed including a discussion of music preference as it pertains to this study.

#### *Memory*

Baddeley and Hitch (1974) proposed a memory model in which STM input is processed by visual and aural components and stored in long-term memory (LTM). The key to long-term storage in their model is the enhancement of the subject matter through aural and visual context. The aural context, or phonological loop, is where knowledge is repeated and reinforced (Baddeley & Hitch, 1974). According to Baddeley (1986), the phonological loop is a limited capacity, speech-based store of information. The phonological loop functions as a tape recorder for auditory input. Auditory input that is repeated will be more engrained in the brain (Baddeley & Hitch, 1974). Information that is stored in the brain but not used or accessed will decay over time since it is not being cycled through the phonological loop (Baddeley & Hitch, 1974). While the phonological loop captures aural information, the visuo-spatial sketchpad is responsible for “the short-term storage of visual and spatial information, such as memory for objects and their locations” (Dehn, 2008, p. 19). As knowledge is enhanced visually or aurally, it becomes a part of LTM.

In contrast, Cowan's (1995) embedded-process model of memory touts the existence of a single system, long-term memory (LTM). Short-term memory (STM) and working memory (WM) function within the context of LTM. Cowan (1995) suggests that WM is essentially activated LTM. Within the pool of LTM, items are subject to decay without activation. Decay occurs when the brain is not utilizing acquired knowledge. Without activation of knowledge, the information will decay. For example, students who took French in high school, but have not used that knowledge in the many years since, may remember very little of the language they once learned. A focus of attention determines which items are needed and activated and decay occurs after extended periods of non-activation (Dehn, 2008).

Hebb (1949) proposed that brain tissue functions differently than other body tissues. Hebb's insight was that in the brain, in contrast with other organs, neurons are connected to thousands of other neurons at their synaptic junctions. Hebb proposed that repeated firings of the particular synapses involved in processing the response to a stimulus result in a permanent physiological change. Repetition of these signals increases efficiency (Hebb, 1949). In short, the physiological change leads to learning. As Geake (2009) puts it, "Neurons that fire together, wire together" (p.48).

### *Music as Therapy*

Research has investigated how music used therapeutically can help to address the needs of disabled students and has confirmed positive correlations between music, memory, and learning. Music therapy studies have found that treatments can reduce agitation (negative displays of behavior) (Helmes & Wiancko, 2006; Park & Specht, 2009; Remington, 2002; Zare, Ebrahimi, Birashk, Niayesh, & Mansouri, 2010), as well

as increase purposeful participation (Clair, Bernstein, & Johnson, 1995; Groene, Zapchenk, Marble, & Kantar, 1998), increase memory recall (Chang, Huang, Lin, & Lin, 2010; Foster & Valentine, 2001), increase overall psychological well-being (Fischer-Terworth & Probst, 2011; Sherratt, Thornton, & Hatton, 2004), and improve autobiographical recall (Rickard et al., 2005). Findings from music therapy research have shown that music therapy can increase skills of autistic students to learn and follow basic classroom procedures and transition between instructional times (Marcus, Schopler, & Lord, 2001; Kern, Wolery, & Aldridge, 2007). Paul and Ramsey (2000) found that music therapy can increase the quality of life and health for disabled children by increasing physical activity, independence, and emotional expression. Gold, Voracek, and Wigram (2004) completed a meta-analysis of 11 studies of music therapy's effectiveness when used with patients with mental disorders and concluded that music therapy had a medium to large effect on improving behaviors of children with behavioral and developmental disorders. Additionally, music therapy has been found to enhance the effectiveness of speech therapy with children exhibiting extreme communication difficulties (Geist, McCarthy, Rodgers-Smith, & Porter, 2008). Music therapy builds on Hebbian concepts of repetition and increases cognitive interconnectivity with music to reinforce academic content and behavioral skills (Levitin, 2006).

### *Music for Learning*

In a study of music cognition, Cross (2009) argued that music in a cognitive context enables cognitive connectivity. He describes this connectivity as “floating intentionality” which “relate[s] to the fact that music’s meanings appear intimately bound to the contexts in which it is experienced” (p.3). Cross found that musical discrimination

in babies becomes more culturally specific with development indicating the effect of repetition on musical characterization (Cross, 2009). Stewart and Walsh (2005) studied the culturally specific nature of music. “Just as different languages have both universal and culturally specific features, so, too, does music. Even in this world of musical pluralism one can experience music of different cultures as alien” (Stewart & Walsh, 2005, p. R. 882). In research with infants, visual response to musical stimuli is measured to discern preference (Hannon & Trehub, 2005). Research has shown that infants have the ability to discern musical pitch and rhythm as familiar or foreign (Hannon & Trehub, 2005; Lynch, Eilers, Oller, & Urbano, 1990).

This concept of musical preference may begin with the mother. Some research contends that maternal singing may shape infant definitions of native music or what is familiar (Sergeant & Thatcher, 1974). Just as language uses different phonemes, music has differing tonal centers, groupings, and rhythmic characteristics. Cognitive definitions of music and language are formed and global descriptions of native and non-native music and language result. “Music could be the means of enhancing development of cerebral interconnectivity in infants’ brains” (Geake, 2009, p. 163).

With adults, Levitin and Cook (1996) found that people can remember actual tempos of music accurately. Almost three quarters of the participants recalled musical selections within eight percent of the actual tempo (Levitin & Cook, 1996). Levitin (2006) found that when asked to sing songs they like, people were able to do so with a close approximation of the actual musical pitch. These studies may indicate a potential for music to increase memory in more traditional academic settings. While some research is attempting to measure the effect of music on memory recall in patients with

dementia or Alzheimer's disease (Berger et al., 2004; Foster & Valentine, 2001; Vanstone & Cuddy, 2010; Vanstone, Cuddy, Duffin, & Alexander, 2009), and other research focuses on increasing knowledge, skills, and memory of children with special needs through music therapy (Cassity & Cassity, 1994; Ilari, 2002; Koelsch, Fritz, Schulze, Alsop, & Schlaug, 2005; Schellenberg, 2011), it is still unclear how music affects memory with general education student populations.

Mrazova, Celec, and Ing (2010) completed a systematic review of music therapy studies which used randomized controlled experiments in a range of settings. They reviewed 28 designs that showed a variety of medical conditions in need of treatment and an array of intervention lengths. Treatment intervention lengths varied from a single session to three months.

A few studies have focused on the effects of music therapy on students reading abilities in more traditional classroom settings (Register, 2001; Register, Darrow, Standley, & Swedberg, 2007). Register, Darrow, Standley and Swedberg's (2007) study of the efficacy of music as a remedial strategy with learning disabled second-grade students lasted four weeks. In this study, they developed an intensive short-term music curriculum to target vocabulary skills and comprehension (Register et al., 2007) and found in both control and treatment groups that there was significant improvement in word decoding, word knowledge, and overall performance. While neither control nor treatment showed significant improvement on comprehension, these skill-based categories suggest that music may indeed be a method to enhance memory of academic objectives. Additionally, analysis of covariance showed that the music curriculum treatment group made greater gains from pre- to posttest than the control, and

significantly greater gains in word knowledge. They conclude that “songs have great potential to teach vocabulary and word usage, and to serve as vehicles for practicing reading fluency and comprehension skills. Results of this study indicate that even a short-term intensive music/reading program has the potential to improve basic reading skills” (Register et al, 2007, p. 36).

### *Musical Preference*

In studying the effect of music on learning and memory, the element of musical preference must not be overlooked. LeBlanc’s (1982) model of musical preference suggests that children have an open-earedness for musical styles until around age eight when they begin to develop a preference for musical styles. Open-earedness was a term coined to identify a high tolerance for differing musical styles (Hargreaves, 1982a). Some research further suggests music preference correlates to listener familiarity or arousal (based on tempo or mood) (Hallam & Price, 1998; Hargreaves, 1982b). This concept of arousal or pleasure may encourage repetition and blur causal conclusions. The effectiveness of music as an academic learning tool becomes more dependent on students’ musical preference as students move into adolescence (Gordon, 2007).

Research surrounding musical preference spans from infants to the aged, from cognitive to neurological, from social to physiological. Hannon and Trehub (2005) tested the ability of infants to discriminate rhythmic difference in native and foreign context. Comparing Western exemplars with Balkan exemplars, they compared six-month old infant responses to 12-month old infant responses, and to adult responses. Balkan music was chosen for its complexity of meter. The purpose was to test whether infants would note a change in meter in only their native music (Western music in this case) or in the

foreign exemplar as well. Six-month old infants responded to the introduction of a change in either meter, while 12-month olds could only identify the change in their native meter. Adults failed to perceive the difference in the foreign sample. After a two-week exposure to the Balkan music, adults were still unable to achieve a native-like perception, while the 12-month old infants were able to identify the change in the foreign music. This study suggests a greater plasticity at younger ages in discerning musical differences. As infants grow into adults, neural pathways are reinforced by their experiences. This reinforcement of musical experience may lead to the decline of musical tolerance towards adolescence.

According to Kopiez and Lehmann (2008), in a study of music listening of 11- to 17- year old children, Behne (2007) concluded that the most important forecaster of musical preference is age. Gembris (2002) concluded that musical preferences of children before age 10 are more unstable than teenagers. Hargreaves, Comber, and Colley (1995) found a decline in preference in most musical style categories in secondary school students. In a study of relationships between the cognitive and affective domains of listening, researchers examined the open-earedness of individuals across all age ranges, and in a secondary study, they evaluated the prominence of pop artists as determined by the participants. Findings supported a conclusion that musical preference becomes fixed at a certain age (Hargreaves & North, 1997). Exposure to music during this “critical period” (p.7) can help to explain why different age groups tend to identify with musical styles (Hargreaves & North, 1997). The effectiveness of music as an academic learning tool becomes more dependent on students’ musical preference as students move into adolescence. By drawing on existing research on musical preference,

familiarity, arousal, style, and identity, it may be possible to develop musical academic supports that assist the classroom teacher in pursuit of increased or improved academic learning time.

### *Summary*

Research surrounding music and education has been extensive. However, studies fall into one of three main categories: (a) studies that seek to justify the existence of music as a discipline; (b) studies that consider music as a potential treatment for disabled populations; and (c) studies that consider the psychological effects of music. There is a paucity of research that seeks to examine the academic impact of music as an academic instructional support in the general education classroom beyond the early childhood years. More research with the general education student population should be done to evaluate the impact of musical instructional strategies on student achievement. “The appeal of a treatment that is enjoyable, has a very low risk of side effects, and is in most scenarios inexpensive and undeniable” may unveil an additional tool that can increase student memory and, in turn, achievement (Rickard et al., 2005, p. 235). Musically enhanced learning strategies may have wide applications in classrooms at all levels and may lead to increased academic achievement of lower performing students. Research that can establish tonality or rhythm as a tool to increase academic memory and background knowledge could inform practitioners and provide evidence for the use of music as an instructional strategy in the academic classroom.



## Statement of the Problem

The academic achievement racial gap in American education is a national concern (National Center for Educational Statistics, 2011; Organisation for Economic Co-operation and Development, 2011). Research has highlighted the importance of background knowledge as a key factor in student achievement (Alexander, Kulikowich, & Schulze, 1994; Dochy, Segers, & Buehl, 1999; Marzano, 2004). Studies have also established the propensity for musically enhanced instructional strategies to improve recall in memory-challenged populations, such as special education students and dementia patients (Gold, Voracek, & Wigram, 2004; Paul & Ramsey, 2000). However, gaps in the research still exist with respect to the effect of music on memory in general education student populations. Research is needed to evaluate the effect of musical strategies on memory tasks with general education students to evaluate how musical teaching techniques can improve student learning.

## Purpose of the Study

The purpose of this study is to add to the body of research on music cognition by evaluating the effect of rhythm and melodic rhythm on an academic memory task. In order to establish the effect of music on memory, research must determine whether or not music strategies improve upon traditional academic approaches. Hebb's (1949) theory of synaptic plasticity contends that repetition of concepts will lead to increased knowledge. It also suggests that repetition causes physiological changes in neural networks which increase learning. Music may simply be a way to increase the arousal level of the learners and increase repetition (Hargreaves, 1982b). This study will also evaluate

whether or not the effects of melodic rhythm and rhythmic treatments contribute beyond that of a poetic treatment.

Using Gordon's (1989) music learning theory as a framework for the separation of musical elements, this study will evaluate whether rhythm or melodic rhythm can be used as an instructional strategy to improve the acquisition and retention of academic information in general education student populations. Additionally, Gordon's music learning theory provides a framework for understanding how music may lead to higher levels of memory recall. By looking at memory through the lens of audiation, hearing sound that is not physically present, research may better establish how individuals have improved recall of academic content. Understanding how tonality and rhythm affect the memory recall of academic content may create new avenues for educators to improve student background knowledge, increase student performance, and reduce achievement gaps.

### Orienting Theoretical Framework

For this study, Gordon's music learning theory provides a framework for understanding the effect of tonality and rhythm on academic memory tasks.

#### *Music Learning Theory*

Simply put, music learning theory explains how individuals learn music (Gordon, 2007). The theory proposes that, although music is not a language, the process of learning music closely resembles the process for learning a language. Music learning theory speculates that patterns of tones and rhythm are equivalent to the words of a language, while meter and tonality are akin to syntax. Repetition of a pattern leads to audiation of that pattern. A person audiates when he can hear and comprehend music for

which the sound is not physically present (Gordon, 2011). When an individual can sing a song in their head, such as “Twinkle, Twinkle, Little Star,” without any sound, that music has been audiated. The fundamental assertion of music learning theory is that in order to give adequate meaning to a piece of music, the listener must be able to audiate that music. Gordon (2009) notes that this skill is particularly strong in jazz musicians. “All capable musicians anticipate and predict in audiation what they expect to hear, perform, improvise, or create before they actually engage in listening, performing, improvising, or composing” (p.13). Gordon (2009) distinguishes between imitation and audiation, suggesting that those who imitate jazz, for example, may only do so in a particular style, but those who have audiated jazz, can produce music in a variety of jazz styles.

If aptitude is the potential to acquire a skill, and achievement is successfully realizing the task, then musical aptitude and musical achievement are different. Musical aptitude is potential for a child to internalize music, or audiate. Music aptitude is normally distributed across the population, and is developmental from birth to approximately nine years of age (Gordon, 2007). Rhythmic aptitude and tonal aptitude function as subdivisions of musical aptitude. Gordon (1989) suggests that it is rare that individuals will have equally strong rhythmic aptitude and tonal aptitude. “If you have a high tonal aptitude, you are probably average or low in rhythm aptitude” (Gordon, 1989, p.7). As these tonal and rhythmic aptitudes are formed, children develop a musical vocabulary for the styles and genres they hear most. Musical cognition studies have not evaluated the memory impact of tonality and rhythm separately. Gordon’s music learning theory provides a framework for the separation of musical elements in order to better evaluate the question of causation. If recall of academic content differs with

additions of tonality or rhythm, it may confirm the interconnectivity of audiated music and academic content.

### Statement of the Research Hypotheses

This study will address the following hypotheses:

- H<sub>1</sub>. There is no interaction between ethnicity (African-American, Hispanic, Asian / Pacific Islander (P. I.), and White) and instructional method (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students immediately after treatment.
- H<sub>2</sub>. There will be no significant effect for ethnicity (African-American, Hispanic, Asian / P. I., and White) on an academic memory task in second-grade students immediately after treatment.
- H<sub>3</sub>. There will be no significant difference between instructional methods (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students immediately after treatment.
- H<sub>4</sub>. There is no interaction between ethnicity (African-American, Hispanic, Asian / P. I., and White) and instructional method (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students following a delayed period after treatment.
- H<sub>5</sub>. There will be no significant effect for ethnicity (African-American, Hispanic, Asian / P. I., and White) on an academic memory task in second-grade students following a delayed period after treatment.

H<sub>6</sub>. There will be no significant difference between instructional methods (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students following a delayed period after treatment.

### Methodology

Educational researchers often use quantitative research to determine whether or not a particular treatment improves student achievement (Creswell, 2008). This quantitative quasi-experimental research discerned the effect of three treatments: poetry, rhythm, and melodic rhythm (song) on an academic memory recall task with second-grade students. The idea of using song or rap/chant to increase student memory is not new, but research has not yet confirmed that any increases in achievement are caused by the integration. Therefore, this study integrated academic content with musically based teaching strategies in an effort to evaluate the effects of tonality and rhythm on memory. The methodology for this study will be discussed more in depth in Chapter Three.

### Significance of the Study

The study adds to the literature on instructional strategies integrated with music in theory, research, and practice. The research tested one application of Hebb's (1949) theory of synaptic plasticity as it relates to educational settings. Though the scope of this study did not include the medical evaluation of physiological change, it adds to the body of research on instructional strategy, integrated curricula, and musical strategies for knowledge acquisition. Further, this study provides additional research on how tonality and rhythm affect memory. Gordon's (1989) theory suggests that individual aptitudes for tonality and rhythm may be different. This study sought to determine whether or not these treatments have significant effect on memory, in turn, enhancing background

knowledge. This study also extends on ideas from the ever-developing field of cognitive neuroscience and the integrative nexus that is suggested between neuroscientist and educator (Geake, 2009).

With a sparse literature base in the effect of music on instruction in general education populations, this study built on the understanding of the impact of music on memory recall. This study addressed the gap in the literature with regard to the influence of musical instructional strategies on general education students. The extensive research on music and memory remains primarily in the areas of disabled populations. This study adds to the body of research on second-grade students without disabilities and determines whether musical elements can be incorporated into second-grade classrooms to enhance learning.

This study finds its strongest significance in terms of educational practice. The results of this study may provide new avenues for integrative curricula in order to enhance classroom instruction. By studying the effect of each treatment on the recall task, this study highlights the successful ways in which background knowledge can be enhanced using musical strategies. In turn, this enhancement of background knowledge, and the retention that may accompany these strategies, may lead to increased learning and new avenues for increasing achievement in K-16 schooling (Marzano, 2004).

### Summary

This chapter has established the need for instructional strategies that can raise the achievement of all students throughout the American P-20 educational system. Specifically highlighted is the existence of academic achievement gaps between white students and students from African-American, Hispanic, and economically disadvantaged

populations. Chapter two will be a review of current literature on the integration of music and academics. Chapter three presents the methodology for this study in detail including research design, development of the treatment conditions, and data collection procedures. In Chapter four, findings of the research are presented. Finally, Chapter five discusses the implications, limitations, and recommendations for future research.

## Chapter 2

### Review of the Literature

This section explores the research in three different sections: neuroscientific research, research on music and cognition; research on music and learning. While neuroscientific studies explore how the brain responds to stimuli (music in these cases), cognitive neuroscientific studies explore how the mind responds to stimuli. Research on music and cognition explores how listening to music and arousal may affect cognition. Finally, research on music and learning explores several ways in which music is used to achieve outcomes.

### Neuroscientific Studies

Levitin and Tirovolas (2009) eloquently sum up recent trends in music cognition study.

The past decade has seen an exponential increase in studies of music cognition. Musical behaviors that are typically studied include listening, remembering, performing, learning, composing, and to a lesser extent, movement and dancing. The largest paradigm shift has been the increased use of neuroimaging and neural case studies to inform theories about the brain basis for musical behaviors. A second theme over the past decade has been an increased interest in the origins of music and its connection with language, both evolutionarily and functionally. (p. 211).

This review of neuroscientific research will begin with an introduction to Hebb's (1949) theory of synaptic plasticity and continue with research that discusses physiological changes in the brain. Next, research that discusses the analogous relationship between



language development and music development will be reviewed, followed by neuroscientific studies that focus on infants and students.

### *Hebb's Theory of Adaptive Plasticity*

In *The Organization of Behavior* (1949), Hebb proposed a model that explains how functional modules in the brain can learn. In other words, he stated that, in the brain, in contrast with other organs, neurons are connected to thousands of other neurons at their synaptic junctions. Hebb proposed that repeated firings of the particular synapses involved in processing the response to a stimulus result in a permanent physiological change. Repetition of these signals increases efficiency which creates learning (Hebb, 1949). However, when Hebb proposed this model, there was no way to test it. Only in the last few decades has the capacity to accurately measure cognitive function become a reality. The development of brain imaging techniques offers new options for understanding and evaluating human responses to stimuli and treatment.

Moreno (2009) suggests it is anatomical and functional changes to the brain itself that affect other cognitive abilities. A 1995 study was the first to propose a link between musical proficiency and the brain. The study sought to identify whether the midsagittal area of the corpus callosum, which is involved in the coordination of movement, is affected by musical expertise. Schlaug et al. (1995) found a significantly larger anterior half of the corpus callosum in musicians. They concluded that instruction on a keyboard instrument, and in some cases, string instruments, may lead to faster hemispheric communication (Schlaug et al., 1995).

Several neuroscientific studies have illustrated a difference between the brain of the musician and the non-musician, including (a) differences in verbal memory

processing and absolute pitch (Keenan, Thangaraj, Halpern, & Schlaug, 2001; Luders, Gaser, Jancke, & Schlaug, 2004; Schlaug, Jancke, Huang, & Steinmetz, 1995; Zatorre, Perry, Beckett, Westbury, & Evans, 1998); (b) differences in motor processing, (Amunts et al., 1997; Hutchinson, Lee, Gaab, & Schlaug, 2003); (c) differences in cross-hemisphere communication (Schmithorst & Wilke, 2002); and, (d) differences in auditory processing (Schneider, Scherg, Dosch, Specht, Gutschalk, & Rupp, 2002; Gaser & Schlaug, 2003; Luders, Gaser, Jancke, & Schlaug, 2004).

Keenan, Thangaraj, Halpern, and Schlaug (2001) researched whether individuals were genetically predisposed to acquire absolute pitch, the ability to identify tone with no musical context. Magneto resonance imaging (MRI) compared musicians with absolute pitch, musicians without absolute pitch, and non-musicians. They found a significant difference in the physiological symmetry of the planum temporale. They conclude that the size of the right planum temporale best predicts membership in a music group and that “although early exposure to music may be a prerequisite for acquiring absolute pitch, the increased planum temporale asymmetry in absolute pitch musicians may be determined in utero, implicating possible genetic influences on planum temporale asymmetry” (Keenan, Thangaraj, Halpern, & Schlaug, 2001, p. 1402). In short, absolute pitch appears to be due to both nature and nurture.

### *Structural Changes in the Brain*

One possibility for the structural changes that occur within the brain is the growth of new dendrites between neurons. Jacobs, Schall, and Scheibel (1993) found a positive relationship between the years an individual spent at school and the number of dendrites in Wernike’s area, which is located in the temporal lobe and is involved in language

comprehension. They examined the effects of intrinsic (gender and hemisphere) and extrinsic (education and personal history) factors on the dendrites in Wernike's area. Twenty right-handed students, equally divided between males and females participated in the study. According to the findings, the level of education had a consistent and significant effect. The dendritic measures increased substantially as education level increased. The amount of education an individual had received correlated to the dendritic density in Wernike's area. This correlation illustrates physical response by the brain to the learning process (Jacobs, Schall, & Scheibel, 1993).

Schneider et al. (2002) compared the processing of tones by non-musicians, amateur musicians, and professional musicians. Thirty-seven individuals were recorded using magneto encephalography (MEG). Participants' responses were compared and significant neurophysiological differences in the brain were found, specifically, 130 percent larger gray matter in Heschl's gyrus region. These results are highly correlated with musical aptitude as measured by psychometric evaluation. This study is an example of using neuroscientific methods to confirm prior psychometric testing (Schneider, Scherg, Dosch, Specht, Gutschalk, & Rupp, 2002).

In Schneider et al.'s (2002) study, professional musicians, amateur musicians, and non-musicians watched a silent movie while passively listening to tones. They were asked to detect deviant sounds. Brain activity was measured through fMRI. Results showed that brain waves were 102 percent larger in professional musicians than non-musicians. In addition, the same waves were 37 percent larger in amateur musicians than non-musicians. The study also indicated that gray matter volume in the anterior-medial part of Heschl's gyrus was 130 percent larger in professional musicians than non-

musicians. The crucial finding in this study was that musical expertise correlated to these brain waves, which suggests learning over innate ability (Schneider, Scherg, Dosch, Specht, Gutschalk, & Rupp, 2002). This study suggests that functional differences may be directly associated with anatomical differences in the brain and “that these functional differences are proportional to the amount of musical training” (Moreno, 2009, p. 332).

In a study of children, Moreno (2009) reported structural changes to the brain after only 15 months of musical training. The study tested public school children with no instrumental musical training (mean age of 6.32 years). Fifteen of these children received 30 minutes of private instruction on a keyboard instrument once per week for a period of 15 months. Sixteen children were in the control group that received no training. Since the treatment was outside of school, all children received their school-based music class. Children received both fMRI scans and behavioral tests to determine initial and final functionings. Following the 15 month study period, results concluded that regional structural brain plasticity in the developing brain can occur within a short period of time in early childhood. Behavioral improvements on auditory and musical tests were correlated with structural brain changes in motor and auditory areas. This study claims to be the first to correlate brain structure and behavioral changes over time in the developing brain (Hyde et al., 2009). In addition, this study extends the previously mentioned study of Schneider et al (2002). These findings suggest that the structural differences found in the adult brain may be a result of training-induced brain plasticity as opposed to genetic predisposition (Moreno, 2009).

In recent neuroscientific studies surrounding phonetic learning, the perception of the “phonetic units of speech,” the sounds that make up words, “is one of the most widely

studied linguistic skills in infancy and adulthood” (Kuhl, 2011, p. 132). These studies range from birth, through infant language development, adolescence, and into adulthood (Kuhl, 2011). As infant native definitions of language increase, the ability to identify differences in foreign languages decreases. This inverse relationship suggests that synaptic pruning, the elimination of weaker synapses to increase the efficiency of the brain, occurs in the process of learning (Kuhl, 2011; Kuhl, Conboy, Padden, Nelson, & Pruitt, 2005; Werker & Tees, 1984). Language and music seem to share common bonds as definitions of both native language and native definitions of music are formed at an early age. Examples of unfamiliar language and unfamiliar music may be pruned away in the process of defining what constitutes music and what constitutes language (Geake, 2009).

### *The Language Analogy*

Researchers are focusing on “the benefit on more general cognitive abilities through the reinforcement of interconnectivity between otherwise cognitively distant functional modules” (Geake, 2009, p. 163). In a study of music cognition, Cross (2009) argues that music in a cognitive context enables cognitive connectivity. Cross presents a proposal that suggests that music is evolutionarily linked to language. Music is used to communicate meaning and likely was an evolutionary precursor to that of language.

Prosody is the rhythm, stress, and intonation of speech. In a sense, prosody is the musicality of speech. Before language fully forms, music and prosodic speech functions as a communicative tool to convey positive or negative feelings to the infant before language develops fully. Cross (2009) concludes that music is “cross-culturally universal, communicates honesty, and can create a shared sense of intention” (p. 8).

While research has not provided evidence to conclude evolutionary benefit may be attributed to music, some studies have ascribed cognitive benefit to music. A neuroimaging study by Bangert et al., (2006), compared fMRI scans of non-musicians and pianists while performing a passive listening task and pressing a key on a keyboard. “A conjunction analysis revealed a distinct musicianship-specific network being co-activated during either task type, indicating areas involved in auditory-sensorimotor integration” (Bangert et al., 2006, p. 917). Moreno (2009) contends that music and language have several features in common, for example, both are auditory systems dependent on the “same four acoustic parameters: fundamental frequency (F0), spectral characteristics, intensity, and duration” (Moreno, 2009, p. 335). Levitin and Tirovolas (2009) highlight the commonalities in the written form, tactile sensations, temporal coherence, and the importance of order in revealing meaning. Patel (2003) proposed that syntax in language and music share common circuitry in the frontal regions of the brain. Most spoken languages utilize pitch variation to convey meaning, and in some languages, altering the pitch can alter the meaning of the word completely (Levitin & Tirovolas, 2009).

Moreno and Besson (2006) researched whether or not music training provides unique benefits over other artistic treatments. They designed an eight-week study that utilized neural imaging aimed at answering whether or not musical training influences neural processing of language (Moreno & Besson, 2006). The goal of the first experiment was to determine whether short-term (eight-week) musical training would help eight-year old children detect pitch changes in language. They theorized that increasing pitch sensitivity, improves pitch detection in language (Moreno, 2009).

Twenty children with no musical training listened to phrases that were prosodically congruous. Ten children received music instruction and 10 children received painting instruction. Using the neuroscientific measurement of event-related brain potentials (ERPs), findings concluded that “relatively short exposure to pitch processing in music exerts influence on pitch processing in language (Moreno & Besson, 2006, p. 287). In short, musical training in this experiment resulted in an increased ability to identify pitch congruity in foreign language, while painting instruction made no difference.

To understand the relationship between language acquisition and music, research is focusing on young children (Geake, 2009). Initially, a baby does not have reinforced neural networks that help to define speech. Synaptic pruning occurs as infants begin to form native definitions of speech and music. Estimates are that a two-year old has 40 percent more neurons than an adult, an excess of synapses (Geake, 2009). This abundance of synapses does not equate to intelligence as the networks are not yet reinforced. Infant babbling begins as random sounds and morphs into phonemes of the mother’s language (Werker & Lalonde, 1988). The primary difference is that the infant’s pitch profile is much higher, hence people tend to speak to infants in a higher register (Geake, 2009).

Several studies have sought to explore the pitch relationship between music and language (Magne, Schon, & Besson, 2006; Schon, Magne, & Besson, 2004; Thompson, Schellenberg, & Husain, 2004). Primarily, these studies focus on the benefit of musical training. Thompson et al. (2004) showed that musically trained individuals were more likely to associate speech prosody with emotional context. In short, they were more likely to identify emotion based on the pitch of speech (Thompson, Schellenberg, &

Husain, 2004). In another study, the direct relationship between speech prosody and music was explored. Linguistic phrases and musical phrases were presented to participants who were to identify whether or not the samples were congruous based on pitch (Schon, Magne, & Besson, 2004; Magne, Schon, & Besson, 2006). While these studies showed a stronger performance of musicians to identify congruity between music and language, these studies do not help to establish causation of the correlation.

Marques, Moreno, Castro, and Besson (2007) similarly studied the impact of musical training on speech. In their six-month study of eight-year old elementary children in Portugal, one group received musical training and the other received painting training. Their findings indicate that students who received a musical treatment could detect changes in tone (pitch discrimination) more accurately than those students who received the painting treatment. This study demonstrated a causal link between musical training and language processing skills (Moreno, 2009). Positive transfer “from music to language ... highlight(s) the plasticity of the human brain by showing that relatively short periods of training have strong functional consequences on the functional organization of a child’s brain” (Moreno, 2009, p. 337).

### *Research with Infants*

Analogies of language development and music development have led researchers to look at elements of music that parallel elements of language such as tonality and prosody and rhythm and syntax. Werker and Lalonde (1988) studied the ability of infant and adult native speakers to differentiate sounds from both Hindi and English languages. This study used exemplars from both languages and the participants’ proportion of correct identifications were measured. Their findings indicate that prior to



age one, infants have an ability to discriminate between phonemic categories in their native language as well as the foreign language. Werker and Tees (1984) concluded that infants have the propensity to acquire any language at birth. This study evaluated the ability of Canadian infants to discriminate between non-native language sounds (Hindi, in this case). At six months of age, these infants raised in English-speaking environments could perceive differences in the Hindi language that English-speaking adults could not. At one year, the infants were less successful at identifying differences in foreign speech, but more successful with identifying differences in their native English speech. This accurate perception of speech sounds is a key in the the development of native language (Werker & Lalonde, 1988; Werker & Tees, 1984). “Just as different languages have both universal and culturally specific features, so, too, does music. Even in this world of musical pluralism one can experience music of different cultures as alien” (Stewart & Walsh, 2005, p. R883). As language uses different phonemes, music has differing tonal centers, groupings, and rhythmic characteristics. Research has shown that infants have the ability to discern musical pitch and rhythm as familiar or foreign (Hannon & Trehub, 2005; Lynch, Eilers, Oller, & Urbano, 1990). Research also suggests that there is an “emergence of a phonological system around 10 to 12 months” (Werker & Lalonde, 1988, p. 682).

To test an infant’s recognition of musical acculturation, Lynch et al. (1990), developed a study of 20 six-month old Western infants and 30 Western adults of differing musical abilities. The participants would listen for mistunings in melodies based on Western major, Western minor, and Javanese pelog scales. Infant responses were measured by means of preferred looking. In preferential looking “if an infant is

presented with a stimulus a number of times, a change in the stimulus will, if recognized, cause the infant to spend longer looking at the source of the stimulus” (Stewart & Walsh, 2005, p. R882). The findings in this study indicated that infants were able to perceive non-native and native scales similarly, while adults were better perceivers of native than non-native scales. These findings suggest that infants are born without preconceived musical definitions, but become acculturated through culturally specific musical influence (Lynch et al., 1990).

Many infants are the recipients of maternal singing. Singing to a child seems to be common across cultures. Maternal singing may shape infant definitions of native music (Sergeant & Thatcher, 1974). Cognitive definitions of music and language are formed and global descriptions of native and non-native music and language result. “Music could be the means of enhancing development of cerebral interconnectivity in infants’ brains” (Geake, 2009, p. 163).

Using the aforementioned concept of preferential looking, Hannon and Trehub (2005) tested the ability of infants to discriminate rhythmic difference in native and foreign context. Comparing Western exemplars with Balkan exemplars, Hannon and Trehub (2005) compared six-month old infant responses to 12-month old infant responses and to adult responses. Balkan music was chosen for its complexity of meter. The purpose was to test whether infants would note a change in meter in only their native music (western music in this case) or in the foreign exemplar as well. Six-month old infants responded to the introduction of a change in either meter, while 12-month olds could only identify the change in their native meter. Adults failed to perceive the difference in the foreign sample. After a two-week exposure to the Balkan music, adults

were still unable to achieve a native-like perception, while the 12-month old infants were able to identify the change in the foreign music. This study suggests a greater plasticity at younger ages in discerning musical differences (Hannon & Trehub, 2005). As infants grow into adults, neural pathways are reinforced by their experiences. This reinforcement of musical experience may lead to a narrower definition of music towards adolescence.

### *Research with Students*

Some teachers believe that repetition, or practice, is necessary for effective and reliable learning. Spiraling instruction, the concept of integrating increasingly difficult concepts through familiar content, is a common practice in public schools. This practice of using the known content to introduce the unknown content is beyond the purpose of this study, but the reinforcement of its construct has a Hebbian connection. While the ability to test the anatomical and functional behavioral effects of instruction on the brain has been growing over the past 20 years, the connections between educators and neuroscientists are not fully realized. Geake (2009) claims that there remains a great divide between the classroom and the brain research on learning. To understand the implications of Hebbian ideology and its applications, discussions between educators and scientists must be ongoing.

A spiraled curriculum better incorporates Hebb's principle of reinforcement. Spiraling offers more opportunities for repetition of concepts through increasing complexity. In short, global concepts emerge from the many instances of the local example (Geake, 2009). This concept of the local example leading to a global construct may be at the heart of Hebbian reinforcement (Thelen & Smith, 1994). As an educational

ideal, this suggests that depth should preside over breadth. “An over-crowded curriculum mitigates against high general levels of basic skills, and frustrates permanent change in children’s naïve concept” (Geake, 2009, p. 55).

A European functional magnetic resonance imaging (fMRI) study on learning to juggle demonstrates the principle. University students with no experience in juggling were recruited for the study. They were scanned using the fMRI to record neural structure. Half of the participants received juggling instruction over the next three-month period. All participants were scanned again with using the fMRI. These neural measurements revealed increased density in the gray matter regions of the brain that involved visual motion perception and anticipation for the would-be jugglers, while the control group showed no change. Here, instruction correlates to a change in the physical composition of the brain (Draganski, Gaser, Busch, Schuierer, Bogdahn, & May, 2004). Three months later, the scans were repeated again and showed, although a slight decrease in the juggler’s gray matter had occurred, the group difference was still present. Learning that is well-reinforced stays, but may diminish over time without use. Dragnaski et al.’s (2004) study affirms Hebbian principles.

The Hebbian principle can also explain why incorrect learning is so hard to thwart, much less eliminate. Since research has established that reinforcement of learning correlates to an anatomical response, and that it takes time for memory to denigrate, incorrect learning may take significant time to overcome. The concept of incorrect learning is difficult to research, because in order to have a controlled experiment, the researcher would need to ensure that control group participants did not receive correct information. Ensuring false learning begs ethical questions.

Much of the musical and psychometric testing that was used before the advent of neuroimaging is being retested using neuroscientific methods. After reviewing the statistical relationship between correlations and reliability measures, Sergeant and Thatcher (1974) showed that correct correlations between musical aptitude and intelligence are high. Music educators at times profess that talented music students have higher levels of general intelligence. Geake (1996) tested this in a study of talented musicians in Australia. Results indicated a clear correlation. The musically talented students indeed had high academic achievement in school. However, Sergeant and Thatcher note that developed musical ability implies a higher level of general intelligence, but not the converse. “A favourable musical environment cannot redeem the absence of the level of intelligence necessary for future musical cognition, nor can intelligence alone suffice for the development of musicality” (Sergeant & Thatcher, 1974, p. 56).

Linking the processes of learning music or art with similar processes can help to develop students’ abilities to generalize knowledge and strategies across fields (Rabkin, 2007). The pursuit of this integration of music and academic content has taken many forms. Pearman and Friedman (2009) note that although there has been a “strong research base for the integration of reading, writing, and the liberal arts”(p. 211) there has been “little exploration” (Rabkin, 2007, p. 13). The findings of studies that evaluate the benefits of this integration are still inconclusive. One qualitative study compared 10 different schools from both inner-city environments and rural environments. All of the schools included in the study made the arts a focus and found that arts programs helped students develop critical thinking and problem-solving skills (Stevenson & Deasy, 2005).

Students in classes that integrated the arts and language arts learned an art form while developing literacy and communication skills, including an increased desire and ability to comprehend often complex texts – their plot, themes, and characters – and to express orally and in writing thoughtful interpretations of the texts.

(Stevenson & Deasy, 2005, p. 52.)

Not only have researchers examined the effect of cross-curricular integration, but they also have evaluated the effect that listening to music has on academic achievement. The “Mozart effect” was a media-enhanced claim to the cognitive benefits of listening to music. Researchers noted a temporary increase in the spatial-temporal development of participants who listen to music by Mozart at the two-year mark. The media glorified these claims and the “Mozart effect” became a common part of language for new parents. What failed to get equal discussion was, the findings that indicated that after three years, the participants who listened to Mozart samples showed equal spatial-temporal abilities with those who did not listen to Mozart. The so-called “Mozart effect” was temporary (Rauscher, Shaw, Levine, Wright, Dennis, & Newcomb, 1997). At best, approximately 50 percent of studies attempting to replicate the results of the testing for the “Mozart effect” have been able to do so (Geake, 2009). Building on the research of Rauscher et al., Geake (2000) devised a similar study and added a Stroop-type attention test. Geake surmised that it is the superior metacognitive strategies, such as inward-directed attention, that contribute to outstanding abilities.

Portowitz et al. (2000) evaluated the effect of a music program “designed to foster cognitive development and social esteem among high-risk elementary school children” (p. 107). Forty-five students in the treatment group received two to three hours per week

a musical enrichment at their day care facility over the course of two years. The purpose of their study was to measure how and why music education affected general learning skills and self-esteem of at-risk children (Portowitz, Lichtenstein, Egorova, & Brand, 2009). Even though the researchers report that children were successful in their musical experiences, the success did not translate beyond the realm of the musical education setting. They note that “viewing these results within a larger context of the child’s world reminds us that these children come from impoverished physical and emotional environments, in which frustrating experiences at home, at school, and in society surely contributed to low social esteem (Portowitz et al., 2009, p. 122). However, their study confirms prior research that cognitive processes that help children perceive musical experiences can lead to applications in other disciplines (Bamberger, 2005; Portowitz et al., 2009; Serafine, 1988).

Eady and Wilson (2004) discuss research studies that use music as a springboard for motivation. Using current musical content with curricular objectives can lead to increased student motivation and enthusiasm, which, although indirect, may have an effect on student achievement and ultimately may increase self-esteem (Kay & Subotnik, 1994). Marcinkiewicz (1995) discovered that the addition of piano keyboarding instruction to an elementary curriculum produced a significantly positive effect regarding the children’s sentiment towards school. This development of skill systematically may lead to development of self-esteem which, in turn results in higher academic performance (Kay & Subotnik, 1994).

Geake (1996) tested this in a study of talented musicians in Australia. Results indicated a clear correlation. The musically talented students indeed had high academic

achievement in school. Vaughn's (2000) meta-analysis of studies investigating the relationship between music and mathematics achievement reported that including music instruction in the curriculum did not necessarily result in improved arithmetic performance. Vaughn noted that these results should be replicated further in order to draw conclusions because of the six studies, three showed an effect, while three did not (Vaughn, 2000). In Butzlaff's (2000) meta-analysis, there was a clear correlation between music and reading performance illustrating a connection between language and music. While the correlation was significant, causation remains elusive. Though some individual studies have shown causation, these meta-analyses revealed no significant conclusions regarding causation.

### Music and Cognition

A considerable amount of research has been done on the effects of music on cognition and academic achievement. This section of literature review will review recent research and reports on the evolutionary importance of music. Second, this section will focus on the cognitive and academic outcomes of listening to music. Finally, research on the concept of arousal as a mitigating factor between music and non-musical achievement will be discussed.

#### *The Evolutionary Importance of Music*

There remains disagreement about what constitutes music. Levitin and Tirovolas (2009) suggest that "one is usually left with a Wittgensteinian conclusion that a new exemplar can be considered music if it bears a family resemblance to other examples that are generally agreed to be music" (p.212). Pinker (1997) claimed that music cognition, the brains' processing of music, is not worth studying because it is "auditory cheesecake"



(p. 534). This language comes from a challenge that is presented in evolutionary theory. “If evolution selects those behaviors that are maximally adaptive, how do you explain that many of us like fats and sweets (as in cheesecake, for example which can actually lead to obesity, diabetes, and other clearly maladaptive outcomes” (Levitin & Tirovolas, 2009, p. 212)? Humans have developed an affinity for strawberry cheesecake, but not because of evolutionary transformation. The enjoyment that is derived from strawberry cheesecake is from the sweet taste of fruit and the soft texture of oils and fats. This sensory blast creates pleasure because of the amount of agreeable stimuli (Pinker, 1997). In short, Pinker (1997) argues that music is nothing more than pleasurable repetition and that it holds no value beyond that of repetition. Levitin (2008) states that music composition and improvisation, both creative manifestations of music, can function as a training ground for cognitive flexibility. From the perspective of neuroscience, enjoyment of artistic products creates a dilemma. Evolutionary advantages are unclear beyond the ability to express personal feelings and of the bonding that may result from that expression.

### *Listening to Music*

Though evolutionary questions still exist, research continues to gain insight into pragmatic benefits of music. Much of the research completed in general education classrooms has focused on the influence on achievement when students listen to music (Hallam, Price, & Katsarou, 2002; Jncke, 2010; Levitin & Cook, 1996; Sims, 1986). Since there are multiple factors that affect the ways in which students will respond to music, it is important to consider both these factors contextually and individually.

Savan (1999) completed a study of physiological response that participants had to classical music of different time periods. In a pilot, Savan (1998) found that only compositions by Mozart reduced body temperature, pulse, and systolic and diastolic blood pressure. The section of Mozart's music that was shown to have the greatest physiological effects was isolated and recorded in a two-hour loop. This recording was used to create alternate recordings with faster and slower tempos and with different pitch considerations including elimination of a recording with pitches above 700 Hertz removed and a sample with pitches below 700 Hertz removed. Additionally a sample transposed up two octaves was used and a selection played entirely in reverse was used. The intention was to play this music in the background of 10 consecutive science classes and student behaviors such as "coordination, work output, task completion, neatness, noise level, concentration span, and attention-seeking behavior" were recorded (Savan, 1999, p. 141). In addition, blood pressure, temperature, and pulse were recorded before and after the lesson. Participants were special education students identified with behavioral or emotional difficulties. During the original and unaltered recording, Savan (1999) noted a drop in all physiological measurements and improved concentration, behavior, coordination, and task completion. The same effects were true in the tempo-altered treatments and with the reverse recording. Interestingly, the samples that eliminated pitch frequencies and transposed the selection up two octaves showed no signs of physiological improvement or behavioral improvements (Savan, 1999). Savan (1999) concludes that "the resultant effects on body metabolism produce an improvement in coordination in these pupils. The underlying reason may be that the angry, disruptive, aggressive behavior often exhibited by pupils with special educational needs results from

frustration due to lack of co-ordination and the consequent inability to perform manual tasks effectively and efficiently” (p. 143). Savan (1999) also suggests that there are clearly multiple factors involved in the outcome and that no generalizations can yet be made.

Another study attempted to discover whether background music enhanced the verbal learning performance of participants (Jncke, 2010). In the Jncke (2010) study, 38 men and 39 women in Switzerland met hearing requirements to participate and were given a verbal memory test after exposure to differing musical stimuli. Jncke used multiple measurements including psychometric testing (including a mood questionnaire), neuroscientific electroencephalogram (EEG) recordings as well as the verbal memory test to measure the effects of the treatments. This research study proposed that “positive background music arouses the perceiver and evokes positive affect” (Jncke, 2010, n.p.). Jncke noted that there was no significant difference in the performance of the participants on the verbal memory test, but that the neurological EEG test indicates that the fast-in-tune music was the most distracting. Additionally, on the out-of-tune selections, “the subjects exert greater...inhibitory control to overcome the adverse impact on learning in the context of listening” (Jncke, 2010, n.p.). In essence, Jncke found that the brain is working to overcome the distraction of unfamiliar pitch combinations and fast tempos, but not to the point that it affected the verbal memory skill in this particular study.

One problem with the literature in this area is the lack of consistent results (Geake, 2009). The aforementioned “Mozart effect,” or temporary increase in spatio-temporal processing, is a prime example of inconsistent results (Costa-Giomi, 2004; Geake, 1996; Rauscher, Shaw, Levine, Wright, Dennis, & Newcomb, 1997; Rauscher &

Zupan, 2000). Some argue that this inconsistency may more likely be due to arousal or participants' mood than any musical effect (Schellenberg, Nakata, Hunter, & Tamoto, 2007). Musically speaking, tempo has been found to equate to arousal and modality, whereas the construction of scales with certain musical characteristics equates to mood (Rickard et al., 2005).

While music listening research has focused on a plethora of different areas, music has been found to lie on a continuum from “highly invigorating to soothing or calming” (Hallam, Price, & Katsarou, 2002, p. 111). In addition to this continuum, research surrounding arousal is complicated by the many individual perceptions, thoughts, and teachings that individuals associate with each piece or style. Tempo, or musical pace, seems to be an indicator of musical arousal.

Hallam, Price, and Katsarou's (2002) study differentiated participant's response to musical stimuli based purely on tempo. Thirty-one children (ages 10-11) were separated into music and non-music groups. During the independent practice portion of their mathematics lesson, students responded to mathematics questions. The findings showed that the music treatment group worked faster but did not have statistically significant difference in the amount of correct responses. However, the researchers note that there was a significant difference in the standard deviation (12.7 with music, 5.57 without music ( $p = 0.025$ ) indicating a “considerable individual variation in the level of accuracy when the music was being played” (Hallam et al., 2002, p. 115). In a second study, they sought to identify the difference in recall between a no-music condition, a calming, pleasant music condition, and an unpleasant, aggressive music condition when students were completing a task. Students listening to the high arousal music had a mean

response of 4.2, while the no-music condition had a 6.4 mean, and the pleasant music condition had a 7.6 response. These findings suggested that “the effects of music on task performance are mediated through its effects on arousal and mood” (Hallam et al., 2002, p.119).

Anderson and Fuller (2010) conducted a quantitative study of the effect of music on comprehension of adolescents. They administered a standardized reading comprehension test to 334 seventh- and eighth-grade students under two different conditions: music and non-music. The music under the treatment condition was selected from 2006 hit singles according to Billboard Magazine. Results indicated that the music condition was detrimental to comprehension, even for those students who claimed to prefer it (music condition,  $M = 26.49$ , no-music condition,  $M = 40.56$ ) (Anderson & Fuller, 2010). While this study claimed a harmful effect of music on task completion, the previously discussed research of Hallam, Price, and Katsarou (2002) claimed a beneficial effect of calming music, again illustrating the inconsistent findings in this area of the literature.

### *Arousal*

With a range of results in studies regarding academic improvement and memory recall, some have suggested that the effect of music may not be the variable at work. The complexity of music coupled with the variability of individual perceptions of music make it difficult to arrive at generalization. Some explanations have tended to focus on mood and arousal. Hallam, Price, and Katsarou (2002) recounted the Yerkes-Dodson law that states “the arousal level of the individual increases performance up to an optimal level beyond which over-arousal leads to a deterioration in performance” (p.113) . Simple

tasks require higher levels of arousal in order for concentration to be maintained, however, individuals may perform with less quality on more complex tasks if the arousal is too great. A variety of stimuli can affect arousal levels. These stimuli and individual personalities are variable over time. Additionally, the emotional state of an individual can positively or adversely affect their task performance (Hallam et al., 2002). Since comprehension is a cognitively complex task, findings often reinforce the Yerkes-Dodson law of arousal and task performance (Anderson & Fuller, 2010; Hallam et al., 2002). A limitation of Anderson and Fuller's study is the lack of attention to tempo or arousal. This focus may be the reason that Anderson and Fuller received negative performance due to music condition, but Hallam et al. received positive effects in calming music.

Diamond, Campbell, Park, Halonen, and Zoladz (2007) clarified the difference in the common misconception of the original Yerkes and Dodson theory and the "Hebbian version" (p.3). Figure one represents a common interpretation of the relationship between task performance and arousal. In this model, the complexity of the task is not taken into consideration. This single inverted U-shape was illustrated by Hebb (1955) but represents an incomplete interpretation of Yerkes and Dodson's (1908) research because it does not account for task complexity. Many researchers have disregarded the original research entirely and neglected the influence of task complexity in studies of arousal and cognition (Diamond et al., 2007).

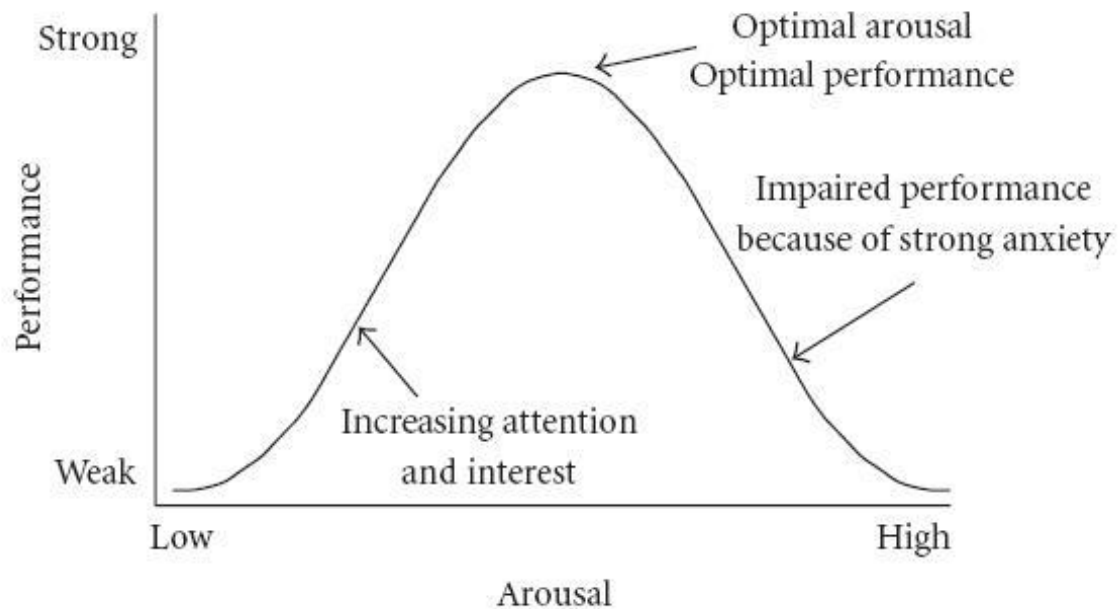


Figure 1. Yerkes-Dodson Law Depiction (Diamond et al., 2007, p. 3).

Figure two more accurately depicts the original theories of Yerkes and Dodson highlighting the difference in simple versus difficult task performance as arousal increases (Diamond et al., 2007). Some argue that inconsistency in music and cognition research may more likely be due to arousal or participants' mood than any musical effect (Schellenberg, Nakata, Hunter, & Tamoto, 2007).

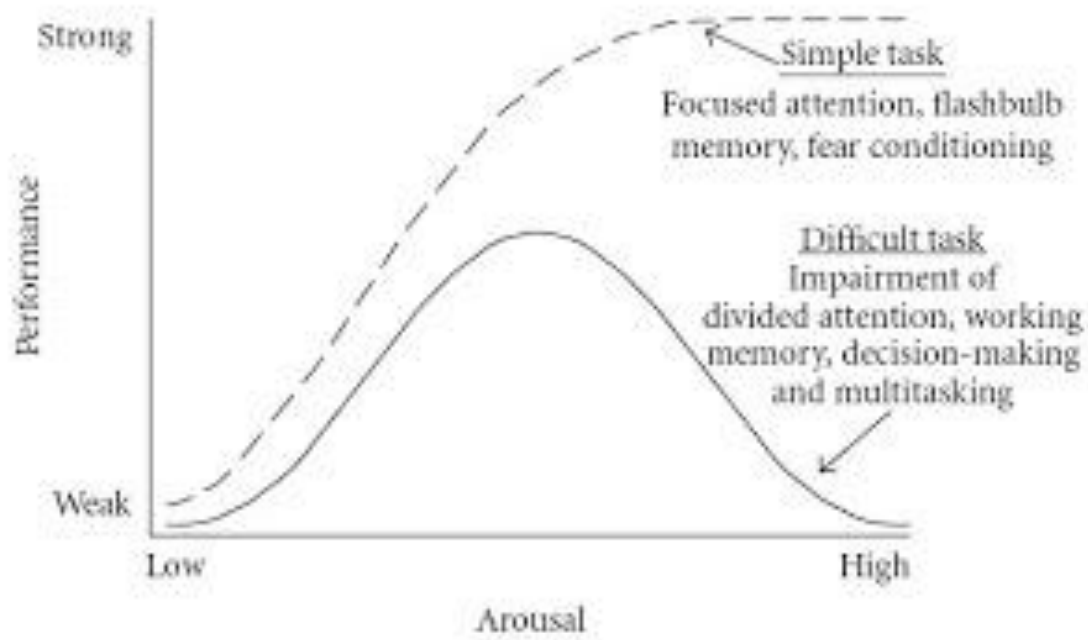


Figure 2. Yerkes-Dodson Law Depiction (Revised). (Diamond et al., 2007, p. 3).

Schellenberg et al. (2007) completed two experiments of musical exposure and cognitive task performance. In their first experiment, 48 Canadian undergraduate students listened to a musical selection by Albinoni or Mozart. The Mozart selection was an up-tempo selection in a major key which anecdotally creates heightened arousal. In contrast, the Albinoni selection was a slower tempo selection in a minor key. Arousal and mood of each participant was measured both prior to exposure and afterwards using the Profile of Mood States (POMS) – Short Form (Schellenberg, Nakata, Hunter, & Tamoto, 2007). Musically speaking, tempo has been found to equate to arousal and mode equates to mood (Rickard et al., 2005). Following the 10-minute listening period, each participant was given three cognitive tests. Two subtests of the POMS test were prioritized, vigor-activity (arousal) and depression-dejection (mood). They found that the arousal measurements “varied reliably as a function of the different music-listening



experiences” (Schellenberg, Nakata, Hunter, & Tamoto, 2007, p. 10). The mood scores also showed an increased depression score after listening to the slow-tempo minor mode Albinoni selection, and reduced depression scores after listening to the up-tempo major mode Mozart selection. Where a reliable difference was found on the arousal and mood scales, a significant difference was also evident on the IQ tests. They conclude that “cognitive byproducts of music learning depend more on arousal than on mood” (Schellenberg, Nakata, Hunter, & Tamoto, 2007, p. 11).

Calming and pleasant music, and aggressive or arousing music have different influences on task performance (Rickard et al., 2005, p. 237). In a study of the effect of tempo on task performance, 70 college students participated in a class project. During the activity, they either listened to slow-paced or fast-paced music (Mayfield & Moss, 1989). Mayfield and Moss (1989) found that exposure to slow music (60 beats per minute (bpm)) impaired performance on simple tasks. The presence of fast music (140 bpm) was similar to the silence condition when participants were asked to perform simple math problems. In short, slow music impaired performance, while fast music did not have an effect.

Alternately, Brodsky (2001) found that fast music (120-140 bpm) caused participants to make significantly more errors on a driving simulation than did slow music (40-70 bpm). This variability in research findings has led some to conclude that “the cognitive-enhancing effect of music, therefore, appears to depend on music complexity, although this factor is likely to interact with other factors, such as task complexity as well” (Rickard et al., 2005, p. 238). The complexity of music coupled with the inability

to siphon out individual human experience from a study on music makes for a complicated subject from which cognitive generalizations can be drawn.

### Music and Learning

While some recent research connects music and cognition, less research has focused on the application of music as an academic instructional strategy. These psychological research studies that incorporate music often focus on the effects on music as it relates to cognitive gains and academic achievement. This research might be categorized into three broad areas. First, some of the literature in this arena focuses on the effects of music listening on academic achievement (reviewed in the section on music cognition). Second, much of this literature has focused on those with cognitive deficiencies, particularly the special needs and aging populations, through the study and practice of music therapy. Finally, a large body of research focuses on the cognitive and academic correlations with the study of music, particularly instrumental study. This section of literature review will focus on research surrounding music therapy applications in disabled populations as well as research that has evaluated the effects of music on the academic performance of general education populations.

### *Music as Therapy*

The field of music therapy has focused on using music as a support for academic and behavioral skills of disabled populations. Music therapy studies are plentiful in spite of its relative newness as an accepted therapy. This portion of the review will focus, first, on music therapy research with profoundly disabled students; secondly, with disabled students who can function in more traditional classroom settings; and thirdly, with aging dementia and Alzheimer's patients. Many of these studies are qualitative in nature since

the subjects often have profound functional disabilities or significant behavioral deficits that are unique to the individual. Case study research involving music therapy research is a common practice in reporting the changes in functional performance and behavior of these individuals. The following examples represent current examples of music therapy research.

#### Music as therapy with children.

Davies and Rosscornes (2012) and O'Neill (2012) discussed the development of a music therapy program in an early childhood intervention and assessment school in the United Kingdom. The goal of the music therapy program during a 12-week time frame was to allow children with complex needs an outlet for expression and through sessions and collaboration with other professionals. In a case study, Davies and Rosscornes discuss Theo, a two-year old who did not speak. Theo initially showed very little interest in the therapy sessions, however; as the sessions progressed, he began to show interest in certain songs and his participation and interaction with those songs increased.

Specifically, goals for Theo's progress were "1) to develop interaction through music-making; 2) to encourage vocalization; and 3) to develop use of eye-contact" (Davies & Rosscornes, 2012, p. 30). Theo's mother said that music therapy encouraged Theo to talk, increased the number of words he knows and uses, and became a calming influence in times when he is upset.

O'Neill (2012) shared her research of Daniel, a three-year old with severe and profound cognitive and functional disabilities. In a childhood intervention and assessment system in the United Kingdom, O'Neill conducted music therapy sessions over a three-year span. The aim in Daniel's sessions was musical expression. While

Daniel's ability to communicate his needs was quite low, Daniel was able to make a selection about which instrument O'Neill would use during therapy sessions. Daniel's educational progress was much different than a typical general education student, but music therapy led to educational progress and increases in quality of life. "For children like Daniel the impact of music therapy on the child and family's quality of life was huge" (O'Neill, 2012, p. 41).

Bruce and High (2012) conducted their research with Mia, a five-year old girl with profound learning disabilities. Again, through qualitative inquiry, multiple caregivers' impressions of Mia's responses to music therapy were reviewed. Music therapy sessions were recorded and Mia's parents, speech therapist, occupational therapist, and physiotherapist were asked for their observations, including the prompt "What did they think that music therapy was providing that was different from other interventions that Mia received?" (Bruce & High, 2012, p. 62). Mia's music therapy took place weekly in group sessions where the aims included increasing communication, and purposeful interaction. Reflections from the speech and language therapist suggest increased response to musical stimuli expressing her liking of the activities as well as increased vocalization to participate. Her other therapists also expressed a belief that the music therapy sessions were adding value beyond their services.

Mia clearly responded to the differing tone and tempo of the music. Her body language and movement clearly demonstrating this. Mia was very animated, clapping both hands, again to the faster rhythm. She enjoyed being in a group and watching the others' reaction. (Bruce & High, 2012, p. 67)

Some music therapy research has sought to study students with learning disabilities who have higher levels of functional and academic performance. Atterbury (1985) researched musical differences between normal-achieving readers and learning-disabled readers. By adapting Gordon's (1979) Primary Measures of Music Audiation (PMMA), Atterbury (1985) aimed to discern differences in the ability of special needs students to identify rhythmic and tonal elements of music as same or different. Ninety-six children, ages seven to nine, were matched for sex, socioeconomic status, and learning-disabled or normal-achieving status. Normal-achieving readers performed significantly better on rhythm tasks than their learning-disabled peers (Atterbury, 1985). Likewise, results of pre- and posttest comparisons on the PMMA tonality measures showed that "normal readers discriminated tonal patterns better than their learning-disabled peers" (Atterbury, 1985, p. 119). This research suggests that the correlation of musical and reading ability is worth further exploration. This research study suggests investigation of a near-hypothesis theory of transfer between musical strategies and reading skills.

Further investigating the near-transfer hypothesis, or direct transfer of learning from one area to another, that musical strategies positively affect reading skills in students, Gromko (2005) investigated the connection between music instruction and phonemic awareness in early readers. In a study with kindergarteners, 43 students received a music instruction treatment over a four-month period. Pre- and posttest phonemic awareness assessments using sub-tests of Dynamic Indicators of Basic Early Literacy Skills (DIBELS) assessment were administered. Gromko found significant positive effects in phoneme-segmentation fluency for students who received the music

treatment. Gromko concluded that music may significantly improve the language literacy of children. Further, applications of musical techniques may provide effective strategies for closing academic gaps between disabled students and general education students.

Overy (2000) investigated possible connections between dyslexia and music. Contending that musical timing and dyslexia have a connection, Overy studied whether or not musical training would improve timing skills which, in turn, would improve dyslexic students' performance in language and on literacy skills. In this research study, a short series of musical tests were used with dyslexics and non-dyslexics to evaluate rhythm perception, rhythm production, rhythm and meter skills, and rhythmic and temporal processing. In addition to the musical psychometric measurement components, the study evaluated the effect on academic elements of language and literacy. Pre-tests indicated that dyslexic students had more difficulty identifying whether two rhythms matched, but were able to identify melodic similarities equally to their non-dyslexic counterparts. The most significant difference in the pre-tests was in the category of rhythm production ( $p < 0.001$ ) (Overy, 2000). Results of the year-long treatment indicate significant improvements in phonological awareness and standard scores in spelling for both groups with the greatest gains coming from the dyslexic group. While Overy suggested the results are not generalizable, there is clear evidence of accelerated learning for spelling and phonological awareness. Overy (2000) concluded that, "music training could replace standard remedial teaching for dyslexic children, but rather that regular music lessons could complement and consolidate work done in language lessons" (p. 227).

Register, Darrow, Standley and Swedberg's (2007) study of the efficacy of music as a remedial strategy with learning disabled second-grade students lasted four weeks. In this study, they developed an intensive short-term music curriculum to target vocabulary skills and comprehension (Register et al., 2007) and found in both control and treatment groups that there was significant improvement in word decoding, word knowledge, and overall performance (Register et al., 2007). While neither control nor treatment showed significant improvement on comprehension, these skill-based categories suggest that music may indeed be a method to enhance memory of academic objectives.

Additionally, analysis of covariance showed that the music curriculum treatment group made greater gains from pre- to posttest than the control, and significantly greater gains in word knowledge (Register et al., 2007). They concluded that "songs have great potential to teach vocabulary and word usage, and to serve as vehicles for practicing reading fluency and comprehension skills. Results of this study indicate that even a short-term intensive music/reading program has the potential to improve basic reading skills" (Register et al, 2007, p. 36).

Music therapy as behavior modification.

With severely disabled school-aged youth and adults, music therapy is also used as a behavioral modification. For many profoundly disabled students, individual educational plans (IEPs) address functional and behavioral performance as a part of the school intervention process. This section will discuss some of the ways music therapy is used to address students behavioral needs.

Kern, Wolery, and Aldridge (2007) investigated the use of song in promoting independence of autistic children in their morning routines. This study evaluated how

two three-year old autistic boys responded to a music therapy treatment aimed at increasing their independence to complete a morning routine consisting of entering the classroom, greeting the teacher and classmates, and playing with other students (Kern, Wolery, & Aldridge, 2007). The two research subjects “had limited speech, and ...showed limited social interactions with peers, played primarily when supported by adults, and engaged in stereotypic [autistic] behaviors” (Kern, Wolery, & Aldridge, 2007, p. 1265). Additionally, caregivers, classmates, and teachers were used as participants. A song was composed to communicate the five-step morning routine procedures.

For one student, an ABAB design was used where A was the typical routine, and B included the musical treatment. For the second student, a slightly different design of ABCAC was used where A was the control, B was the treatment, and C was a modification of the treatment song to adjust for his specific needs (Kern, Wolery, & Aldridge, 2007). Data were collected via student observations and occurred over 28 and 31 sessions of observation for the students, respectively. In as few as 10 sessions, one child began to show consistently improved response with the treatment. During the third cycle of the design (a return to the control condition), his independence immediately decreased. Upon the reintroduction of the song, his performance again, rose and on the ninth session of the final treatment stage, he was performing the activity independently. For the second child, one of the procedures involved a change in caregiver which, made him upset. When the treatment song was modified to eliminate that uncomfortable transition (the C stage), his performance closely mirrored the performance of the first child. Kern, Wolery, and Aldridge conclude that “individualized greeting songs matching the participants’ personality and the demands of the morning greeting routine were



effective in facilitating a smooth transition from home to the child care program. These findings support the recommendation to use songs to ease transitioning for individuals with autism” (p. 1269).

Reflecting on the question of when music education stops and when music therapy begins, Ockelford (2000) concluded music pedagogy had neglected the needs of the student with profound disabilities. “There was a lack of conceptual clarity as to what should reasonably constitute music education for those with severe or profound levels of learning disability as opposed to what could appropriately be regarded as falling within the remit of music therapy, and no clear idea of how music education and therapy were related in this context” (Ockelford & Markou, 2012, p. 383). In a research project called PROMISE, 52 schools were researched to add clarity to the conceptual differences between music education and music therapy (Ockelford & Markou, 2012). The PROMISE research found that music coordinators found it easier to conceptualize extra-musical outcomes to musical activity with pupils with learning difficulties than purely musical attainment and progress” (Ockelford & Markou, 2012, p. 385). The PROMISE project concluded that music therapy and music education lines with profoundly disabled students were often blurry and extra-musical goals were often behavioral in nature (Ockelford & Markou, 2012).

Ockelford (2000) proposed that through music, extra-musical outcomes would fit into four domains: body awareness and movement; learning; language and communication; and social interaction. The question remains then as to how music education and music therapy differ in their behavioral goals with this group of students.

Markou (2010) tested the model below (Figure 3) in an effort to discern whether these two concepts overlap.

Markou (2010) consulted music teachers and music therapists (N=96). Music therapists tend to see themselves as wholly child-centered, or promoting ‘well-being’ while music teachers see themselves as attending to both the external and internal needs of the child (Markou, 2010). Markou found a significant difference in self-perception of music educators and music therapists. Music education and music therapy are closely connected, but there appears to be a focus on well-being through body awareness, language and communication, and social interaction behaviors through music therapy.

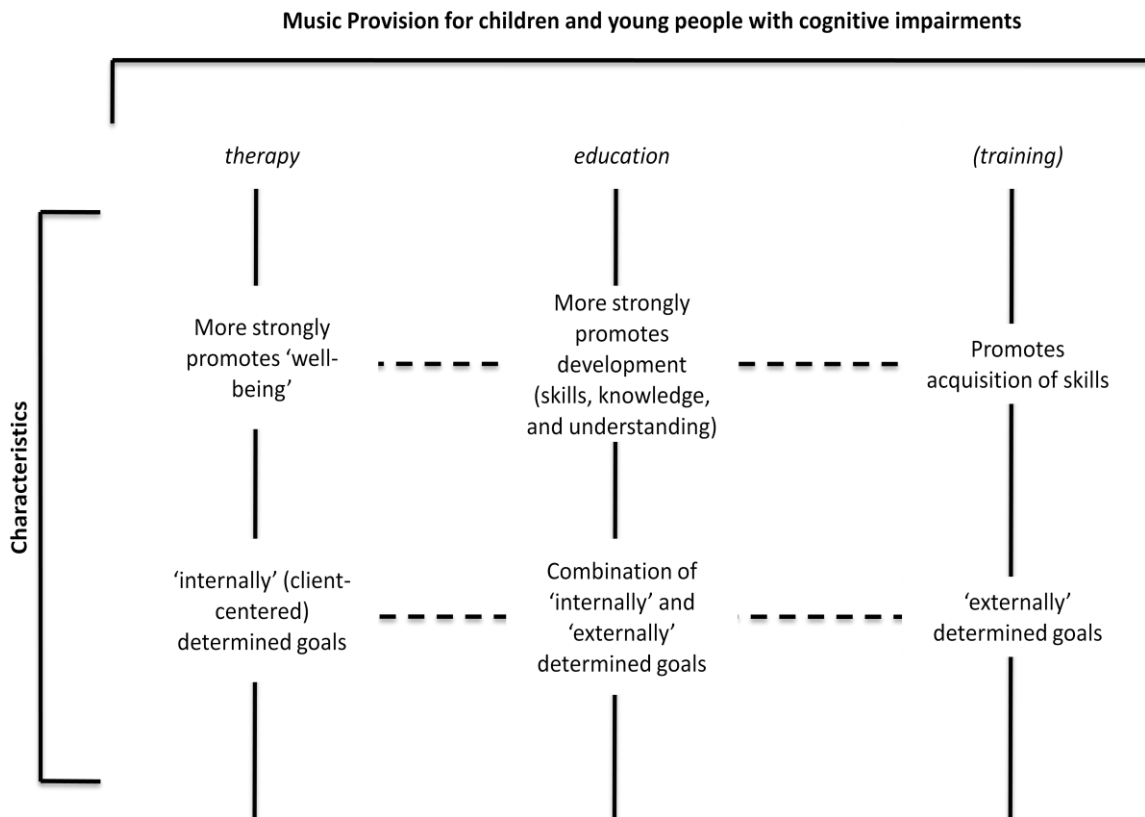


Figure 3. Music Education vs. Music Therapy. (Markou, 2010).

Brown and Jellison (2012) recently completed a systematic review of music research with disabled children and youth. They attempted to “locate every [American] article for the time period 1999 through 2009 that examined music variables and reported data for participants who were children and youth with disabilities” (Brown & Jellison, 2012, p. 338). Forty-five articles met the parameters for the study and included child participants with autism, intellectually or developmentally disabilities, or sensory or vision impairments. Not surprisingly, the bulk of the articles selected were from the *Journal of Music Therapy*. Fifty-eight percent of these studies researched behavioral responses of participants to the musical treatments. Eighty-one percent of these studies report effective or partially effective results with the development of behavioral and social skills being the primary measure of effectiveness. The primary difference between this review and research of the previous decade is the amount of studies that used music interventions for non-musical behavioral interventions (Brown & Jellison, 2012).

Paul and Ramsey (2000) found that music therapy can increase the quality of life and health for disabled children by increasing physical activity, independence, and emotional expression. Music therapy has been used increasingly in rehabilitation centers to ease pain caused by therapeutic treatment and increase participants’ participation (Paul & Ramsey, 2000). Sandness (1995) found that individuals’ responses to these types of therapy were more pronounced when the patient expresses a preference for the music being used. In fact, the tempo of the music increases the effectiveness of the physical rehabilitation when it matches the desired outcome of accompanying physical therapy (Sandness, 1995).

Music can be integrated into speech-language therapy and physical and occupational therapies, in order to develop and normalize muscle tone; improve movement patterns and eventually ambulatory ability; increase independence in activities of daily living; and to restore socialization and emotional well-being. (Paul & Ramsey, 2000, p. 113)

Gold, Voracek, and Wigram (2004) conducted a meta-analysis of 11 studies of music therapy effectiveness. In these studies, music therapy was delivered to the patients in either group or individual settings. The study concluded that “music therapy has a medium to large positive effect ( $ES=.61$ ) on clinically relevant outcomes that was statistically highly significant ( $p<.0001$ ) and statistically homogeneous” (Gold, Voracek, & Wigram, 2004, p. 1054). The researchers identified a particularly large effect for children who suffer from either behavioral or developmental disorders (Gold, Voracek, & Wigram, 2004). Therefore, in terms of behavioral improvements due to music therapy, research of the past decade confirmed the benefits of music therapy on the behavior of children and adolescents in both educational settings and in clinical settings (Brown & Jellison, 2012; Gold, Voracek, & Wigram, 2004; Markou, 2010; Ockelford & Markou, 2012; Paul & Ramsey, 2000).

Music as therapy with dementia and Alzheimer’s patients.

A recent issue of *Music Perception* focused on research evaluating the effect of musical intervention on dementia and Alzheimer’s patients. A primary focus of this research was on how music therapy affects the memory. This portion of research will focus primarily on music therapy research that is targeting memory recall systems.

One research team evaluated the effectiveness of a four-week music intervention on the emotional well-being of severe Alzheimer's patients (Clement, Tonini, Khatir, Schiaratura, & Samson, 2012). Interventions took place over four weeks with two sessions occurring each week. Emotional states of the participants were measured by "analyzing discourse content and facial expressions from short filmed interviews as well as caregivers' judgments of mood" (Clement et al., 2012, p.533). In this study, 11 participants with Alzheimer's disease completed either a cooking or music intervention. Participants were matched for age, cognitive function, and behavioral function. The two-hour intervention sessions occurred eight times and consisted of either listening to music and playing hand-drums or tasting cakes and preparing recipes. Long-term effects of the interventions were measured through continuous assessment after the end of the treatment period. The study showed that musical intervention had a more pronounced effect of the mood of Alzheimer's patients and lasted longer than the cooking intervention. The authors' findings indicated the possibility that music could be used effectively to regulate the emotions of cognitively impaired Alzheimer's patients (Clement et al, 2012).

While the previous study evaluated the effect of music on the emotional state of Alzheimer's patients, Moussard, Bigand, Belleville, and Peretz (2012) investigated the verbal recall of Alzheimer's patients. To investigate this connection, case study research was conducted with JL, a 68-year-old female with Alzheimer's disease. Pre-tests were completed to evaluate JL's verbal and musical memory. Lyrics of four musical excerpts were recorded in the following treatment conditions: spoken word; original and unfamiliar melody; and a familiar melody (Beethoven's "Ode to Joy"). After exposure to

the treatment, JL remembered the familiar melody lyrics better than the unfamiliar melody and spoken word treatments. These findings suggested that audiated melodies equate to learning new lyrics better than unfamiliar melodies.

At initial learning of lyrics, singing does not necessarily help memorization. The effect of singing on learning during this initial phase depends on prior knowledge of the melody. Learning the lyrics on an unfamiliar melody is more difficult than learning them without a melody (spoken) or on a low or high familiar melody.

(Moussard et al., 2012, p. 528)

This study also suggested that dementia patients may still have the ability to remember musical information, but using unfamiliar melodies may actually interfere with learning (Moussard et al., 2012).

Research has investigated how well Alzheimer's patients remember melody and lyrics after treatment (Cuddy, Duffin, Gill, Brown, Sikka, & Vanstone, 2012). To better understand the effect of music therapy on memory, the authors of this study differentiated between musical semantic memory, "musical information acquired through prior experience outside the laboratory and independent of the temporal or spatial context in which it was acquired," and musical episodic memory, "memory for the musical events and the context in which they were heard" (Cuddy et al., 2012, p. 479). Participants in this study included 150 healthy adults and 50 participants diagnosed with mild, moderate, or severe Alzheimer's disease or dementia. All participants were given six different tests for melodies and lyrics over four video-recorded sessions. Multiple raters were used to increase the reliability of the testing.

While the biggest predictor of recall ability in the dementia patients was the level of their cognitive impairment, long-term familiarity for melody was found across all dementia categories (Cuddy et al., 2012). Additionally, some dementia patients detected musical differences at a level comparable to their normal peers. Cuddy et al. (2012) also state that the musical language can be at least partially preserved in early to moderate stages of Alzheimer's disease. In short, semantic memory for music may be preserved even when episodic memory has denigrated. They further suggest that this memory preservation does not appear to be related to any form of musical training, making it a potential treatment for any dementia patient (Cuddy et al., 2012).

Omar, Hailstone, and Warren (2012) reviewed research on the effects of music on semantic memory, or memory for objects and concepts of memory-challenged populations. They defined the areas of semantic musical memory primarily as melody and musical emotion. They reported that Alzheimer's patients are more likely to remember familiar melodies than new melodies and that semantic memory may be the only place where research has shown cognitive preservation (Bartlett, Halpern, & Dowling, 1995; Cuddy & Duffin, 2005; Hsieh, Hornberger, Piguet, & Hodges, 2011; Omar et al, 2012; Vanstone et al., 2009). They articulated that the evidence emerging for these semantic memory studies "provides a rationale for music-based therapies" (Omar et al., 2012, p.474). They further suggested that research should continue to investigate the specificity of any effect to comparable nonmusical stimuli that has a similar arousal effect (Omar et al., 2012).

Halpern (2012) describes the primary focus of current research as differentiating between episodic and semantic memory systems. Music therapy with dementia and

Alzheimer's patients has shown that memory-disabled adults can enjoy music, improve affect, improve social interaction, reduce agitation behaviors, and increase purposeful participation (Halpern, 2012). In recommending directions for future research, Halpern stated that many authors have reported on the difficulty of working with these participants. Also, the background knowledge of known music is vastly different at the individual level. It is difficult to synthesize research into a clear theory because of the influence of individual context. Also of consideration is how to operationalize and measure effectiveness in these studies. Observations, a subjective measure, are common but continue to provide a qualitative and opinion-laden method of evaluation. Future research with music therapy and memory systems should seek to address these gaps (Halpern, 2012).

#### *Non-academic Effects of Music*

Research on the nonmusical benefits of music education are not a primary focus for the public. "Unlike most other areas of scientific inquiry, there is no parallel interest on the part of the public, the media, and educators who want to know if non-musical intellectual and academic benefits are a welcome by-product of sending children to music lessons" (Schellenberg & Winner, 2011, p. 129). Still, researchers are investigating how music may affect academic skills of general education students. While some studies are comparing the differences between musicians and non-musicians (Patston & Tippett, 2011; Strait & Kraus, 2011), other research focused on the effect of formal music training on children (Corrigall & Trainor, 2011; Moreno, Friesen, & Bialystock, 2011). Most experiments in this genre are quasi-experimental or correlational. Studies with children are tangled with socioeconomic issues, as well as intelligence issues. Research with



adults often compares musicians and non-musicians are ways to better equalize those elements.

Hebb's theory suggests that learning is a matter of repeated content. To this end, some research has focused on the ability of people to recall characteristics of music while other studies have focused on the function of music as a memory device, or a mnemonic. Levitin and Cook (1996) studied how well people can remember the actual tempo of music. In their experiment, 46 individuals (ages 16-35) sang two popular music songs from memory. Findings indicated that 72 percent of the recalled songs were within eight percent of the actual tempo. In short, people remember music tempos accurately (Levitin & Cook, 1996).

Other research has found correlations between fine arts other than music and academic task performance indicating the possibility that while correlations exist, music may not be a mediating factor of causation (Crnec, Wilson, & Prior, 2006). These contradictions might suggest factors other than music that impact directly on the learning process (Butzlaff, 2000). Research on music's effect on learning has fallen into three main categories: the "Mozart effect"; instruction of music; and music as background listening (Crnec et al., 2006).

Although there have been scant reports of harmful effects of listening to music (North & Hargreaves, 1999), the majority of studies have used music in such a way as to reduce anxiety (Rickard et al., 2005) that has led to increases in performance on a range of cognitive tasks including reading comprehension, arithmetic performance, and exam performance. Rickard et al. (2005) note that "appropriate controls (for instance, on

different types of music) were not incorporated into many of these studies, nor was the possible impact of music preference considered” (p.236).

### *Music Research with General Education Populations*

This section of literature review will focus on students who fall into normal ranges and participate in general education. It will focus on correlational and causational research that has sought to understand the relationships between music and reading and music and math.

#### Music and reading skills.

In Butzlaff’s (2000) meta-analysis of 30 studies, there was a clear correlation between music and reading performance illustrating a connection for participants with music experience. Selected studies were categorized as correlational or experimental and separate meta-analyses were conducted. In all of these studies reading performance was compared with students who have had music experience and students who have not had musical experience (Butzlaff, 2000). “The meta-analysis of the correlational studies shows that students studying music do in fact have significantly higher scores on standardized reading tests” (Butzlaff, 2000, p. 174). However, the experimental study results yielded no evidence that reading performance and music experience had a causal connection (Butzlaff, 2000). Butzlaff further notes that the variability of effect sizes in the experimental studies indicates an instability in the results. Butzlaff suggests that there are likely other effects that have not been taken into account. While the correlation was significant and robust, causation remains elusive.

Moreno, Friesen, and Bialystock (2011) studied the influence of musical training on the preliteracy skills of 60 children who participated in either a musical arts or a visual

arts program over a four-week period for two hours each day during the summer. Children's phonological awareness and their ability to map visual symbols into words were measured. A pretest/treatment/posttest design evaluated phonological awareness skills and visual-auditory mapping skills. "Equivalent training was observed for both groups on the phonological awareness measure, but the children with music training improved significantly more than the art-trained children on the visual-auditory learning measure" (Moreno et al., 2011, p. 165). This study and others have shown that components of reading can be enhanced with musical training (Moreno, 2009; Moreno & Besson, 2006; Moreno et al, 2011).

Corrigall and Trainor (2011) investigated whether or not musical training could lead to reading comprehension. They researched whether or not the length of time children took music lessons was correlated to their decoding and reading comprehension abilities. The researchers evaluated whether or not music training would cause near transfer or far transfer. Far transfer occurs when training in one skill leads to improvements in seemingly unrelated skills (Corrigall & Trainor, 2011, p. 148). One example of far transfer would be a correlation between musical training and general intelligence. "Near transfer occurs when training in one skill leads to improvements in a highly associated skill, such as when music training affects auditory skills associated with both music and language" (Corrigall & Trainor, 2011, p. 147). As an example of near transfer, research has found that music training caused faster maturation in brain responses to auditory stimuli (Fujioka, Ross, Kakigi, Pantev, & Trainor, 2006; Shahin, Roberts, Chau, Trainor, & Miller, 2008).

Corrigall and Trainor (2011) studied 46 children between the ages of six and nine who participated in instrumental music lessons. All participants were given an intelligence test and a reading test. Although they found no correlation between the length of musical training and reading components, the length of music training did predict comprehension when all other variables were covaried out (Corrigall & Trainor, 2011). They suggest a strong association between reading comprehension and musical training, indicating that a far transfer occurred (Corrigall & Trainor, 2011).

Tsang and Conrad (2011) examined whether or not music processing skills would predict reading performance when music training was a variable. In their study, they compared 69 children between five and nine years old. Sixty-one percent of the children had no history of musical training, while the remaining children had participated in piano, violin, or voice lessons. Three tests were used to measure the reading skills of participants: the Peabody Picture Vocabulary Test, Woodcock Reading Mastery Test, and Tests of Auditory Analysis Skills. For music perception measures, they used Gordon's Primary Measures of Music Audiation, and melodic, rhythmic, and timbral discrimination tasks. They concluded that pitch perception was correlated with phonological awareness, and that music skills and reading skills were correlated. While they establish correlation, there was no causality established (Tsang & Conrad, 2011). They discuss that it is difficult to attribute causation to musical studies since music is a complex medium. "Future research should try to examine the causal nature of the association between music training and reading more explicitly, focusing specifically on both pitch and rhythmic processing skills as they pertain to reading outcomes" (Tsang & Conrad, 2011, p. 162).

Music and math skills.

With elementary-aged students, Hetland (2000) conducted a meta-analysis of experimental studies that reviewed the influence of instrumental training on spatial tasks. To be included in the analysis, studies must have met four criteria: (a) research was conducted in English and included a treatment in which the participants were taught to make music; (b) research included a control condition with no-music; (c) research included an outcome measure on spatial tasks; and (d) research had the statistics necessary to compute effect size (Hetland, 2000). Hetland (2000) concluded that music instruction led to improvements in spatial temporal reasoning with elementary-aged children. Rauscher and Hinton (2011) cautiously note that while there seem to be clear cognitive correlations to musical training, research should be careful not to justify the value of musical arts as a vehicle for non-musical benefit, but to appreciate its aesthetic benefits.

Rauscher and Hinton (2011) contended that in addition to phonological awareness, music instruction can affect numerical reasoning. “Longitudinal studies of middle-income and economically disadvantaged preschoolers reveal that children who receive music instruction prior to age seven show improved performance on numerical reasoning tasks” (Rauscher & Hinton, 2011, p. 216). Rauscher and Hinton (2011) reviewed three studies with preschool-aged children that affirmed significant increases in spatial-temporal reasoning after music training. They concluded that “music is an activity that may help at-risk children perform academically more like their middle-income peers” (Rauscher & Hinton, 2011, p. 218).

Vaughn (2000) conducted a meta-analysis of 25 research studies that contained hypothesis testing of a musical training effect on math performance. The analysis included 20 correlational studies, five experimental studies in which the variable was music participation, and 12 experimental studies in which the variable was music listening. Like Butzlaff (2000) found for reading, Vaughn found a modest but significant correlation between musical study and mathematical achievement. However, causal conclusions cannot be drawn. It is conceivable, perhaps likely, that socioeconomic issues are mitigating influences on academic performance (Vaughn, 2000).

In most studies of in this area, music is used as an independent variable. Haimson, Swain, and Winner (2011) designed a research application using musicality as the dependent variable. They recount many of the mathematical ties to music including harmonics, intervals, rhythmic elements, chord progressions, and melodic structures (Haimson, Swain, & Winner, 2011). Other research has reported correlation between musical training and mathematics achievement (Bahna-James, 1991; Bahr & Christensen, 2000; Helmbold, Rammsayer, & Altenmuller, 2005; Vaughn, 2000).

In an effort to evaluate whether mathematicians have better musical abilities, they created and validated a music survey designed to evaluate musicality and musicianship. Using an online survey, 248 doctoral members of the American Mathematical Association and 336 doctoral level members from the Modern Language Association were polled. Analysis of survey responses indicated that the professionals from the math organization showed no significant difference in musicality or musicianship from the linguistic scholars. While they concluded no correlations between music and mathematical skills, they did find that “because music has underlying mathematical

properties, it easily lends itself to being a subject of mathematical analysis. However despite music's mathematical structure, "the ability to create music may not require particularly high levels of mathematical thinking" (Haimson, Swain, & Winner, 2011, p. 209).

Childhood music involvement was found to positively correlate with IQ and school performance in early childhood, late childhood, and adolescence (Schellenberg, 2006). Schellenberg (2011) investigated connections between musical training, emotional intelligence, and IQ. In a research study of 52 women and 54 men, ranging in age from 17 to 26, Schellenberg evaluated the effect of long-term musical training on emotional intelligence. Participants had either had a minimum of eight years of music lessons or no music lessons. Participants were given the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) and the Kaufman Brief Intelligence Test (KBIT). Schellenberg found no significant difference for emotional intelligence and suggests that perhaps "nonmusical associations with music training are restricted to measures of cognitive ability" (Schellenberg, 2011, p. 190).

In a second phase of the 2011 study, the KBIT IQ test was used to identify correlations between IQ and musical training. Musically trained individuals performed higher than untrained subjects on composite IQ scores, and verbal and non-verbal subscores (Schellenberg, 2011). The main finding was that "musically trained participants had higher IQs than their untrained counterparts, an advantage that did not extend to an ability-based measure of overall emotional intelligence" (Schellenberg, 2011, p. 190).

### *Music Learning Theory*

In the early 1970's, Gordon proposed the music learning theory to explain how music is learned (Gordon, 2007). The theory proposes that, although music is not a language, the process of learning music closely resembles the process for learning a language. Music learning theory speculates that patterns of tones and rhythm are equivalent to the words of a language, while meter and tonality are akin to syntax. Repetition of a pattern leads to audiation of that pattern. The fundamental assertion of music learning theory is that in order to give adequate meaning to a piece of music, the listener must be able to audiate that music.

If aptitude is the potential to acquire a skill and achievement is successfully realizing the task, then musical aptitude and musical achievement are different. Musical aptitude is potential for an individual to internalize music, or audiate. Music aptitude is normally distributed across the population and is developmental from birth to approximately nine years of age (Gordon, 2007). During this time period, the quality of the musical environment has influence on the child's musical aptitude. After musical aptitude has stabilized and the child is approximately nine years old, the child will not be able to achieve at a higher level than their developed aptitude. In short, musically rich environments increase musical aptitude prior to age nine (Gordon, 2011). Rhythmic aptitude and tonal aptitude function as subdivisions of musical aptitude. Gordon (1989) suggests that it is rare that individuals will have equally strong rhythmic aptitude and tonal aptitude. "If you have a high tonal aptitude, you are probably average or low in rhythm aptitude" (Gordon, 1989, p.7). As these tonal and rhythmic aptitudes are formed,



children develop a musical vocabulary for the styles and genres they hear most. This process is analogous to the early formation of language.

### *Musical Preference*

To explore music preference research, it is first necessary to operationalize the terminology. Two terms are used inversely in the literature. Musical tolerance refers to the openness that individuals have for receiving music. Individuals with a high musical tolerance will listen to a variety of music and have a low preference for any specific genre. Conversely, individuals with high musical preference will have a low musical tolerance. Additionally, research discerns the difference between musical preference and musical taste.

To be clear at the outset, we use the term *preference* to refer to a person's liking for one piece of music as compared with another at a given point in time, and *taste* to refer to the overall patterning of an individual's preferences over longer time periods. (Hargreaves, North, & Tarrant, 2006, p. 135)

This section will discuss LeBlanc's theory of musical preference as well as present current research in the field.

Leblanc's interactive theory of musical preference.

A good deal of research has been conducted to understand the genesis of musical preference. The difficult part of the research is that there may be many factors that collectively form an individual's musical preference. LeBlanc (1982) proposed a theory of musical preference development over the lifespan of an individual that suggests many factors will work to formulate a person's musical preference. LeBlanc's (1982) theory of musical preference contends that many variables contribute to musical preference

including: complexity of the musical stimulus, referential meaning, performance quality, peer group influences, family, authority figures, ethnicity, gender, musical training, personality, maturation, memory, physical properties of the stimulus, and attention (Leblanc, 1982). Leblanc's (1999) model illustrates the complexity with which these variables interact to lead to musical preference. The components of the theory include the musical stimulus, the environment, and the listener. LeBlanc (1982) sums up his theory as follows, "Music preference decisions are based upon the interaction of input information and the characteristics of the listener, with input information consisting of the musical stimulus and the listener's cultural environment" (p.29).

Music preference research.

Open-earedness was a term coined to identify a high tolerance for differing musical styles (Hargreaves, 1982a). Hargreaves coined the term "open-earedness" (p.17) to help describe an impression that younger children were more open to different genres of music than adolescents. Children have an open-earedness for musical styles until around age eight when they begin to develop a preference for musical styles (Leblanc, 1982). Musical tolerance begins to decline and musical preference is at its peak around age 16. While the tolerance doesn't completely return to its initial level, musical tolerance increases slightly over into the early twenties (Hargreaves, 1982a).

The use of music in early childhood and elementary school as a learning aid has been shown to be an effective strategy for improving academic achievement (Bilhartz, Bruhn, & Olson, 2000; Butzlaff, 2000). The effectiveness of music as an academic learning tool becomes more dependent on students' musical preference as students move into adolescence. According to Kopiez and Lehmann (2008), in a study of music

listening of 11- to 17-year old children, Behne (2007) concluded that the most important forecaster of musical preference is age. To investigate this concept further, a research study was conducted with 186 elementary students between six- and 10-years old (Kopiez & Lehmann, 2008). Hargreaves (1982a, 1982b) proposed the open-eared hypothesis to explain how musical preference changes over time. Kopiez and Lehmann (2008) sought to test that “younger children may be more open-eared to forms of music regarded by adults as unconventional; their responses may show less evidence of acculturation to normative standards of good taste than those of older subjects” (Hargreaves, 1982b, p. 51). This study found a “decline in the open-earedness for unconventional music” (Kopiez & Lehmann, 2008, p. 121). They further suggested that future research investigate which additional factors might contribute to this phenomenon and better define when the phenomenon occurs.

Musical training or acculturation may affect the level of dislike that students have for particular musical styles. In some studies, a lower level of dislike for musical selections is treated as a higher level of liking. Hargreaves, Comber and Colley (1995) studied the effects of age, gender, and musical training on musical preference for students ages 11, 12, 15, and 16. Student participants (N=278) completed a survey in which they were asked to respond with their level of liking for each of 12 different musical styles. The authors professed the limitation of conducting this study without the use of music. Simply allowing students to respond to identifying styles allows for different interpretations of what comprises that style. However, they also articulated that students do not profess a liking for one song, but reflect more on general stylistic interpretations of that genre. Hargreaves, Comber, and Colley (1995) found a decline in most musical

style categories in secondary school students from age 11 to age 16, confirming the musical preference model proposed by LeBlanc. Further, they found that girls exhibited a higher level of liking for serious styles of music. This conclusion was based on a lower level of disliking in preferential responses. They added that this conclusion may be connected to musical training received, noting a significant main effect of gender on musical training.

Gembris and Schellberg (2003) found that as students aged from seven to 10 years, their dislike for classical music grew, while their preference for popular music remained the same. In this study, classical music was defined as unconventional because of its unfamiliarity to the students. This study confirmed hypotheses of open-earedness declination into adolescence.

In a study of relationships between the cognitive and affective domains of listening, Hargreaves and North (1997) examined the open-earedness of individuals across all age ranges and, in a secondary study, they evaluated the prominence of pop artists as determined by the participants. Findings supported a conclusion that musical preference becomes fixed at a certain age. Exposure to music during this “critical period” (p.7) can help to explain why different age groups tend to identify with musical styles. It has been suggested that additional research should seek to more clearly define the relationships between musical preference and cognitive and affective domains (Hargreaves & North, 1997).

Since the distinction of musical effects on music has been hard to pinpoint, it may be possible that these domains are not entirely independent in relation to musical preference. May (1985) developed a five-point Likert-type pictographic scale to measure

the preference of elementary school children. Using this Music Preference Reaction Index (MPRI) students rated their level of preference of recorded musical selections from varying genres. Results of this quantitative dissertation concluded that the musical preference of children can be reliably measured using short musical selections and a pictographic scale. May's findings also revealed no significant differences in preference based on gender or race. However, primary-aged children favored current musical styles to non-current styles. This may indicate a further relationship between familiarity and preference (May, 1985). In short, children are more inclined to like what they hear.

As previously mentioned, some theoretical approaches seek to evaluate the effect of other influences on musical preference. Studies have identified positive relationships between preference and familiarity (Hargreaves, Messerschmidt, & Rubert, 1980; Teo, Hargreaves, & Lee, 2008). In one study, students were asked to rate their preference for and familiarity with Chinese, Indian, and Malay musical selections (Teo, Hargreaves, & Lee, 2008). Participants were 131 junior high or high school students from Singapore (n=78) and the UK (n=53). Students were asked to complete a survey to evaluate their level of interest, or liking, for Chinese, Malay, and Indian music (Teo, Hargreaves, & Lee, 2008). Teo, Hargreaves, and Lee (2008) found that people are more likely to prefer musical styles that identify with their own cultures. In their study, they reported that 43 percent of the variance in musical preference is accounted for by familiarity (Teo, Hargreaves, & Lee, 2008).

Kopiez and Lehmann (2008) contended that it is likely that several different variables work in tandem with age to help bring shape to musical preference. They proposed "additional dependent scales such as familiarity, interestingness, or associative

exploration (curiosity behaviour) for the rating of open-earedness in unconventional music” (p. 134). Additionally, the researchers suggested the elements of tempo, media influence, and personality type may interact with musical preference (Kopiez & Lehmann, 2008). Teo, Hargreaves, and Lee (2008) suggested that the influences of culture, preference, familiarity, and identification provide implications for classrooms. Understanding student preference may also provide better tools to increase student interest and participation in the curriculum (Teo, Hargreaves, & Lee, 2008).

### Summary

This chapter has reviewed the research surrounding the intersection of music and academics. Neuroscientific studies that have looked at the intersection of music and learning were discussed, including current research that has considered how the brain and mind of infants, children, and adults reacts to musical stimuli. Additional studies that have reviewed how individuals react when listening to music were presented. Research that evaluates the connections between learning and music were reviewed including behavioral connections and therapeutic applications with special education students, as well as academic effects of music on reading and math. Gordon’s (1989) music learning theory was discussed as well as concepts of musical preference including LeBlanc’s (1982) music preference theory.

## Chapter 3

### Methodology

#### Introduction

The review of literature highlighted the importance of interconnected learning strategies between music, memory, and learning. These strategies have often used music to address extra-musical outcomes (Butzlaff, 2000; Hetland, 2000; Vaughn, 2000). However, research is still needed to evaluate the effect of musical strategies on memory tasks with general education students to evaluate how musical teaching techniques can improve student learning. This study added to the body of research on music cognition by evaluating the effect of rhythm and tonality on an academic memory task with general education students.

The research questions for this study were best addressed with quantitative research techniques. Creswell (2008) states that “experimental designs are procedures in quantitative research in which the investigator determines whether an activity or materials make a difference in results for participants” (p. 60). By following the procedures outlined by Gall, Gall, and Borg (2007), this quantitative quasi-experimental research discerned the effect of three treatments on academic memory: poetry, rhythm, and melodic rhythm (song) on an academic memory recall task with second-grade students. Though this study was quasi-experimental rather than truly experimental, statistical analysis sought to measure the extent to which causality may be based on the treatment condition.

This chapter will discuss the methodology for this study including the hypotheses, variables, participants, research design, data collection procedures, and statistical analysis

procedures. The following hypotheses were established to evaluate effects on memory immediately after treatment and following a delayed period after treatment.

- H<sub>1</sub>. There is no interaction between ethnicity (African-American, Hispanic, Asian / P. I., and White) and instructional method (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students immediately after treatment.
- H<sub>2</sub>. There will be no significant effect for ethnicity (African-American, Hispanic, Asian / P. I., and White) on an academic memory task in second-grade students immediately after treatment.
- H<sub>3</sub>. There will be no significant difference between instructional methods (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students immediately after treatment.
- H<sub>4</sub>. There is no interaction between ethnicity (African-American, Hispanic, Asian / P. I., and White) and instructional method (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students following a delayed period after treatment.
- H<sub>5</sub>. There will be no significant effect for ethnicity (African-American, Hispanic, Asian / P. I., and White) on an academic memory task in second-grade students following a delayed period after treatment.
- H<sub>6</sub>. There will be no significant difference between instructional methods (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students following a delayed period after treatment.



## Variables

This experimental study researched the effect of independent variables on dependent variables. This section will define those variables and operationalize them for this study. Both independent and dependent variables are presented.

### *Independent Variables*

Independent variables are manipulated by the researcher in order to ascertain their effect on the dependent variable (Creswell, 2002). As previously described, this study sought to discover the effect of different treatments on the memory recall of student participants. Research has highlighted the potential for difference in memory recall and retention based on treatment (Butzlaff, 2000; Clair et al., 1995; Gordon, 1989) and based on ethnicity (Hargreaves et al., 1995; Marzano, 2004). In this research design, the effects of treatment, ethnicity, and gender as predictors of the dependent variables were investigated.

### *Dependent Variables*

A dependent variable is described as the outcome or effect of the independent variable (Creswell, 2008). The dependent variables in this study are memory recall immediately after treatment (posttest) and memory recall after delayed time (final posttest). The dependent variables will be referred to as memory (posttest) and retention (final posttest).

## Participants

This study took place in four public elementary schools in the north central region of Texas in an urban public school district. Chapter one highlighted the connection between underperforming students and economically disadvantaged status, therefore only

schools with an economically disadvantaged student population of 50 percent or more were chosen. In order to minimize the effect of ethnicity and socioeconomic status as variables, schools were chosen that had comparable ethnic and economically disadvantaged populations. Once the school district had granted permission for the study, the 2011 Texas Academic Excellence Indicator System (AEIS) reports were reviewed and the appropriate schools selected. Table 1 below shows the ethnic and socioeconomic percentages of participating schools.

Table 1  
Population Percentages at Participating Ccampuses

School	African-American	Hispanic	White	Am. Indian	Asian / P. I.	Econ. Dis.	Male	Female
Control	30.7	43.4	16.6	1	6.6	64.7	42.9	57.1
Melodic Rhythm	32	38	16.7	1	9.9	68.2	55.9	44.1
Chant / Rap	28	40	17.5	0.1	13.6	70.8	52.4	47.6
Poem	30.9	36.1	18.3	0.7	13.9	73.7	60.7	39.3
Means	30.4	39.375	17.275	0.7	11	69.35	52.5	47.5

Research highlighted in the literature shows that musical preference in children begins to form at approximately age nine (Hargreaves, 1982b; LeBlanc, 1991). To eliminate the variable of preference, second-grade students were selected because the vast majority of second-grade students have not reached the age of nine. All students from

each school participated in the treatment sessions as the content had relevance to the curriculum, but only students who consented were tested by the researcher. The study included 139 second-grade participants (N=139), including both girls (n=66) and boys (n=73). The ethnic diversity of the student participants closely mirrored the ethnic breakdown of the school populations (African-American – 30.2%; Asian / P. I. 10.1%; Hispanic – 37.4%; White – 22.3%).

Campuses had either four or five classrooms of second-grade students comprising a total possible participation of approximately 360 students. One-hundred fifty students gave consent to participate in the study. Eleven of those students were eliminated due to absences, withdrawal from the school, and in one case, an insufficient understanding of the English language. All of these students were either seven- or eight-years old. Table 2 shows the participation in this study by ethnicity. Of note is the low percentage of Asian / P. I. participants. However, when comparing the percentages of students participating in this study with the ethnic distribution of the school district as a whole, the percentages are in line with district averages (Table 2).

Table 2  
Participation Comparison to School District

	African- American	Asian / P. I.	Hispanic	White
Research Study	30.20%	10.10%	37.40%	22.30%
School District	30.40%	11.00%	39.40%	17.30%

For research of this kind, Olejnik (1984) recommends a minimal size for sample groups for each treatment should be 21 ( $k=4$ ,  $n=21$ ,  $N=84$ ). Based on Olejnik's recommendation, minimal treatment group sizes were exceeded ( $k=4$ ,  $n=28-42$ ,  $N=139$ ).

### Research Design

Experimental designs are often used in quantitative research methodology (Cook & Campbell, 1979; Creswell, 2008). The current study used a between-groups quasi-experimental model, specifically a pretest-posttest-posttest control-group design. This section will discuss the research design and procedures for the current study.

#### *Treatment Recordings*

Treatment conditions were prepared prior to any testing. All treatment conditions were recorded by a certified music therapist to ensure proper range and chord structure. The poem treatment was recorded with no accompaniment (Appendix B). The chant recording was accompanied by a rhythmic track from Garage Band ("Motown Drummer 03" played at 76 beats per minute) and was chanted as shown in Appendix C. The recording for the melodic rhythm treatment was a collaboration between the music therapist and the researcher (Appendix D) but kept in the major mode. All recordings were made using an Apple Macbook Pro computer and dubbed onto TDK 52x CD-R recordable CDs.

#### *Pilot Study*

A pilot study is a "small scale version, or a trial run, in preparation for the major study" (Polit, Beck, & Hungler, 2001, p. 467). Since there was little research to give guidance in the design of this study, a pilot study was conducted to evaluate the appropriateness of the design. Baker (1994) reported that a pilot test should be

approximately 10 percent to 20 percent of the actual population to be tested. The two primary objectives of this pilot study were to evaluate the appropriateness of the treatment recordings and to determine if substantial evidence was found to conduct the full research plan.

Four second-grade classrooms comprising approximately 80 students participated in the pilot study. Second-grade students were asked to name as many countries as possible. Three recordings were prepared using the text in Appendix A: (a) a recorded poetic reading of the text; (b) a chanted or rapped version of the text with a rhythmic accompaniment; and (c) a melodic rhythm recording (or song). The pilot was conducted at a school that was racially diverse and more than 50 percent of its population was economically disadvantaged. Separate classes comprised of 18 to 22 students participated in the pilot study with each of the four classes participating in a different treatment condition. Results of the pilot study indicated that the melodic rhythm treatment and the chant treatment resulted in higher increases in recall than did the poetic treatment. After treatment, the average recall of the pilot results was approximately 11 more countries for the melodic rhythm treatment and seven more countries for the rap treatment when compared to the poetic treatment. The control condition showed no growth. In short, the pilot showed sufficient evidence that conducting the full research study was worthwhile.

The pilot study also revealed that changes were necessary to the treatment recordings. Student results and teacher feedback indicated that the recordings were too lengthy and too fast. The briskness of the tempo did not allow students time to understand and properly pronounce the countries. Following the pilot study,

modifications were made to the treatment conditions. The original text was shortened for the main study. Thirty-one countries were selected as the academic content for the main study. A revised handout entitled “The Countries” was created so that all three treatment groups plus a control would have access to the text (Appendix B). In an effort to ensure that access to the text did not influence the aural treatments, the control group was given the handout and told to place the handout in their poetry folder. The pilot study revealed a need to decrease the treatment tempo slightly (94 beats per minute) to better enable children to pronounce the names of the countries. Treatment recordings were adjusted for these findings and re-recorded for the main study.

#### *Procedures for the Main Study*

Gall et al. (2007) affirm that experimental design is used to test the significance of independent variables on dependent variables but randomization of the participants provides strong confidence that effects are not caused by extraneous variables, but are caused by the independent variables being studied (Gall, Gall, & Borg, 2007).

#### *Sampling procedures.*

Efforts were made to minimize, if not eliminate, the effects of extraneous factors that may affect the results of the study and therefore function as additional variables. The variables of ethnicity and socioeconomic status were controlled for with the selection of campuses for participation.

In experimental research, random sampling of the population is necessary in order to address questions of causation (Creswell, 2008). Since this study employed treatment within classrooms, a randomized field experiment was conducted. “Random assignment means that each sampling unit (e.g., student, class, school district) has an equal chance of

being in each experimental condition” (Gall et al., 2007, p. 397). According to Gall et al. (2007), random assignment is the most effective strategy available for researchers to ensure initial equivalence between treatment groups. Polit and Beck (2004) purport that random assignment of individuals to groups is an effective way to control extraneous variables, control for threats to internal validity, and creates a superior design for determining significance of the treatment.

For this study random assignment was achieved through cluster sampling. “Cluster sampling is used when it is more feasible to select groups of individuals from a defined population” (Gall et al., 2007, p. 173). Cluster sampling involves selecting participants that occur in natural groups, such as a classroom (Creswell, 2003). The participants were randomly assigned to treatments by assigning campuses to different treatment conditions using a random number generator. The four schools participating were ordered alphabetically and numbered one, two, three, and four, respectively. Likewise, the four treatment groups were ordered by progressive complexity: control, poem, rhythm, melodic rhythm. Then an online random number generator was used to randomly order both the participating schools and the treatment conditions (Urbaniak & Pious, 1997). After each school was paired with its treatment and random assignment had been completed, the researcher began the process of collecting consent from participants.

#### Measurement Instrument.

Since this study measured the changes in recall of the individual participants, a unique measurement protocol was created. In order to protect the anonymity of participants, a coding system was developed. Each participant was issued a unique

participant number to be matched to their recording sheet. Their gender and ethnicity were recorded on the data recording sheet as well. Each of the 31 countries used in the handout page was placed into three different sections within the recording sheet (Appendix E). Participants were given this prompt for response: “There are a lot of countries in this world. We live in the United States. Some people call it America. How many other countries can you name?” Correct student responses were recorded with a checkmark in the appropriate box. Incorrect student responses were documented by writing those responses below the check boxes. The identification sheets that matched names and unique identification numbers were destroyed upon completion of data collection.

#### Experimental Design.

This study evaluated the effect of control and treatments on memory and retention. Therefore a quasi-experimental pretest-pottest-pottest control-group design was executed (Figure 5).



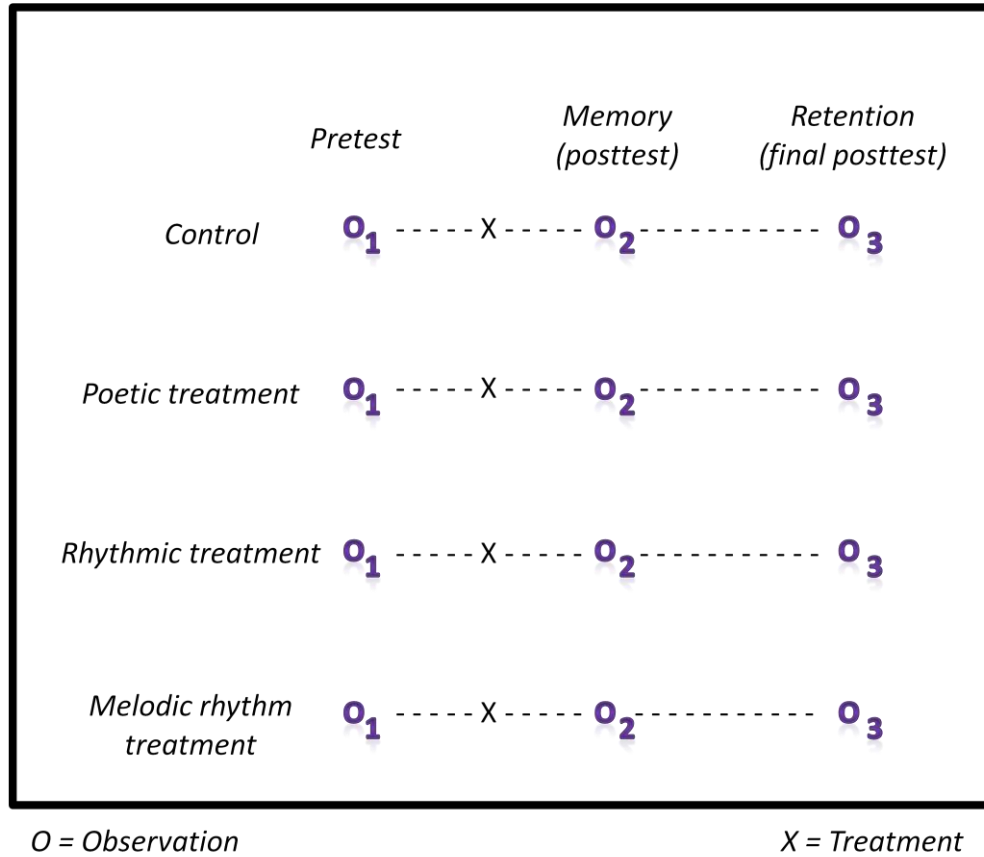


Figure 4. Experimental design for the current study.

This study followed the recommended procedures of Gall, Gall, and Borg (2007) and was a modified version of Register, Darrow, Standley, and Swedberg's (2007) design. All pretests and posttests were administered by the researcher. Teachers were given all materials for gaining consent from student participants including the Research Description for Parents (Appendices F, G, and H) and the informed consent document(s) (Appendices I, J, and K).

Confidentiality.

Since this research study involved the participation of minor students, student and parental consent forms were collected before participation was granted. Students and parents alike had the right to withdraw from the study at any time. In order to align pretest and posttests, students' names were temporarily aligned with unique participant numbers. Once all posttests were completed, participant names were deleted leaving the participant number as the identification and preserving anonymity of the participants.

Teacher Preparation.

Once student participants had responded, the researcher assigned campuses to treatment conditions using the aforementioned sampling protocol. The researcher met with each teacher to complete training on the administration of the treatment. In order to have consistent implementation, teacher instructions were precise. Teachers received specific directions including how to introduce the recordings, when to play the recordings, and how to deal with questions from students (Appendix L). All student participants received the handout entitled "The Countries" (Appendix B). All treatments occurred between 8:30 a.m. and 9:30 a.m. so that time of day would not create an additional variable. Teachers were given instructions to be read verbatim and behavioral expectations for their responsibilities during the treatment. To minimize the effect of teachers on the outcome measures, teachers were asked not to participate with the treatment and to present the treatment in a consistent and positive manner. Anecdotal reports indicate that second-grade students are likely to reflect teachers' opinions in the classroom. Teachers were therefore instructed to be positive about the activity but not to show extreme endorsement of the activity. Following the reading of the scripted

instructions, teachers played the treatment recording from their computer through Altec Lansing BXR1220 speakers.

Treatment Implementation.

Register et al. (2007) completed 12 treatment sessions over a four-week period. Due to the timeline of the local school districts, for this research, 12 sessions occurred over a three-week period, occurring Tuesday through Friday for three weeks. Once the 12 treatment sessions were complete, the researcher conducted the memory tests. Following the treatment period, an equivalent three-week period of non-treatment elapsed in which all materials and recordings were collected and kept from participants. This assured consistency of the non-treatment period. Following the three-week non-treatment period, the researcher conducted retention tests.

Focus group interviews with teachers.

Focus groups were conducted to discern any anomalies that may have affected the results. Teachers from each treatment school were interviewed. All teachers who participated in the delivery of the treatments were invited to participate in these focus group discussions. A protocol was devised to glean any anomalies that might have affected the outcome measures (Appendix N).

#### Data Collection

Experimental groups received treatments by certified classroom teachers trained on the unique process for this study. Since it was the spring semester, these teachers served as the best facilitators of this brief daily treatment. By the spring semester, classroom teachers have established relationships, expectations, and routines for their

classrooms, so it was assumed that incorporation of these treatments into the classroom routine would be most successfully done by the classroom teachers.

Testing was administered by the researcher to ensure consistency of presentation and questioning. All students were identified by gender and ethnicity in the pretest session. At the first testing administration, the researcher took 30 seconds to one minute with each child to establish some basic rapport and comfort. The researcher told the participants that he was an educator and talked briefly about their day. They were told that they were helping him with college and that he was very thankful they were willing to do so. Students were informed that they would not receive a grade and that there were no correct or wrong answers to the question.

Results for memory and retention were ascertained through individual testing sessions using the researcher's recording document (Appendix E). Pre-tests were conducted before any treatment sessions began. The three-week treatment period was followed by memory test. After an additional three-week period of non-treatment a retention test was conducted in an effort to gain insight into participants' retention. The same open-ended prompt was given for each test session, "There are a lot of countries in this world. We live in the United States. Some people call it America. How many other countries can you name?" Students were given as much time as needed to respond, but after a period of six to nine seconds of silence, they were prompted with the question "Can you think of any more countries?" If no additional responses occurred within six to nine more seconds or if the child responded that there were no additional responses, the testing session ended.

In addition, teachers who granted informed consent (Appendix M) participated in a focus group interview at the completion of all treatments in an effort to identify any anomalies that might have affected the outcomes of the research study. These interviews followed an interview protocol to ascertain the impressions and beliefs of the teachers (Appendix N).

### Statistical Analysis

For quantitative research, statistical analysis serves two purposes: a description of what the data look like (descriptive statistics), and conclusions that may be drawn from the data (inferential statistics) (Creswell, 2008). Van Dalen (1979) stated that descriptive statistics help to identify single values that can describe whole data sets. Descriptive statistics including measures of central tendency, means, and standard deviations were presented. Inferential statistics involve making generalizations about the knowledge collected. Interpreting data by comparing new results to prior studies helps to explain “why the results turned out the way they did, and often will explain how the results either support or refute the expected predictions in the study” (Creswell, 2008, p. 57).

For this study, statistical analysis was conducted using IBM Statistical Package for the Social Sciences (SPSS) Statistics 21 software. For this study, the pretest acted as a measure of prior knowledge.

Data analysis for this study must consider appropriate sample sizes for ANOVA comparisons. For this study, a priori values were set at  $\alpha=.05$ , effect size  $d = .5$ , and power  $\eta^2 = .5$ . Using Olejnik’s (1984) recommendations, a minimum sample size for each treatment group should be 24 participants ( $n=24$ ). Recognizing that there will be

one control condition and three treatment conditions ( $k=4$ ), the total participants should be 96 ( $N=96$ ) at a minimum. After 11 students were eliminated from the study, each group met minimum standards for ANOVA assumptions: control ( $n=35$ ); poem ( $n=28$ ); chant ( $n=42$ ); melodic rhythm ( $n=34$ );  $N=139$ . This reduced the potential for erroneous findings and strengthens the fidelity of the implementation. Evans and Anastasio (1968) state that research studies in which intact groups are randomly assigned to treatment conditions will satisfy the assumption of random assignment for ANOVA comparisons.

Prior to conducting ANOVA comparisons, the researcher tested for interaction and homogeneity of variance using Levene's test within IBM SPSS Statistics 19 software. At a 99 percent confidence level Levene's test was not significant, therefore equal variances were assumed. SPSS Type III sums of squares were used when analyzing data to affirm that the difference in group size is not meaningful and all groups should be treated the same (Tabachnick & Fidell, 2001).

### Summary

This chapter presented the methodology for this experimental study. Six research hypotheses evaluating the main effects and interaction of ethnicity and instructional method were presented. Independent and dependent variables were discussed. The pilot study found enough evidence to suggest that the main study would add new information to the field. The components of the main study were presented and discussed in depth, including participants and procedures. Finally, data collection and data analysis procedures were outlined.

## Chapter 4

### Findings

The purpose of this research study was to examine the effect of a rhythmic and melodic rhythm treatment on the memory recall of an academic task in second-grade students. A quasi-experimental pretest-posttest-posttest control-group research experiment was designed and executed. This study also looked for potential differences in performance based on gender and ethnicity. Though this study was quasi-experimental rather than truly experimental, statistical analysis sought to measure the extent to which causality may be based on the treatment condition.

This chapter describes the statistical analysis procedures and articulates the findings from the completed research study. First, the participants and setting for the research will be discussed. Next, descriptive statistics will be reviewed. Inferential statistics surrounding ethnicity, treatment type, and gender will be discussed. Focus group interviews will be presented. The chapter will close with a summary of findings.

#### Descriptive Statistics

Participant information was disaggregated. Total participation by gender was 47.48 % female (n=66) and 52.52 % males (n=73). The total breakdown of the participants by ethnicity revealed that the sample in this study was representative of the larger population of the entire school district. In spite of comparable percentages, the sizes of the Asian / P. I. participants was quite small, with more than half of these participants receiving the chant treatment. Table 3 shows the breakdown of participants by ethnicity, gender, and treatment group.

Table 3

## Number of Participants in Each Treatment Group

Category	Total	Control	Poem	Chant	Melodic Rhythm
<b>Gender</b>					
Female	66	20	11	20	15
Male	73	15	17	22	19
<b>Ethnicity</b>					
African-American	42	10	10	11	11
Hispanic	53	15	9	15	13
Asian / P. I.	13	1	2	8	3
White	31	9	7	8	7

Participants were assigned to one of four treatment conditions. Descriptive statistics for each of treatment condition were computed. Of particular note is the lower bound of the range on almost every category is zero. Only on the melodic rhythm memory test did every student give at least one response from the recording sheet. As a result of this wide range, standard deviations increased from pretest to memory test and reduced slightly from memory test to retention test, matching the recall results that decline slightly from memory test to the retention test on all treatment groups (Table 4).



Table 4  
Descriptive Statistics of Treatment Groups

Category	Mean	Median	Variance	SD	Range
<b>Control (<i>n</i>=35)</b>					
Pretest	0.66	0	0.761	0.873	0 – 3
Memory test	1.00	1	1.294	1.138	0 – 4
Retention test	1.03	1	1.558	1.248	0 – 5
<b>Poem (<i>n</i>=28)</b>					
Pretest	0.93	1	1.476	1.215	0 – 5
Memory test	4.11	3	9.284	3.047	0 – 13
Retention test	3.86	4	8.053	2.838	0 – 12
<b>Chant (<i>n</i>=42)</b>					
Pretest	0.88	1	0.839	0.916	0 – 3
Memory test	6.71	5.5	35.575	5.964	0 – 27
Retention test	5.36	5	27.943	5.286	0 – 30
<b>Melodic Rhythm (<i>n</i>=34)</b>					
Pretest	0.88	1	0.652	0.808	0 – 3
Memory test	9.24	6.5	57.761	7.600	1 – 35
Retention test	6.82	4	45.604	6.753	0 – 23

All treatment groups, including the control, showed gains from the pretest to the memory test, and all groups showed denigration from the memory test to the retention test. These results are consistent with memory models and denigration patterns presented in chapter one (Baddeley, 1986; Cowan, 1995; Dehn, 2008). Table 5 shows the means and significance from pairwise comparisons for the three testing sessions. Note that all *p* values are less than or equal to 0.003.

Table 5  
Pairwise Comparisons for All Tests

	Mean Difference	Standard Error	Significance
Memory test to Pretest	5.349	0.500	0.000
Retention test to Memory test	-1.163	0.339	0.003
Retention test to Pretest	4.187	0.424	0.000

*Tests of Assumptions*

In order to ensure reasonable and accurate results for ANOVA procedures, several assumptions must be met, including: (a) random sampling of participants, (b) the independent effects of scores on dependent variables, (c) normal distribution of the sample population, and (d) sphericity of homogeneity of variance (Tabachnick & Fidell, 2001).

Random sampling and independence.

Randomization was achieved through cluster sampling as outlined by Gall et al. (2007). A detailed description of sampling procedures was completed in Chapter Three.

Independence of scoring was achieved because each assessment was completed in a one-on-one setting between researcher and participant.

Outliers.

Treatment group outliers were adjusted to the nearest outer bound to achieve homogeneity of regression for ANOVA comparisons. All outliers were above the upper bound and were therefore adjusted to the upper bound of their treatment group. Table 6 shows the number of adjustments made prior to ANOVA comparisons and the upper bounds to which outliers were adjusted.

Table 6  
Transformation of Outliers

Treatment Group	Number of Outliers lowered to the Upper Bound	Upper Bound
Pretest		
Control	2	2
Poem	3	2
Chant	3	2
Melodic Rhythm	1	2
Memory test		
Control	4	2
Poem	1	2
Chant	2	9
Melodic Rhythm	1	18
Retention test		
Control	2	3
Poem	1	8
Chant	1	14
Melodic Rhythm	3	18

Explorative analyses to check for normality and homogeneity of variance.

Tabachnick and Fidell (2001) noted that ensuring the normality of the distributed data is an essential part of data analysis. Skewness, “the symmetry of the distribution,”

and kurtosis, “the peakedness of the distribution,” should be considered when analyzing data (Tabachnick & Fidell, 2001, p. 73). Skewness of a variable indicates a higher volume of cases above or below the mean. Non-normal kurtosis may indicate an underestimation of variance. Table 7 shows the values for skewness and kurtosis after the adjustments of outliers to the upper bounds. Tabachnick and Fiddell (2001) say that underestimation of variance with negative kurtosis disappears with 200 or more samples. Since this study does not meet that criteria (N=139), the alpha value for ANOVA comparisons will be reduced to 0.01 to account for underestimation of variance.

Table 7

Means, SD, Skewness, and Kurtosis for Testing Sessions

Treatment Group	M	SD	Skewness	Kurtosis
Pretest				
Control	0.60	0.736	0.809	-0.654
Poem	0.75	0.799	0.498	-1.234
Chant	0.81	0.773	0.348	-1.220
Melodic Rhythm	0.85	0.553	0.248	-1.101
Memory test				
Control	0.83	0.785	0.320	-1.285
Poem	3.96	7.221	0.547	-0.593
Chant	6.40	5.095	0.896	0.024
Melodic Rhythm	8.91	6.644	0.964	-0.035
Retention test				
Control	0.94	1.027	0.810	-0.457
Poem	3.71	2.492	0.321	-1.017
Chant	4.98	3.848	0.564	-0.285
Melodic Rhythm	6.44	5.909	0.988	-0.388

Since analysis of kurtosis and skewness revealed a need to change the a priori value to 0.01, homogeneity of variance was examined with the adjusted confidence interval of 99 percent ( $\alpha=.01$ ). Levene's test of homogeneity of variance was used because it is less sensitive to departures from normality (Tabachnick & Fidell, 2001).

Considering the three treatment groups, at the 0.01 a priori value, Levene's test for homogeneity of variance showed no significance. Table 8 shows the computed Levene's statistics for the three treatment groups at ( $\alpha=.01$ ). With no significance, equal variances can be assumed, and there is no violation to the homogeneity of variance assumption (IBM Corp., 2012; Tabachnick & Fidell, 2001).

Table 8

Levene's Test for Equality of Variance

	F	df 1	df 2	Sig.
Pretest	0.681	11	92	0.753
Memory test	2.263	11	92	0.017
Retention test	1.260	11	92	0.260

### *Findings of Statistical Analyses*

Prior to analysis of dependent variables, an analysis of variance (ANOVA) was conducted to ensure that pretest means were not significantly different. With no significant difference between the pretest means due to treatment group, hypotheses could be addressed. No significant difference was found between pretest means,  $F(3,123) = 0.674, p = 0.569, \eta^2 = 0.016$  (Table 9).

Table 9

Univariate Source Table for Pretest Mean Comparisons

Source	Type III SS	Df	MS	F	Sig.	Partial $\eta^2$
Corrected Model	10.094 <sup>a</sup>	15	0.673	1.189	0.289	0.127
Intercept	56.354	1	56.354	99.606	0.000	0.447
Treatment Group	1.144	3	0.381	0.674	0.569	0.016
Ethnicity	2.594	3	0.865	1.529	0.210	0.036
Treatment Group * Ethnicity	6.222	9	0.691	1.222	0.288	0.082
Error	65.590	123	0.566			
Total	159.000	139				
Corrected Total	79.683	138				

*a.  $R^2 = 0.456$  (Adjusted  $R^2 = 0.390$ )*

*\*\*\*sig. at  $\alpha = 0.01$*

For each dependent variable, a 4 x 4 ANOVA procedure was conducted to assess the interaction and main effects of the hypotheses for this research study. First, univariate analyses were conducted to examine the interaction and main effects of ethnicity and treatment condition on the dependent variables of memory (posttest) and retention (final posttest). Though not a research question, a second univariate analysis was conducted to evaluate the interaction and main effects of gender on the memory testing. Thirdly, gender univariate analyses were repeated for the dependent variable



retention testing. As previously discussed, the non-treatment group was removed for these ANOVA comparisons.

H<sub>1</sub>. There is no interaction between ethnicity (African-American, Hispanic, Asian / P. I., and White) and instructional method (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students immediately after treatment.

Using IBM SPSS 21 software, univariate analyses were conducted to identify interaction effects between ethnicity and treatment conditions. For the dependent variable, memory recall, which occurred immediately after treatment, no significant interaction was found between instructional method and ethnicity,  $F(3,123) = 1.255, p = 0.268$ . When evaluating interaction between these two variables on the memory test, the goal was to ensure that interaction did not occur. The finding of no significance means that the effects of the variables of ethnicity and treatment condition act independently on the memory test outcomes (Table 10).

Table 10

Univariate Source Table for Memory test (Treatment x Ethnicity)

Source	Type III SS	Df	MS	F	Sig.	Partial $\eta^2$
Corrected Model	1813.594 <sup>a</sup>	15	120.906	6.874	0.000	0.456
Intercept	2599.740	1	2599.740	147.813	0.000	0.546
Treatment Group	976.507	3	325.502	18.507	0.000***	0.311
Ethnicity	168.461	3	56.154	3.193	0.003***	0.072
Treatment Group * Ethnicity	198.626	9	22.070	1.255	0.268	0.084
Error	2163.327	123	17.588			
Total	7624.000	139				
Corrected Total	3976.921	138				

a.  $R^2 = 0.456$  (Adjusted  $R^2 = 0.390$ )

\*\*\*sig. at  $\alpha = 0.01$

H<sub>2</sub>. There will be no significant effect for ethnicity (African-American, Hispanic, Asian / P. I., and White) on an academic memory task in second-grade students immediately after treatment.

The effect of ethnicity on the dependent variable of memory was examined. A main effect was found for ethnicity,  $F(3,123) = 3.193$ ,  $p = 0.003$ ,  $\eta^2 = 0.072$ . Tukey post hoc testing revealed significance between Asian / P. I. students and African-American students ( $p < 0.001$ ), between Asian / P. I. and Hispanic students ( $p < 0.001$ ), and

between Asian / P. I. and white students ( $p < 0.001$ ) (Table 14). While the Asian / P. I. population was smaller, the conservative alpha value ( $\alpha = 0.01$ ) reduces the likelihood of a type I error. In short, Asian / P. I. students were more likely to have increased memory when compared to other students within this study. With a significant finding, this null hypothesis is rejected. Asian / P. I. students outperformed other ethnic groups in this experiment. Table 11 shows the Tukey post hoc comparisons for ethnicity on memory test.

Table 11  
Memory Test Post Hoc for Ethnicity

	African- American	Asian / P. I.	Hispanic	White
African- American	1.000	.000***	0.714	0.987
Asian / P. I.		1.000	0.000***	0.000***
Hispanic			1.000	0.925
White				1.000

\*\*\* *The mean difference is significant at the 0.01 level*

H<sub>3</sub>. There will be no significant difference between instructional methods (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students immediately after treatment.

On the memory test, a significant main effect was found for treatment group,  $F(3,123) = 18.507, p < 0.001, \eta^2 = 0.311$ . This main effect for treatment group indicated that treatment type was highly significant in memory testing. Both the chant treatment

and the melodic treatment were significantly more effective than the control treatment ( $p < 0.001$ ). While there was no significance between the poetic treatment and chant treatment ( $p = 0.085$ ) or between the chant and melodic rhythm treatment ( $p = 0.052$ ), Tukey post hoc testing revealed significance between the melodic rhythm treatment and poetic treatment ( $p < 0.001$ ). In other words, students who received the melodic treatment performed significantly better than those students who received the poetic treatment. Since a significant main effect for treatment was found, the null hypothesis of no difference is rejected (Table 12). The melodic rhythm treatment was significantly more effective than the poetic treatment.

Table 12  
Memory Test Post Hoc for Treatment Condition

	Control	Poem	Chant	Melodic Rhythm
Control	1.000	0.020	0.000***	0.000***
Poem		1.000	0.085	0.000***
Chant			1.000	0.052
Melodic Rhythm				1.000

\*\*\* *The mean difference is significant at the 0.01 level*

H<sub>4</sub>. There is no interaction between ethnicity (African-American, Hispanic, Asian / P. I., and White) and instructional method (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students following a delayed period after treatment.

Again, using IBM SPSS 21 software, interaction effects between ethnicity and treatment condition were evaluated for the dependent variable, retention, which occurred after a delayed period after the treatment. For the dependent variable retention, no significance means that the effects of the variables of ethnicity and treatment condition act independently on the retention test outcomes (Table 13).

Table 13

Univariate Source Table for Retention Test (Treatment x Ethnicity)

Source	Type III SS	Df	MS	F	Sig.	Partial $\eta^2$
Corrected Model	1122.462 <sup>a</sup>	15	74.831	6.519	0.000	0.443
Intercept	1656.615	1	1656.615	144.313	0.000	0.540
Treatment Group	581.620	3	193.973	16.889	0.000***	0.292
Ethnicity	121.674	3	40.558	3.533	0.009***	0.160
Treatment Group * Ethnicity	269.061	9	29.896	2.604	0.017	0.079
Error	1411.956	123	11.479			
Total	4831.000	139				
Corrected Total	2534.417	138				

a.  $R^2 = 0.443$  (Adjusted  $R^2 = 0.375$ )

\*\*\*sig. at  $\alpha = 0.01$

H<sub>5</sub>. There will be no significant effect for ethnicity (African-American, Hispanic, Asian / P. I., and White) on an academic memory task in second-grade students following a delayed period after treatment.

A main effect was also found for ethnicity on the retention test,  $F(3,123) = 3.533$ ,  $p = 0.009$ ,  $\eta^2 = 0.160$ . Tukey post hoc testing again revealed significance between Asian / P. I. students and African-American students ( $p < 0.001$ ), between Asian / P. I. and Hispanic students ( $p < 0.001$ ), and between Asian / P. I. and white students ( $p < 0.001$ ). Asian / P. I. students outperformed students from other ethnicities on retention test. Just as on the memory test measure, the use of a more conservative alpha value ( $\alpha = 0.01$ ) reduces the likelihood of a type I error on the retention testing results. After the three-week non-treatment period, Asian / P. I. students retained significantly more information than other ethnic populations. With a significant finding, the null hypothesis is rejected. Asian / P. I. students outperformed other ethnic groups in this experiment. Table 14 shows the Tukey post hoc comparisons for ethnicity on the retention test.

Table 14

Retention Test Post Hoc for Ethnicity

	African-American	Asian / P. I.	Hispanic	White
African-American	1.000	0.000***	0.413	0.732
Asian / P. I.		1.000	0.000***	0.000***
Hispanic			1.000	0.766
White				1.000

\*\*\* *The mean difference is significant at the 0.01 level*

H<sub>6</sub>. There will be no significant difference between instructional methods (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students following a delayed period after treatment.

On the retention test, a significant main effect was found for treatment group,  $F(3,123) = 16.889, p < 0.001, \eta^2 = 0.292$ . Treatment type was highly significant for retention. All treatment conditions were significant when compared with the control group: (a) poem ( $p = 0.009$ ); (b) chant ( $p < 0.001$ ); and (c) melodic rhythm ( $p < 0.001$ ). Tukey post hoc testing for the treatment group did not show any further significance between treatment groups on the retention test. The slight decreases in retention of information from the memory test to the retention test measures confirm previous research that information will decay if it is not activated (Baddeley & Hitch, 1974; Cowan, 1995). Since a significant main effect for treatment was found, the null hypothesis of no difference is rejected (Table 15).

Table 15  
Retention Test Post Hoc for Treatment Condition

	Control	Poem	Chant	Melodic Rhythm
Control	1.000	0.009***	0.000***	0.000***
Poem		1.000	0.425	0.011
Chant			1.000	0.244
Melodic Rhythm				1.000

\*\*\* *The mean difference is significant at the 0.01 level*

*Univariate analyses – Treatment group and gender*

Though gender was not a part of the research hypotheses, univariate analyses were conducted to evaluate the effects of gender. For the memory test, no significant interaction was found between instructional method and gender,  $F(3,131) = 0.907$ ,  $p = 0.440$ ,  $\eta^2 = 0.020$ . There was no main effect found for gender,  $F(1,131) = 0.008$ ,  $p < 0.907$ ,  $\eta^2 = 0.000$  (Table 16).

Table 16

Univariate Source Table for Memory Test (Treatment x Gender)

Source	Type III SS	Df	MS	F	Sig.	Partial $\eta^2$
Corrected Model	1297.622 <sup>a</sup>	7	185.375	9.064	0.000	0.326
Intercept	3401.091	1	3401.091	166.291	0.000	0.559
Treatment Group	1220.805	3	406.935	19.896	0.000***	0.313
Gender	0.160	1	0.160	0.008	0.930	0.000
Treatment Group * Gender	55.638	3	18.546	0.907	0.440	0.020
Error	2679.299	131	20.453			
Total	7624.000	139				
Corrected Total	3976.921	138				

a.  $R^2 = 0.326$  (Adjusted  $R^2 = 0.290$ )

\*\*\*sig. at  $\alpha = 0.01$



For the dependent variable, retention, no significant interaction was found between instructional method and gender,  $F(1,131) = 0.867, p = 0.460$ . No significant main effect for gender was found,  $F(1, 131) = 0.637, p = 0.426, \eta^2 = 0.005$  (Table 17).

Table 17

Univariate Source Table for Retention Test (Treatment x Gender)

Source	Type III SS	Df	MS	F	Sig.	Partial $\eta^2$
Corrected Model	615.421 <sup>a</sup>	7	87.917	6.002	0.000	0.243
Intercept	2211.891	1	2211.891	150.994	0.000	0.535
Treatment Group	572.090	3	190.697	13.018	0.000***	0.230
Gender	9.336	1	9.336	0.637	0.426	0.005
Treatment Group * Gender	38.097	3	12.699	0.867	0.460	0.019
Error	1918.997	131	14.649			
Total	4831.000	139				
Corrected Total	2534.417	138				

a.  $R^2 = 0.243$  (Adjusted  $R^2 = 0.202$ )

\*\*\*sig. at  $\alpha = 0.01$

## Ethnicity Data Plots

All ethnic populations recalled more academic material as the complexity of the treatment increased. Each ethnic group recalled more information with the chant treatment as compared to the poetic treatment, and with the melodic rhythm treatment when compared to the chant treatment (Figure 5).

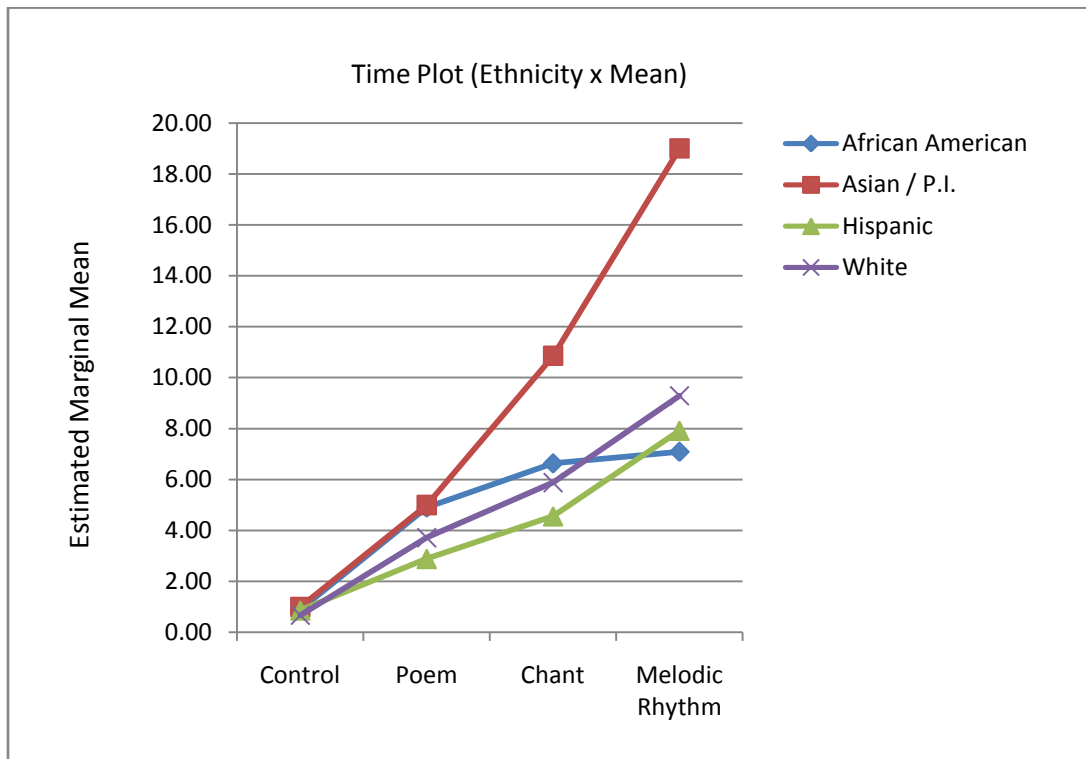


Figure 5. Ethnicity Plot (Treatment Group x Mean). (IBM Corp., 2012).

Figure 6 compares the overall performance means of all ethnic groups. While Asian / P. I. participants showed the greatest overall gains from pretest to memory test, Hispanic students showed the most conservative overall gains from pretest to memory test.

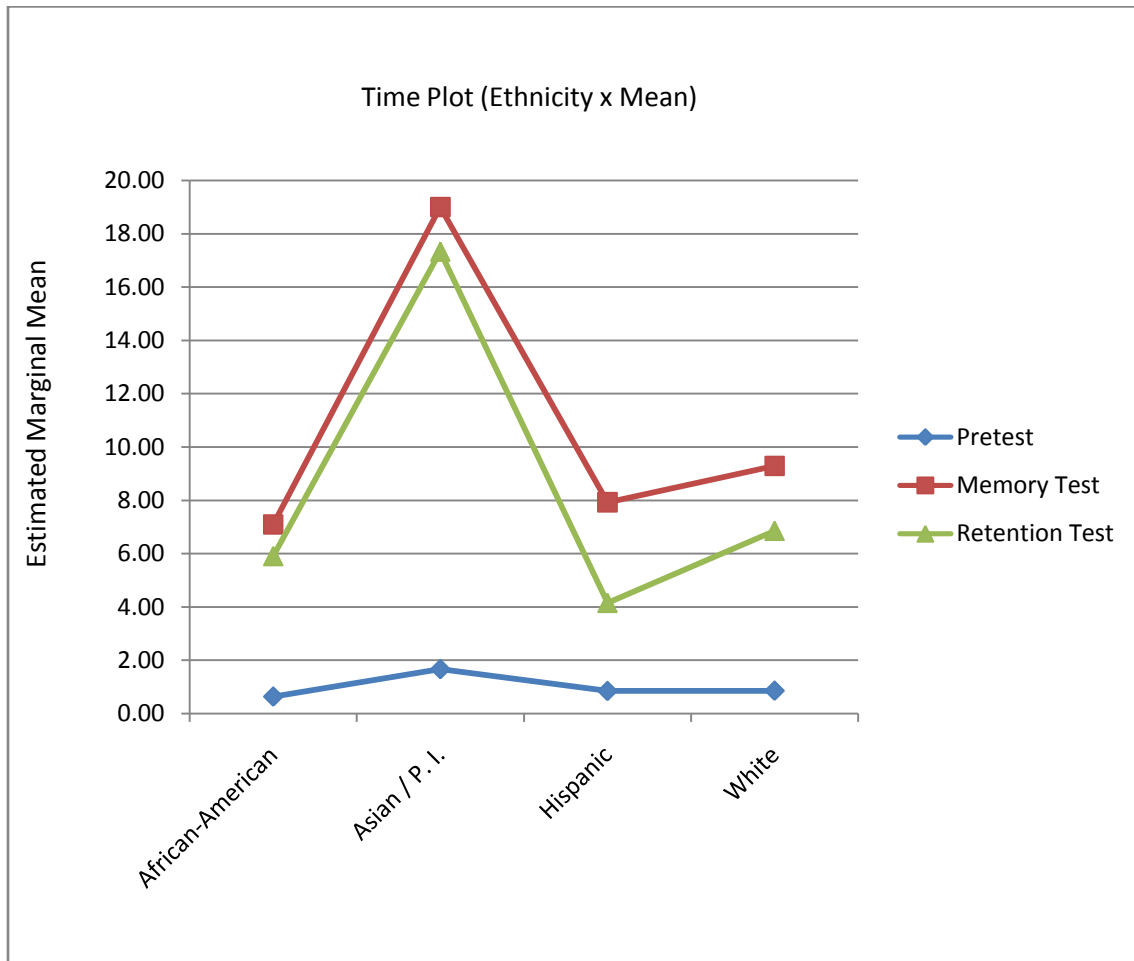


Figure 6. Time Plot (Ethnicity x Mean). (IBM Corp., 2012).

However, Hispanic students who participated in the poem treatment group were the only ethnic population to show an increase from the memory test to the retention test under any treatment condition. This increase may be due to the low memory recall scores allowing room for an increase on the retention test. The fact that these students had increased recall during the non-exposure period suggests that learning continued in absence of the treatment. Focus group interviews with teachers did not provide any insight into reasons this may have occurred (Figure 7).

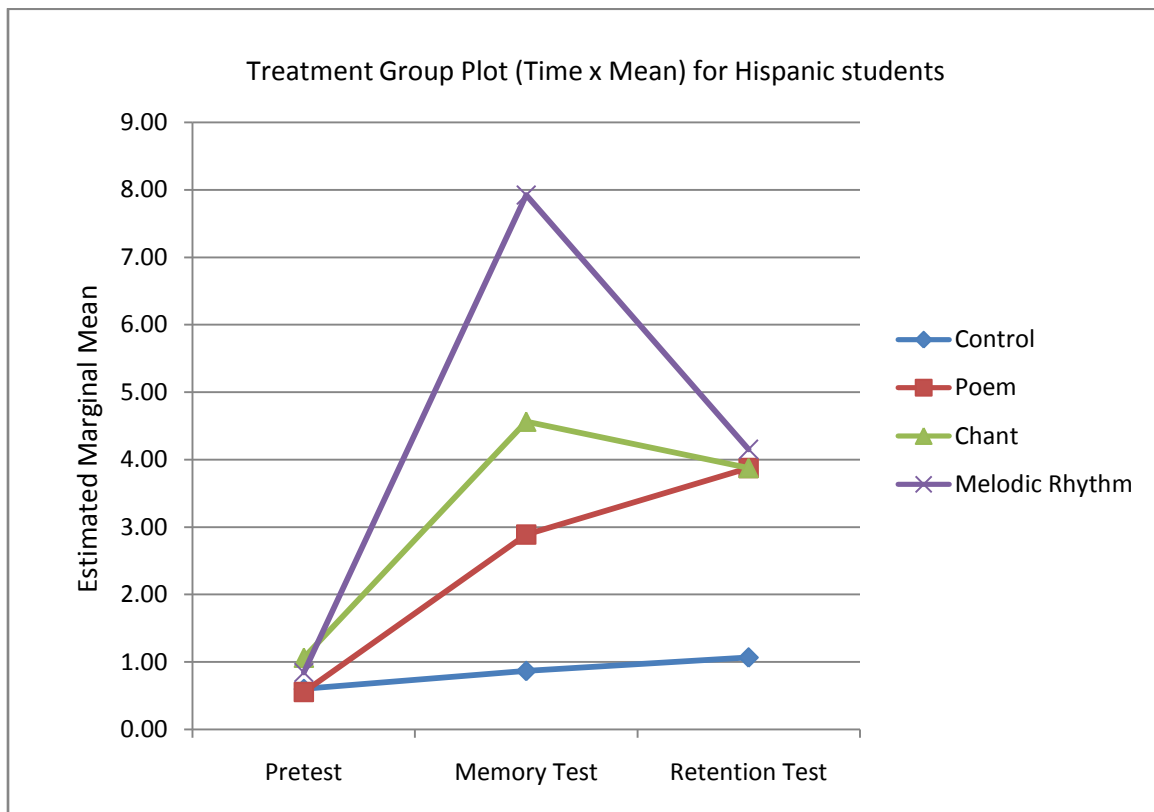


Figure 7. Treatment Group plot (Time x Mean) for Hispanic students.

(IBM Corp., 2012).

Figures 8, 9, and 10 show the performance for the other ethnic subgroups. Though the number of items of the memory and retention test differ, African-American, white, and Asian / P. I. students have some similarities. Each of these ethnic populations have the greatest performance with the melodic rhythm treatment and the lowest performance with the poetic treatment. On all treatments, and with all subgroups, memory recall wanes on the retention test.

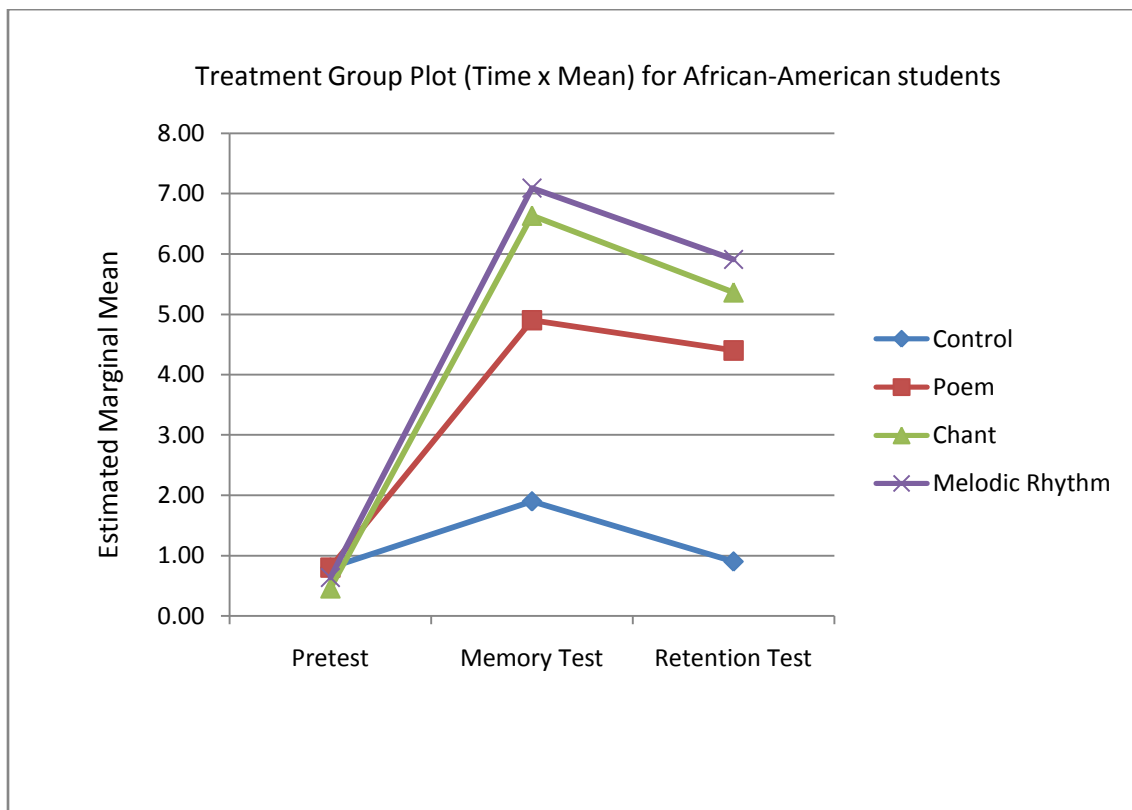


Figure 8. Treatment Group plot (Time x Mean) for African-American students.

(IBM Corp., 2012).

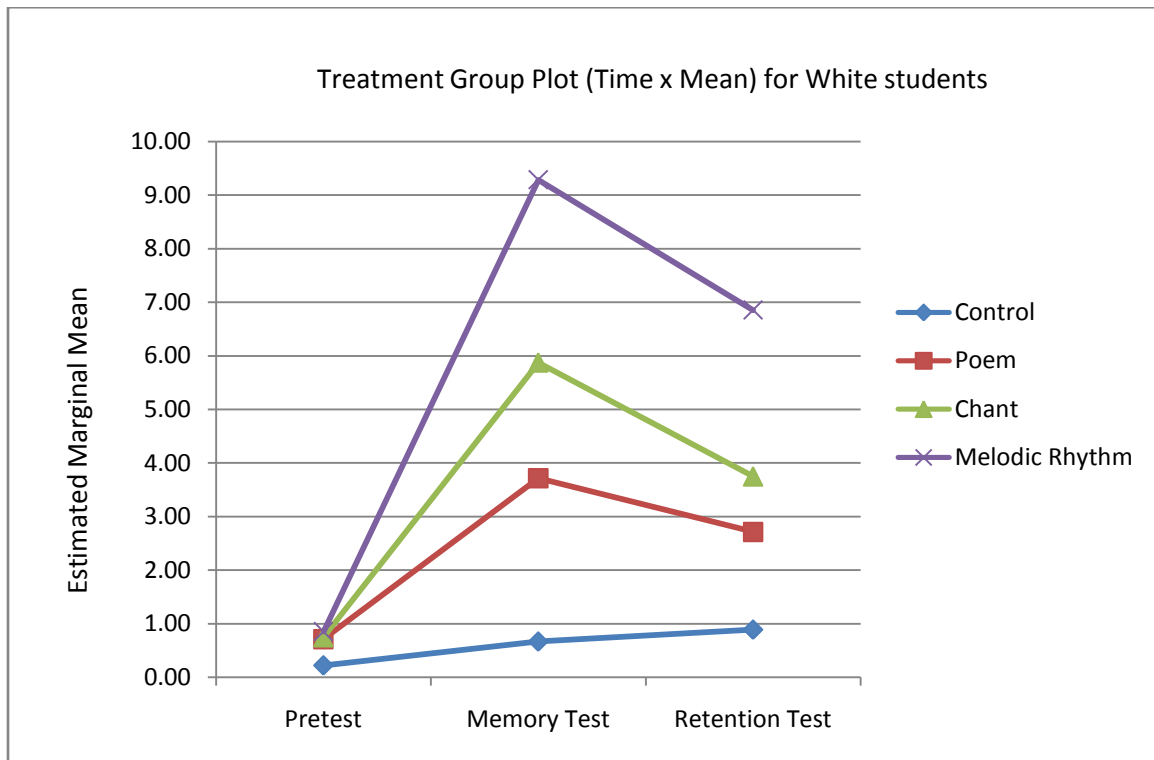


Figure 9. Treatment Group plot (Time x Mean) for white students. (IBM Corp., 2012).

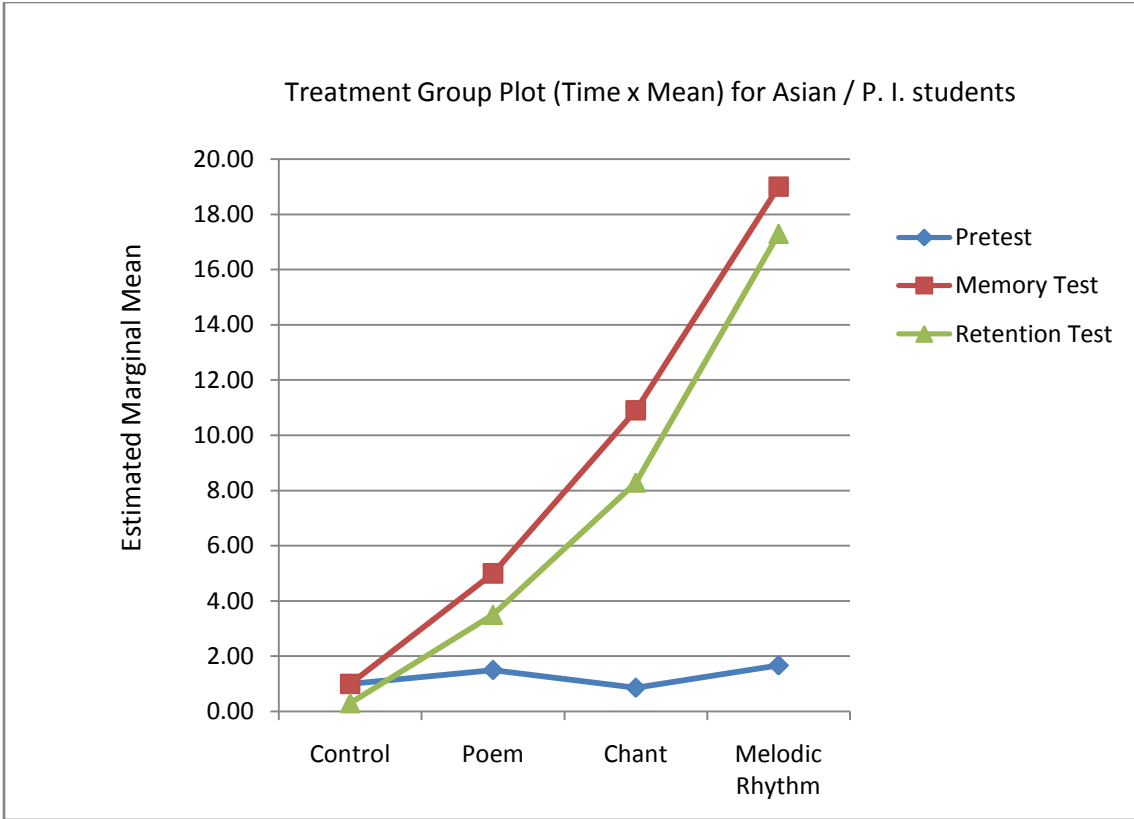


Figure 10. Treatment Group plot (Time x Mean) for Asian / P. I. students. (IBM Corp., 2012).

Figure 11 depicts the mean performance of all students by treatment group over time.

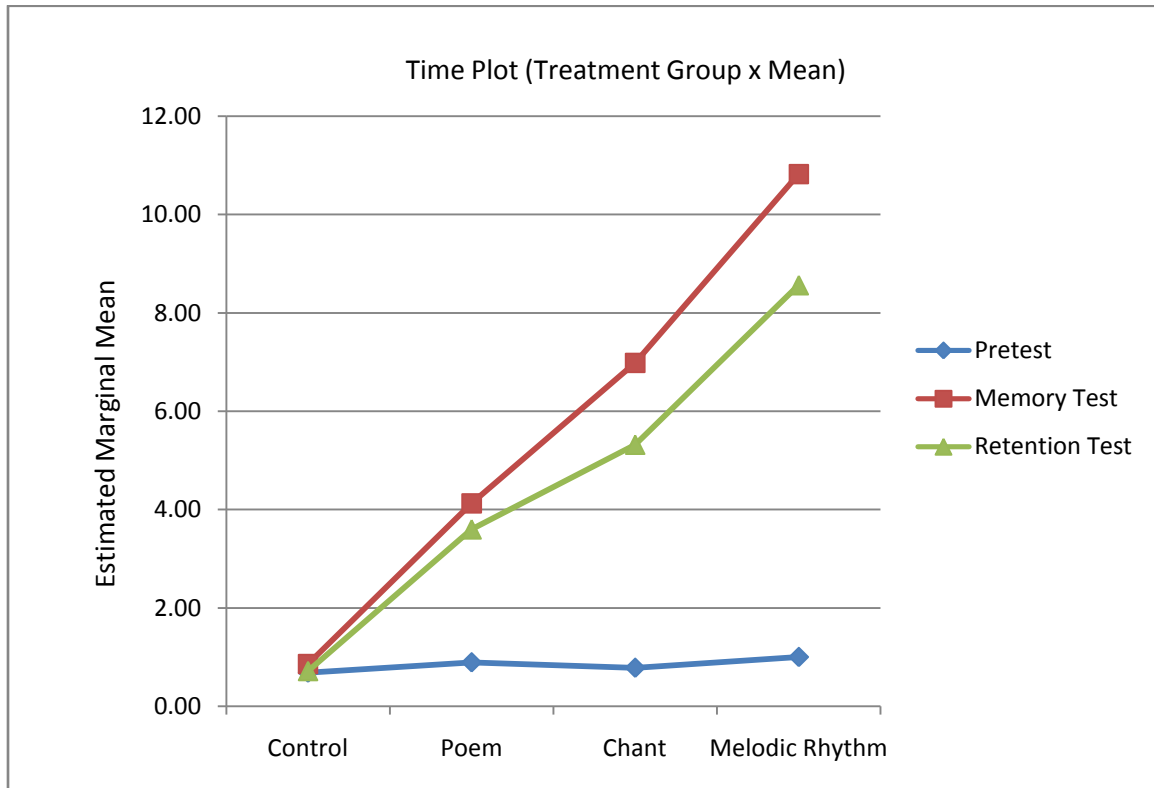


Figure 11. Time Plot (Treatment Group x Mean). (IBM Corp., 2012).



## Gender Data Plots

Figure 12 shows the means for post test by treatment group and gender on the retention test. Though there was no significant effect due to gender on the memory test, the figure illustrates that boys performed better on the chant treatment, while girls performed better on the poem and melodic rhythm treatments.

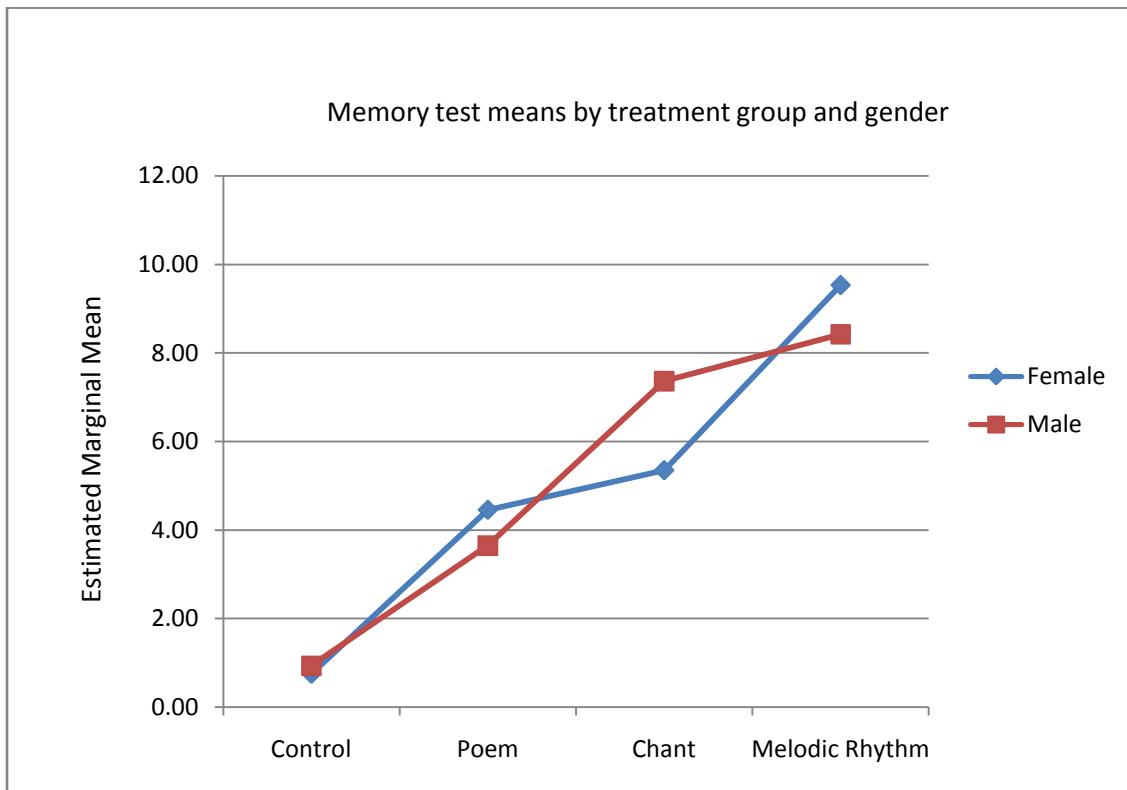


Figure 12. Memory Test means (Treatment Group x Gender). (IBM Corp., 2012).

Figure 13 shows the same comparisons for the retention test which follow the same pattern. Though there is no significance, this does suggest that there may be differences based on gender. While effects based on gender are beyond the scope of this study, further exploration would be appropriate before any conclusions about gender effects could be drawn.

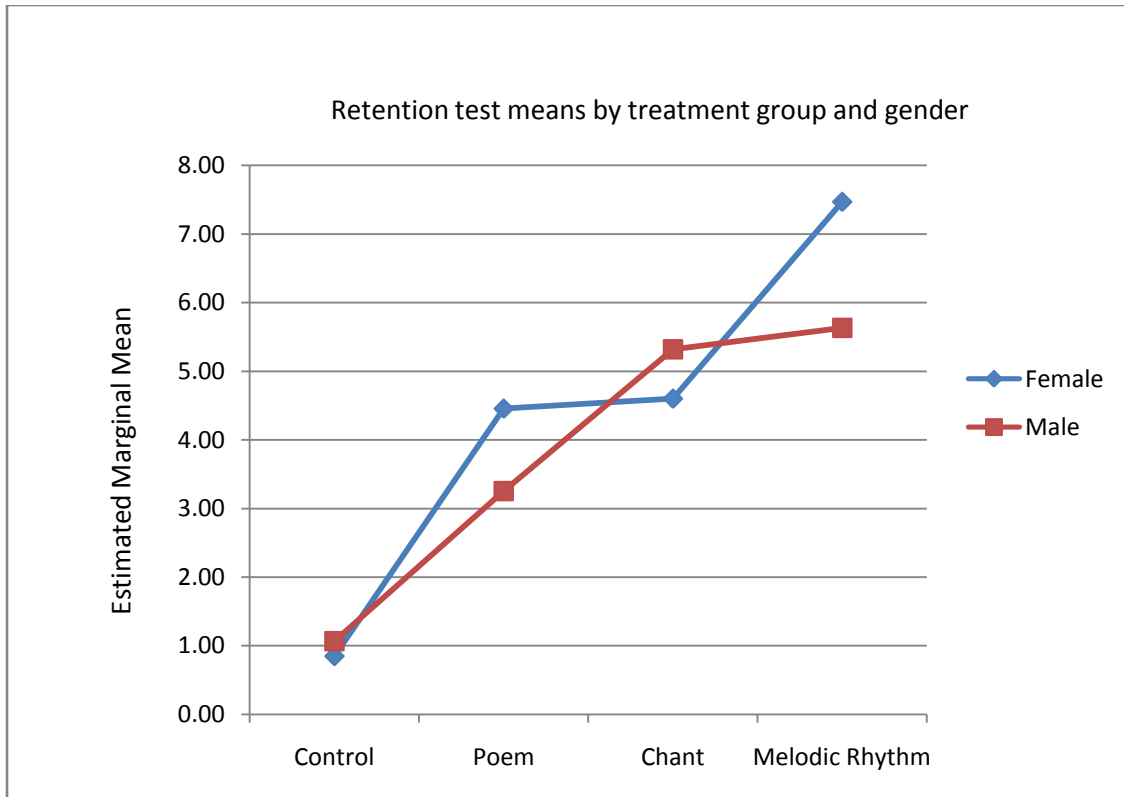


Figure 13. Retention Test Means (Treatment group x Gender). (IBM Corp., 2012).

## Focus Group Findings

Following the completion of the experiment, the researcher met with the teachers responsible for executing the daily treatment. The purpose of these focus group interviews was to discern any anomalies that may have affected the results. Teachers from each treatment school were interviewed. Students from the control group did not receive treatment, therefore the interview protocol would not have provided any information relevant to a treatment. Thirteen teachers from the treatment sites participated in focus group interviews. One teacher did not participate in the focus group interviews. Three possibilities that could have affected the results have emerged from the focus group findings: (a) student enjoyment; (b) student engagement; and (c) competitiveness.

When asked to discuss how the students responded to the treatment used at their particular campus, all teachers agreed that the students enjoyed the activity. They participated willingly and were often disappointed that they could not spend more class time on the activity. One teacher noted “It became part of our routine, and the kids were disappointed when we had to stop.” Teachers from the chant and melodic rhythm campuses reported that the children were excited throughout the treatment, and that children would challenge themselves to memorize the song and even though some weren’t adept readers, they were engaged and excited during the treatment sessions. A teacher from one of these groups said “all the kids participated, they were smiling, and interacting with each other. It was their favorite part of the day.” Teachers from the poem group recounted similar responses but added that the excitement faded after several treatments. In one teacher’s words “It lost its newness and became less attractive.” The

students in the poem group completed the treatment, but the activity became less exciting for students and their enthusiasm waned.

When teachers were asked to discuss what they believed made the difference in the students' learning, all of them, regardless of treatment, agreed that the repetition played a role. However, the chant and melodic rhythm teachers felt strongly that the rhythm and music increased the students' enjoyment and engagement in the activity. One teacher felt that the activity allowed the students to stand and be more physically engaged in the activity. While everyone was allowed to stand, this comment may reflect greater openness from the teachers to different learning styles. Teachers of the melodic rhythm group discussed the idea that the "song had more sticking power." One teacher noted that "they would sing it later, at recess, lunch, wherever. They would hear the other class and follow along, too." The idea that the students' engagement in the melodic and rhythmic treatments caused more repetition of the treatment than the scheduled treatment may help explain their increased learning, but does not violate the fidelity of the treatment. In fact, it may give credence to the notion that increasing audiation leads to retention.

When asked if there were any factors that could have affected the students' ability to retain the information, only two comments arose. One teacher noted that a component of the math curriculum used the flags during the time of the treatment. While the focus was on the patterns of the flags for that class, there were a few flags of countries in the study. Another teacher commented that her students "would go to the globe and point out the countries. They were trying to connect their learning." While these incidents do reflect a spirit of learning, it is possible that these isolated incidents could affect the results of the treatment.

The teachers confirmed that all of the students had the handout during their treatment sessions and it seemed to support the students' learning. The teachers from all campuses noted that the children would try to challenge themselves to memorize the countries. "It became a contest. Kids wanted to get more right than their friends." One teacher recounted that "they would turn their papers over and try to do more from memory than the other students." Teachers felt that this competitive spirit was playful and encouraged children to learn the countries. The teachers further noted that the students learned the chorus much better than they learned the verses. One teacher stated that "even with [the handout] they would have to really pay attention to the countries. Some of my students would forget how to pronounce the countries unless the recording was playing."

#### Summary of Findings

Chapter four presented a summary of findings from this research study. Overall, 139 participants completed the treatments and all testing sessions. Results of this study indicated that all treatment groups showed improved memory recall from pretest to memory test and recall declined slightly from the memory test to the retention test. Assumptions for statistical analysis were considered and addressed. The alpha value was reduced to 0.01 in order to account for homogeneity of variance and kurtosis. Univariate analyses were completed for ethnicity and treatment type for both dependent variables memory test and retention test. Though not addressed by the hypotheses, univariate analyses were completed for gender and treatment type.

No interaction between ethnicity and treatment type was found for either dependent variable. A main effect was found for ethnicity and post hoc testing revealed

that Asian / P. I. students performed significantly better than all other populations on both dependent measures. A second main effect was found for treatment group on both the memory and retention tests. Melodic rhythm was significantly more successful than the poem treatment in memory recall. On the retention measure, the melodic rhythm was significantly more effective than the poetic and rhythmic treatments. Finally, teacher feedback and insight on the treatments and resulted were collected during focus group settings. Teacher feedback revealed three themes that may have affected the findings: (a) student enjoyment; (b) student engagement; and (c) competitiveness.

## Chapter 5

### Discussion and Recommendations

In this chapter, the findings of research will be briefly reviewed. Second, research findings will be reviewed, including a discussion of hypotheses related to interaction, ethnicity, treatment type, and gender. Implications for theory and practice will be presented. Recommendations for future research and limitations for the research will be addressed. Final thoughts on this research study will conclude chapter five.

### Summary of Findings

This research study was designed to add to the body of research on music cognition by evaluating the effect of rhythm and tonality on an academic memory task using three different treatments: a poem, a chant / rap, and a melodic rhythm treatment. The independent variables for this study were ethnicity and treatment type, but as gender data was available, gender relationships to the dependent variables, memory and retention, were investigated as well.

Chapter four presented a summary of findings from this research study. Findings showed that all treatments improved memory recall from pretest to memory test. In line with memory models of Baddeley and Hitch (1974) and Cowan (1995), memory recall declined slightly from the memory test to retention test. For both dependent measures, a main effect for ethnicity was identified. Asian / P. I. students recalled significantly more countries than other ethnicities.

Additionally, treatment group was found to be significant on both the memory and retention tests. On the memory test and retention test, all treatment conditions were significant when compared to the control group. On the memory test, melodic rhythm

was significantly more successful than the poem treatment and on the retention test, all treatments significantly outperformed the control, but were not significant when compared to each other.

### Discussion of Research Findings

A quasi-experimental pretest-posttest-posttest control-group research experiment was designed and executed. Though this study was quasi-experimental rather than fully experimental, statistical analysis measured the extent to which causality may be based on the treatment conditions. For this study, treatment group and ethnicity were independent variables, but the effects of gender were investigated as well. The dependent variables in this study were memory recall immediately after treatment (posttest) and memory recall after delayed period following the treatment (retention test).

All three treatment groups showed gains from the pretest to memory test and from the pretest to the retention test. Pairwise comparisons showed highly significant differences between the overall means for pretest, memory test, and retention test ( $p = 0.003$ ,  $p < 0.001$ ,  $p < 0.001$ ). The means for recall for all treatment groups, ethnicities, and gender groups were higher immediately following the treatment, and fell slightly after the non-treatment period.

Both Baddeley and Hitch (1974) and Cowan (1995) proposed that short-term memory functions as a component of long-term memory. In both models, researchers agree that memory will decay during periods of non-use (Baddeley & Hitch, 1974; Cowan, 1995). Since all treatment groups in this study showed increases after treatment and slight declines on retention tests, the results of this study are consistent with the memory models developed by Cowan (1995) and Baddeley and Hitch (1974).



In the Baddeley and Hitch (1974) model, the phonological loop is the aural context where knowledge is repeated and reinforced. Similarly, Gordon's music learning theory suggests that repetition of a musical selection can lead to audiation of that pattern (Gordon, 2007). Since the recall of academic content increased with the addition of poetry, tonality, and rhythm, it is reasonable to conclude that there is an additional benefit to musical strategies beyond that of repetition.

### Discussion of Research Hypotheses

#### *Interaction*

- H<sub>1</sub>. There is no interaction between ethnicity (African-American, Hispanic, Asian / P. I., and White) and instructional method (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students immediately after treatment.
- H<sub>4</sub>. There is no interaction between ethnicity (African-American, Hispanic, Asian / P. I., and White) and instructional method (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students following a delayed period after treatment.

Hypotheses one and four studied the interaction between the variables of ethnicity and treatment condition. It was determined that there was not significant interaction between treatment group and ethnicity on either the memory test or the retention test. A finding of no interaction means that the variables are acting independently from each other on the dependent variables. This was a desirable outcome because it means that the variables of ethnicity and treatment type were not loaded onto each other.

*Ethnicity.*

The breakdown of students by ethnicity revealed comparable comparisons to the ethnic distribution across the entire school district sampled (see Table 4). In spite of comparable percentages, the sizes of the Asian and Pacific Islander participants was small, with more than half of these participants receiving the chant treatment. The reduction of the alpha value to ( $\alpha = 0.01$ ) increased the scrutiny of the results from that subgroup and makes the calculation of significance more conservative.

H<sub>2</sub>. There will be no significant effect for ethnicity (African-American, Hispanic, Asian / P. I., and White) on an academic memory task in second-grade students immediately after treatment.

A main effect for ethnicity immediately following the treatment was found. On the memory test, post hoc testing revealed that the Asian / P. I. subgroup significantly outperformed all other ethnic subgroups. Though the conservative 0.01 alpha value was used, the higher performance by Asian / P. I. students may be a result of a comparatively small sample of Asian / P. I. students.

What seems clear from the findings on the memory test is that as the complexity of the treatment increases (from poem to chant to melodic rhythm) the performance of all ethnic subgroups increased. The Asian / P. I. population had large increases while the other ethnic groups had smaller increases. Additionally, when comparing the performance of ethnic sub-group means by treatment group over time, it is notable that the mean differences from poem to chant and again from chant to melodic rhythm are greater than any other subgroups. In focus group debriefings, specifically at the chant and melodic rhythm treatment campuses, teachers made comments that the students

challenged themselves to recall more. In a sense, it became a competitive task for some participants. Since the chant treatment had a higher percentage of Asian / P. I. participants, it may be that the performance of Asian / P. I. students was higher due to their competitive spirit.

H<sub>5</sub>. There will be no significant effect for ethnicity (African-American, Hispanic, Asian / P. I., and White) on an academic memory task in second-grade students following a delayed period after treatment.

Again on the retention test, after the delayed period, a main effect for ethnicity was found. Once again, post hoc testing revealed that the Asian / P. I. subgroup significantly outperformed all other ethnic subgroups. However, the fact remains that Asian / P. I. students' performance on the retention test was still significant when compared to the other ethnic subgroups. The retention of information for Asian / P. I. students on the retention test showed a decrease from the memory test that was comparable to the other ethnic groups, but remained significantly higher than the other groups. Though all subgroups showed gains, these findings may indicate a particularly effective strategy for Asian / P. I. students. However, research with a larger Asian / P. I. population would be necessary to draw such a conclusion.

#### *Treatment Type*

The analysis of performance by treatment group revealed differing significance on the memory test and the retention test. It is clear that all groups improved their recall abilities from the pretest to the memory test indicating that all treatments increased students' memory of the content.

H<sub>3</sub>. There will be no significant difference between instructional methods (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students immediately after treatment.

Statistical analysis of the treatment condition revealed significant differences on memory tests due to treatment type. Univariate analyses of the memory test revealed significant difference between the poetic treatment and the melodic rhythm treatment on the memory test. In short, the poetic treatment proved less effective than the melodic rhythm treatment at increasing the recall of academic material. Both the melodic rhythm and rap treatments increased memory significantly more than the poetic treatment but were statistically comparable to each other. All treatment groups performed significantly better than the control group.

H<sub>6</sub>. There will be no significant difference between instructional methods (control, poem, rhythm, melodic rhythm) on an academic memory task in second-grade students following a delayed period after treatment.

As on the memory test, statistical analysis of the treatment condition on the retention test revealed significant differences due to treatment type. Analysis of treatment effects on the retention test revealed significant effect between the control group and all treatment groups. While there was no additional significance, the melodic rhythm was only 0.001 away from significance. Since there was significant difference between the poem and melodic rhythm on the memory test, and the retention test approached significance, the differential between the chant and melodic rhythm treatments suggests that the melodic rhythm is a more effective retention method.

It is notable that with increasing complexity of treatment condition, participants' performance on the recall test improved. This suggests that the addition of chant and melodic rhythm instructional strategies to an academic recall task can significantly improve the ability of students to recall the material. Since the task was a simple recall task, the addition of more stimulating instructional strategies increased the performance of student recall. This finding is consistent with Yerkes and Dodson's (1908) law of arousal and task performance. It also appears that the treatment design did not lead to audiation on any of the treatment conditions. Longer periods of time may be necessary to further evaluate the effects of audiation on retention.

### *Gender*

Though not included in the hypotheses, a review of the data by gender was also conducted. Following exploratory analysis, no interaction between gender and treatment type was found and no main effect was present for the memory test or retention test. On both the poetic treatments and the melodic rhythm treatments the mean scores for girls was higher than the mean scores for boys. Conversely, the boys outperformed the girls on the rap treatment. Gordon (1989) suggests that tonal and rhythmic aptitude function as subdivisions of musical aptitude. Gordon (1989) suggests that it is rare that individuals will have equally strong rhythmic aptitude and tonal aptitude. "If you have a high tonal aptitude, you are probably average or low in rhythm aptitude" (Gordon, 1989, p. 7). This finding suggests that rhythmic strategies may be more successful for boys in second grade while tonal strategies may be more effective for second-grade girls.

By looking at gender within isolated ethnic groups, some differences were identified in the memory recall. For both white and Hispanic students, males had greater

recall on the memory test and retention test than female students. For the Asian / P. I. subgroup, female students slightly outperformed male students on the chant, but the male students overtook them on the melodic rhythm. In spite of these differences, the gaps remained relatively small. The results from African-American students are quite different. On the chant treatment, the male students outscored the female students by almost double the number of items recalled. However, on the melodic rhythm treatment, the female African-American students outscored the males threefold. The African-American male group is the only subgroup, ethnically or by gender, in which the recall on the melodic rhythm was lower than the recall on the chant treatment. This may speak to how African-American males have audiated music from an early age. Just as students from India would have early childhood experiences that make Eastern tonalities familiar and Western tonalities foreign, African-American males may find rap and chant more familiar than melodic styles.

Mathews (2009) discussed the effectiveness of chant and rap instructional strategies in a charter school system that is heavily African-American. This finding suggests that while the chant was an effective strategy for African-American males, the melodic rhythm treatment was substantially more effective for African-American female students. Noting the substantial achievement gap between African-American males and other students (Darling-Hammond, 2010; Organisation for Economic Co-operation and Development, 2011), this difference in performance by African-American males is in need of further exploration. This finding echoes the claims of Mathews (2009) who touts the importance of chant –based strategies in the instructional practices of charter schools that work with substantial African-American male populations.

## Limitations

Some limitations of the current study are related to its design. First, this study cannot fully address causation because it was not fully experimental. Though the quasi-experimental design is an accepted practice in school settings, a fully randomized model would be better to reach causal conclusions (Creswell, 2008). Further, the variables of treatment condition and repetition are intertwined. With this study, it is difficult to know how many times a student repeated the treatment outside of the allocated class time. Participating teachers mentioned hearing students, on occasion, practicing certain treatments outside of the treatment period in their classroom. It is also not clear how the use of other countries' flags in the math class affected student learning. Research on repetition suggests that repetition alone can have a considerable effect (Geake, 2009; Pinker, 1997). Some researchers suggest that music can cause increased repetition because it is pleasurable, but music itself does not contain learning benefits (Pinker, 1997). Efforts were made to eliminate the variable of repetition through the use of the control group and poetic treatments, but it remains a limitation of the research.

An additional limitation is the use of the handout that included the academic content. The use of the handout, though necessary for equalizing the access of all participants to the content and isolating the variables being studied, makes it possible that visual stimulation and the ability to read the content had an effect on the outcome of the results. This limits the ability to conclude that the handout had no effect on the memory recall variables. Yet, all groups had access to the handout, so it might have had an equalizing effect across all treatments, but this study was unable to determine the extent of that effect.

Third, this study was limited to second-grade students in the North Texas area. It should not be assumed that these research results can be generalized to other geographic locations or age groups. Also, all members of this study came from schools with economically disadvantaged populations in the 60 percent to 70 percent range in an urban school district. As a result of geography and socioeconomic status of the participants, the concept of music has a local definition. Had this study taken place in an alternate location such as Mexico or Pakistan, or in an affluent setting, definitions of musical elements would likely differ.

Fourth, while this study deliberately chose students who would have a high musical tolerance, beyond the age of nine, musical preference develops and certainly will have an effect on the generalizability of this study to other age groups. The effect of musical preference on the use of musical instructional strategies is not yet clear, but it is likely that the results will be affected by the additional variable of musical preference.

Finally, the variable of background knowledge of musical elements was not considered as a variable. It is not known how prior experience with singing, instrumental practice, or musical listening may affect the dependent variables included in this research study.

This study represented a sample of students from the participating schools. Approximately 35 percent of students invited gave consent to participate in the study and completed the study. This sample does not represent a majority of the students invited, but this research met the minimum sample sizes for the statistical analysis and is typical response rate for causal-comparative research. Though the study received a medium-sized number of participants (N=139), a fully randomized experiment was conducted



increasing the validity of the findings and the fidelity of the findings over that of a quasi-experiment.

### Implications

This section will discuss implications for this research study. First, potential implications for theory will be discussed. Second, this section will discuss implications for practice.

#### *Implications for Theory*

This study used Gordon's music learning theory to explain how memory might be increased with the addition of rhythmic and musical elements. Music learning theory speculates that patterns of tones and rhythm are equivalent to the words of a language, while meter and tonality are akin to syntax. Repetition of a pattern leads to audiation of that pattern. The fundamental assertion of music learning theory is that in order to give adequate meaning to a piece of music, the listener must be able to audiate that music.

This study showed a significant difference between the effects of the melodic rhythm treatment and the rhythmic treatment and, therefore, suggests that rhythm alone does not lead to audiation. Since the melodic rhythm treatment was a significantly stronger recall tool than the rhythmic or poetic treatment, it appears that rhythm alone did not lead to significant audiation in the timeframe of this study. Audiation of the musical content may require a tonal element in order to increase memory recall. During memory tests, students often recalled countries in clustered groupings reflecting the lyrical patterns within the treatment conditions. A few students gave clustered responses on the chant treatment, but many students responded with clustered responses on the melodic rhythm treatment. This clustered recall may be a way to measure the amount of the

content attributed to audiation. In this study, it is clear that the addition of tonality increased the effectiveness of memory recall. This study suggests that audiation is dependent upon tonal elements. While audiation may include rhythmic elements as well, the interconnectivity of academic content and melodic elements seems dependent upon tonality.

Chapter one discussed the idea of musical aptitude. Musical aptitude is the potential for a child to internalize music, or audiate. Gordon (2007) states that music aptitude is normally distributed across the population and that it occurs prior to age nine. Rhythmic aptitude and tonal aptitude function as subdivisions of musical aptitude. Gordon (1989) suggests that it is rare that individuals will have equally strong rhythmic aptitude and tonal aptitude. “If you have a high tonal aptitude, you are probably average or low in rhythm aptitude” (Gordon, 1989, p. 7). As these tonal and rhythmic aptitudes are formed, children develop a musical vocabulary for the styles and genres they hear most.

Explorations of the data based on gender from this study showed that on the chant treatment males performed better on both recall tests than females. This finding suggests differences in audiation based on gender. Musical audiation may differ by gender. Future studies on audiation should consider more closely the effects of gender on musical audiation. If differences in audiation exist based on gender, then audiation may not be normally distributed as Gordon (1989) states.

#### *Implications for Practice*

The findings of this study have direct implications for educational practitioners in general education settings. This study affirms instruction that intentionally incorporates

musical elements and academic content. In order to increase the background knowledge of students, general education practitioners may incorporate more interconnected musical approaches into traditional classrooms to better engage students and increase memory of prerequisite knowledge. Teachers and school administrators should capitalize on the effects of musically enhanced instructional strategies by incorporating musical and rhythmic approaches with existing curricula. Many of these approaches are common in special education settings and in early childhood settings, but have not manifested in general education settings to the same extent. Amid the decline in the performance of American school children, these strategies applied to general education settings may address the ever-increasing need for engaging instructional methods that maximize student learning.

Research highlighted in chapter one discussed the current achievement gaps in between African-American students and white students, specifically with African-American males. In this study, African-American males were the only subgroup whose mean scores were higher on the chant treatment than on the melodic rhythm treatment. This suggests the idea that African-American males may learn differently than other students. The increased performance using chant/rap strategies affirms Mathews (2009) reports that these strategies are effective in high-minority charter school programs. Perhaps these rap-based instructional strategies provide new avenues to intentionally close achievement gaps and engage the African-American male student. This finding has implications for educational practitioners and for administrators and researchers seeking to close the achievement gaps. Uniquely designed educational strategies that incorporate

chant/rap strategies, can increase achievement more than traditional instructional approaches.

The fact that music has intrinsic aesthetic value should not be overlooked; however, this study suggests that there are opportunities for music teachers to reinforce core academic content through rap and song structures. Elementary and secondary vocal music teachers are prepared to integrate new content with familiar melodies and rhythm accompaniments. Using familiar melodies and rhythmic patterns increases the opportunities for exposure to academic content in music education settings. Educator preparation programs should ensure that students have opportunities to participate in and design interconnected lessons and instruction. One consideration for the enhancement of educator preparation programs would be to increase the focus on cross-curricular lessons and to require prospective educators to develop lessons that utilize interconnected strategies. Not only can cross-curricular designs increase engagement, but this study has shown the potential benefits of these practices.

Current and future educators and educational administrators who are looking to increase the background knowledge of underperforming students would benefit from reviewing this study. Although these results are contained to the memory of second-grade students, applying these same strategies with all general education students may prove productive. Researchers who seek to duplicate this study with other grade levels should give attention to the existing literature on musical preference.

The results of this study confirm that memory of academic material can be affected by the addition of musical elements. For all ethnic groups on a simple memory recall task, the complexity of the treatment (from control, to poem, to chant, to melodic

rhythm) led to increased recall on the memory test. This research lends credence to the idea that interconnected learning strategies can enhance student academic achievement. Using instructional strategies with general education students that incorporate musical elements of rhythm and melody can lead to increased memory which, in turn, can lead to increased learning.

#### Recommendations for Future Research

This study should be replicated with a larger population of second-grade students in order to make generalizations about the effectiveness of rhythm and tonality as instructional strategies for improving academic memory. The target participant group of this study is quite specific. In addition to broadening the sample size with second-grade students, this study should be broadened to different age groups as well. Extending this study into different ages will add to a more complete understanding of how tonality and rhythm affect the recall of memory on academic tasks.

In conducting this study with older children, the issues of musical preference may have an effect on the results of the effectiveness of the strategy used. As an additional recommendation for future research, studies that seek to correlate the effectiveness of musical instructional strategies with the preference of students for particular musical idioms should be considered. Sample research questions to expand on this study might be, “Is rap a more effective strategy with students who profess to like rap?,” or “Do students who grow up in Eastern countries have less success using melodic strategies based in Western tonalities?” Future research may also examine the effect of gender on the effectiveness of musical instructional strategies. While hypotheses for this study did

not involve gender, exploratory analysis of collected data revealed potential differences based on gender.

Additionally, the time of implementation of this and similar treatments should be extended in future research in order to better evaluate the effectiveness of audiation on memory retention. Expanding the treatment to involve implementing multiple sessions per day, extending the overall length of treatment, and extending the time allotted in each treatment session would all add to the body of music cognition research. Identifying the time involved to reach audiation of the melodic or rhythmic material may lead to better understanding about how and when academic recall of material is the most effective.

Finally, in pursuit of the narrowing of the achievement gap, future research should consider how the effect of musical instructional strategies relates to background knowledge and to student achievement. Future research should consider how application of these strategies over extended periods of time may correlate to audiation of the musical strategies and relate to content.

In summation, more research with the general education student population should be done to evaluate the effect of musical instructional strategies on memory of academic content and student achievement. “The appeal of a treatment that is enjoyable, has a very low risk of side effects, and is in most scenarios inexpensive and undeniable” (Rickard et al., 2005, p. 235) may continue to reveal instructional tools that can effect student memory and, in turn, student achievement. Learning strategies that have wide applications in classrooms at any level may lead to increased academic achievement of lower performing students and reductions in achievement gaps of American students.

## Final Thoughts

The purpose of this study was to add to the body of research on music cognition by evaluating the effect of rhythm and melodic rhythm on an academic memory task. To determine the effect of music on memory, Gordon's (1989) music learning theory was presented as a theoretical framework to separate the effects of rhythmic and tonal elements and to present the idea that audiated music allows the individual to access academic content. A need for research that evaluates the effect of musical strategies on memory tasks with general education students was established. This study added to the body of research by researching the integration of musical elements into instructional strategies and evaluating their effects on memory and retention of the content.

While limitations for this study exist, this research has added to the body of knowledge for music cognition and academic instructional strategies. The primary outcome that should not be overlooked is that in a relatively short amount of treatment time, less than one hour total of total treatment time, the rhythmic and melodic rhythm treatments each increased the memory recall of all students groups. Before disaggregating the data, it is clear that these strategies were an efficient and effective way to increase student memory. Reports from the focus groups indicate that these strategies were engaging and enjoyable to students. This study and its findings affirm that this study has an "appeal ... that is enjoyable, has a very low risk of side effects, and is ... inexpensive and undeniable" (Rickard et al., 2005, p. 235).

This study has discussed implications for theory, including raising questions about the influence of ethnicity and gender on audiation. While this study confirms that repetition of a musical pattern can lead to audiation of that pattern, differences do exist

based on gender and ethnicity. Asian / P. I. students performed at the highest level throughout this study, perhaps due to a competitive spirit. Boys performed higher on the chant while girls performed more successfully on the melodic rhythm. The findings of this study suggest that audiation may occur differently in boys and girls in second-grade.

This study has also discussed implications for practice. Using these strategies provides the opportunity for cross-curricular support of all students through interconnected learning strategies. These strategies already exist in special education and early childhood settings. They will likely find similar success in general education settings beyond early childhood as well. This study has also identified unique differences by both gender and ethnicity. These ethnic and gender differences inform practitioners of how certain strategies will effect certain groups of students. As with all instructional strategies, on-size-fits-all strategies are not always effective. Practitioners should use this study and others to determine which musically enhanced instructional strategies are most effective for the makeup of individual classrooms.

Properly applied to classroom settings, the incorporation of these musically enriched instructional strategies can increase foundational background knowledge of all students. Increasing the background knowledge of students more adequately prepares them for the learning in classroom settings. Increasing background knowledge provides one avenue to increase student performance and close academic achievement gaps. This researcher hopes that researchers and practitioners alike continue to explore the nexus and relationships of musical instructional strategies and student achievement. There is much to learn.



## Appendix A

“The Countries” handout for the pilot study

## Appendix A

“The Countries” handout for the pilot study

### The Countries

We’re gonna’ learn some countries today.  
We’re gonna’ learn some countries today.  
All around the world, we’re gonna’ learn some countries today.

China, Indonesia, and the Phillipines, too  
Thailand, Myanmar, Afghanistan, Peru  
Tanzania, France, Colombia, Germany, too.

Yemen, Romania and Italy  
North Korea, South Korea, make seventeen  
Pakistan, Iran, and Gobble-Gobble-Gobble, Turkey.

We’re gonna’ learn some countries today.  
We’re gonna’ learn some countries today.  
All around the world, we’re gonna’ learn some countries today.

Ghana, Nigeria, Brazil, Japan  
Venezuela, Bangladesh, I’m getting a tan  
Malaysia, Australia, Congo, and the Sudan

Poland, Colombia, Kenya, and Spain,  
Uganda, Morocco, Nepal, Ukraine,  
Mexico, Egypt, and the USA.

We’re gonna’ learn some countries today.  
We’re gonna’ learn some countries today.  
All around the world, we’re gonna’ learn some countries today.

## Appendix B

“The Countries” handout for the main study

## Appendix B

“The Countries” handout for the main study

### The Countries

We’re gonna’ learn some countries today.  
We’re gonna’ learn some countries today.  
All around the world, we’re gonna’ learn some countries today.

China, Indonesia, and the Phillipines, too  
Thailand, Myanmar, Afghanistan, Peru  
Tanzania, France, Algeria, Germany, too.

We’re gonna’ learn some countries today.  
We’re gonna’ learn some countries today.  
All around the world, we’re gonna’ learn some countries today.

Ghana, Nigeria, Brazil, Japan  
Venezuela, Bangladesh, I’m getting a tan  
Malaysia, Australia, Congo, and the Sudan

We’re gonna’ learn some countries today.  
We’re gonna’ learn some countries today.  
All around the world, we’re gonna’ learn some countries today.

Poland, Colombia, Kenya, and Spain,  
Uganda, Morocco, Nepal, Ukraine,  
Mexico, Egypt, and the USA.

We’re gonna’ learn some countries today.  
We’re gonna’ learn some countries today.  
All around the world, we’re gonna’ learn some countries today.

Appendix C  
The Rhythmic Treatment

Appendix C

The Rhythmic Treatment

**The Countries**

Score

Rhythm Treatment

Varnell & Stein

Chorus

We're gon-na learn some coun-tries to-day \_\_\_\_ We're gon-na

5

learn some coun-tries to-day. \_\_\_\_ All a-round the world we're gon-na

8

learn some coun-tries to-day. \_\_\_\_ Verse #1  
Chi-na, In-do-nes-ia, and the

12

Phil-lip pines too. Thai land, My-an-mar, Af-ghan-is-ta. Pe-ru, Tan-za-ni-a, France Al-

16

ger-i-a, Ger-man-y too. \_\_\_\_ Chorus  
We're gon-na learn some coun-tires to-day. \_\_\_\_

20

\_\_\_\_ We're gon na learn some coun tries to-day. \_\_\_\_ All a-round the world we're gon-na

24

learn some coun-tries to-day. \_\_\_\_ Verse #2  
Gha-na, Ni-ger-i-a, Bra-

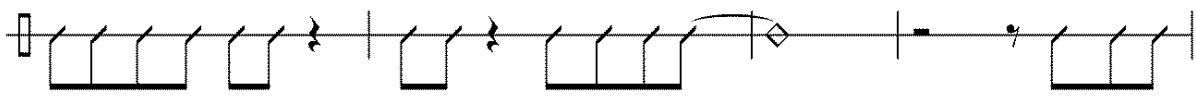
28

zil, and Ja - pan. Ven-e-zue-la, Bang-la-desh, I'm get-ting a tan. \_\_\_\_ May -

The Countries

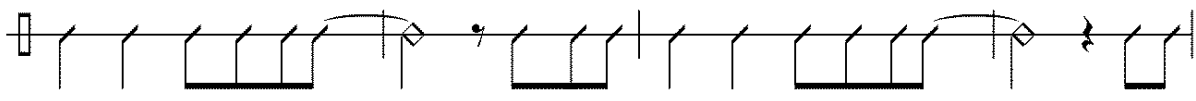
2

31 Chorus



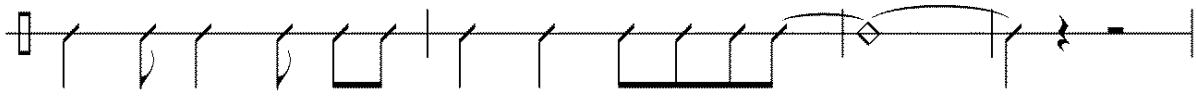
lay-sia and Aus-tra-lia Con-go and the Su-dan. \_\_\_\_\_ We're gon-na

35



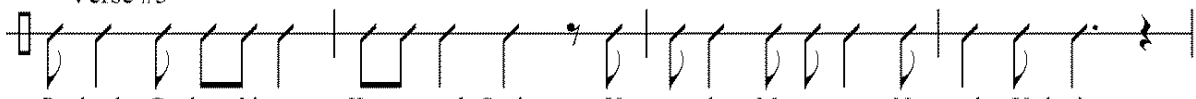
learn some coun-tires to-day. \_\_\_\_\_ We're gon na learn some coun-tries to-day. \_\_\_\_\_ All a-

39




round the world we're gon-na learn some coun-tries to-day. \_\_\_\_\_

43 Verse #3



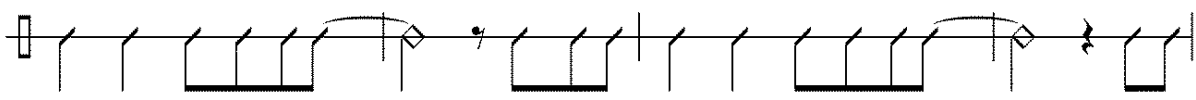
Po-land, Co-lom-bi-a Ken-ya and Spain, U-gan-da, Mo-roc-co, Ne-pal, U-kraine,

47 Chorus



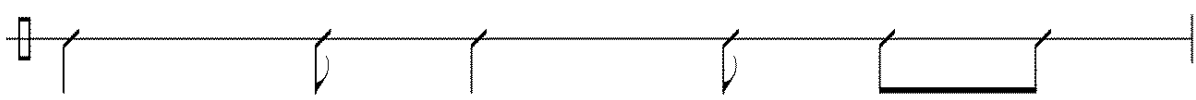
Mex-i-co, E-gypt and the U. S. A. We're gon-na

51



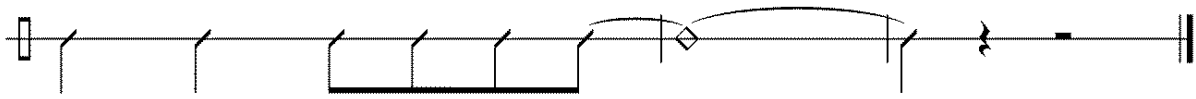
learn some coun-tires to-day. \_\_\_\_\_ We're gon na learn some coun-tries to-day. \_\_\_\_\_ All a-

55



round the world we're gon - na

56



learn some coun-tries to-day. \_\_\_\_\_

## Appendix D

### The Melodic Rhythm Treatment



Appendix D

The Melodic Rhythm treatment

# The Countries

Score

Melodic Rhythm Treatment

Varnell & Stein

Swing ♩ = 96

Chorus

Voice: We're gon na learn some coun tries to-day We're gon na

Guitar: D D D DMaj7

5

Voice: learn some coun-tries to - day. All a - round the world we're gon - na

Guitar: G G Emin

8 Verse #!

Voice: learn some coun-tries to - day. Chi-na, In - do-nes-ia, and the

Guitar: A7 D D D

12

Voice: Phil lip pines too. Thai land, My-an-mar, Af - ghan-is-ta, Pe - ru, Tan-za ni - a, France Al-

Guitar: DMaj7 G G Emin

The Countries

2

16 Chorus

ger-i - a, Ger-man-y too. We're gon-na learn some coun-tires to-day.

A7 D D D

20

We're gon-na learn some coun-tries to-day. All a -

DMaj7 G G

23

round the world we're gon-na learn some coun-tries to-day.

E min A7 D D

27 Verse #2

Gha-na, Ni-ger - i - a, Bra-zil, and Ja - pan. Ven-e zue - la, Bang-la-desh, I'm

D DMaj7 G

30

get-ting a tan. May-lay-sia and Aus-tra-lia Con-go and the Su-dan.

G E min A7 D

34 Chorus

We're gon - na learn some coun - tires to - day. We're gon - na

D D DMaj7

37

learn some coun - tries to - day. All a - round the world we're gon - na

G G Emin

40 Verse #3

learn some coun - tries to - day. Po - land, Co - lom - bi - a

A7 D D D

44

Ken ya and Spain, U - gan da, Mo - roc - co, Ne pal, U - kraine, Mex - i - co, E - gypt and the

D G G Emin

48

U. S. A. We're gon - na learn some coun - tires to - day.

A7 D D D

The Countries

4

52

We're gon - na learn some coun - tries to - day. All a -

DMaj7 G G

55

round the world we're gon - na

E min

56

learn some coun - tries to - day.

A7 D D

Appendix E  
Recording Sheet

Appendix E

Recording Sheet

Recording Sheet

This recording sheet will be used for pretest, posttest, and final posttest. The experimenter will take each participant to a location within the school convenient for the host campus. The interview will consist of one question asked in a one-on-one setting.

The experimenter will ask the following question for the pretest, posttest, and final posttest.

The recorder will identify each participant by asking their name, their grade, and acquiring their ethnicity and gender.

Participant Number \_\_\_\_\_ Campus \_\_\_\_\_

Gender \_\_\_\_\_ Ethnicity \_\_\_\_\_

*“There are a lot of countries in this world. We live in the United States. Some people call it America. How many other countries can you name?”*

Pretest Responses

Date Given \_\_\_\_\_

Participant Name \_\_\_\_\_ Campus \_\_\_\_\_

Afghanistan		Egypt		Mexico		Spain	
Algeria		France		Morocco		Sudan	
Australia		Germany		Myanmar		Tanzania	
Bangladesh		Ghana		Nepal		Thailand	
Brazil		Indonesia		Nigeria		Uganda	
China		Japan		Peru		Ukraine	
Colombia		Kenya		Phillipines		Venezuela	
Congo		Malaysia		Poland			

Participant Number \_\_\_\_\_

Posttest responses

Date Given \_\_\_\_\_

Afghanistan		Egypt		Mexico		Spain	
Algeria		France		Morocco		Sudan	
Australia		Germany		Myanmar		Tanzania	
Bangladesh		Ghana		Nepal		Thailand	
Brazil		Indonesia		Nigeria		Uganda	
China		Japan		Peru		Ukraine	
Colombia		Kenya		Phillipines		Venezuela	
Congo		Malaysia		Poland			

Final Posttest Responses

Date Given \_\_\_\_\_

Afghanistan		Egypt		Mexico		Spain	
Algeria		France		Morocco		Sudan	
Australia		Germany		Myanmar		Tanzania	
Bangladesh		Ghana		Nepal		Thailand	
Brazil		Indonesia		Nigeria		Uganda	
China		Japan		Peru		Ukraine	
Colombia		Kenya		Phillipines		Venezuela	
Congo		Malaysia		Poland			

## Appendix F

### The Research Description for Parents - English



## Appendix F

### The Research Description for Parents – English

#### A study of academic memory

Your child is invited to participate in a research study. The purpose of this study is to better understand how different strategies can be used to increase academic achievement.

This research is being conducted by AISD Principal, Matt Varnell (Ph. D. student at the University of Texas at Arlington in Arlington, TX). As a musician and educator, Mr. Varnell is interested in the use of strategies which increase educational achievement in all academic areas.

Your child is being asked to participate in a brief activity that will take place in his/her homeroom class. Different learning strategies will be used in an effort to identify if any or all of them help.

Your child's name, gender, and ethnicity will be collected in this process in order to match the pretest and posttests. However, following the study, all names will be eliminated.

If you have any questions regarding this study, please email Matt Varnell at [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com).

If you would agree to your child's participation in this study, please sign consent on the attached form giving permission. Your child will sign as well.

Thank you for your participation in this research study,

Matt Varnell  
Principal, Sherrod Elementary  
Ph.D. Student at U.T. Arlington

## TITLE OF PROJECT – Music and Recall

### PRINCIPAL INVESTIGATOR

Matt Varnell - Ph.D. student in K-16 Educational Leadership and Policy Studies, College of Education and Health Professions.  
Home Phone – 817-868-9286  
Cell Phone – 817-980-2811  
Email – [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com)

### FACULTY ADVISOR

Dr. Barbara Tobolowsky – Professor in K-16 Educational Leadership and Policy Studies, College of Education and Health Professions.  
Office – Trimble Hall, Room 103G  
Office Phone Number - 817-272-7269  
Email – [tobolow@uta.edu](mailto:tobolow@uta.edu)

### INTRODUCTION

Your child is being asked to participate in a research study about academic memory. Participation in this research study is voluntary. Choosing not to participate in this study will involve no penalty or loss of benefits to which your child is entitled. You or your child may stop participating in the study at any time. If you have any questions regarding this study at any time, please feel free to ask. The purpose of this research study is to look at the role of memory in learning. Participation in this study will be over a 6 week time period. The number of anticipated participants in this portion of the research study is 500.

### PROCEDURES

Prior to the in-class practice sessions, students will work with the researcher to identify what knowledge they have about world geography. Students will identify their name, age, ethnicity, and gender. This will be one-on-one with Mr. Matt Varnell, a principal in the Arlington ISD. This session will last no longer than 10 minutes. Over three weeks, the class will do an activity in class. Following the class activities, Mr. Varnell will review their knowledge of world geography. After a three week time period with no practice sessions, the students will review the information about world geography to consider their retention of information.

### POSSIBLE BENEFITS

It is my hope that the information gathered will be used to study how music might be used as a tool to improve upon traditional learning strategies for all children. There are no perceived risks or discomforts for participating in this research study. Should your child experience any discomfort please inform the researcher, your child has the right to quit any study procedures at any time at no consequence.

## CONFIDENTIALITY

While student names and ethnicities will be collected during this study, once all forms are completed, names will be blacked out from participants' response forms. Student names will be replaced by unique numbers to identify each participant. Every attempt will be made to see that your child's study results are kept confidential. A copy of this signed consent form and the survey responses from this study will be stored in a locked office on UTA premises for at least three (3) years after the end of this research. The results of this study may be published and/or presented at meetings without naming your child as a participant. Additional research studies could evolve from the information your child has provided, but your child's information will not be linked to your child in anyway; it will be anonymous. Although your child's rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the UTA Institutional Review Board (IRB), and personnel particular to this research have access to the study records. Your child's records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above. The IRB at UTA has reviewed and approved this study and the information within this consent form. If in the unlikely event it becomes necessary for the Institutional Review Board to review your child's research records, the University of Texas at Arlington will protect the confidentiality of those records to the extent permitted by law.

## CONTACT FOR QUESTIONS

Questions about this research study may be directed to Matt Varnell, researcher, at [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com), or Barbara Tobolowsky, Ph.D., at [tobolow@uta.edu](mailto:tobolow@uta.edu). Any questions you may have about your rights as a research participant or a research-related injury may be directed to the Office of Research Administration; Regulatory Services at 817-272-2723 or [regulatoryservices@uta.edu](mailto:regulatoryservices@uta.edu).

## Appendix G

### The Research Description for Parents - Spanish

## Appendix G

### The Research Description for Parents – Spanish

#### Un estudio de la memoria académica

Su niño está invitado a participar en un estudio de investigación. El propósito de este estudio es para entender mejor cómo las diferentes estrategias se pueden utilizar para aumentar el logro académico.

Esta investigación está siendo realizada por el director de AISD, Matt Varnell (Ph. D. estudiante de la Universidad de Texas en Arlington en Arlington, TX). Como músico y educador, el Sr. Varnell está interesado en el uso de estrategias que aumenten el rendimiento escolar en todas las áreas académicas.

Su hijo está siendo invitado a participar en una actividad breve que tendrá lugar en su clase. Diferentes estrategias de aprendizaje se utilizará en un esfuerzo por identificar si alguno de ellos o todos ayudar.

El nombre de su hijo, el género y la etnia se recogerán en este proceso a fin de que coincida con el una prueba antes y otra después de la actividad. Sin embargo, ya que termine el estudio, todos los nombres de los participantes serán eliminados. Si usted tiene alguna pregunta con respecto a este estudio, por favor mande un correo electrónico a Matt Varnell [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com).

Si usted está de acuerdo en que su hijo participe en este estudio, por favor firme el consentimiento en el formulario adjunto dando permiso. Su hijo firmará también.

Gracias por su participación en este estudio de investigación,

Matt Varnell  
Principal, Sherrod Elementary  
Ph.D. Student at U.T. Arlington

## TÍTULO DEL PROYECTO - Música y Recall

### INVESTIGADOR PRINCIPAL

Matt Varnell - Ph.D. estudiante en K-16  
Liderazgo Educativo y Estudios de  
Políticas, Facultad de Educación y  
Profesiones de la Salud.  
Teléfono de la casa – 817-868-9286  
Teléfono celular – 817-980-2811  
Email – [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com)

### FACULTAD DE ASESORÍA

Dr. Barbara Tobolowsky – Profesor en  
K-16 Liderazgo Educativo y Estudios  
Políticos de la Facultad de Educación y  
Profesiones de la Salud.  
Oficina – Trimble Hall, Room 103G  
Teléfono de la oficina - 817-272-7269  
Email – [tobolow@uta.edu](mailto:tobolow@uta.edu)

### INTRODUCCIÓN

Su hijo está siendo invitado a participar en un estudio de investigación sobre la memoria académica. La participación en este estudio de investigación es voluntaria. La elección de no participar en este estudio implica ninguna sanción o pérdida de beneficios a los que tiene derecho su hijo. Usted o su hijo puede dejar de participar en el estudio en cualquier momento. Si usted tiene alguna pregunta acerca de este estudio en cualquier momento, por favor, no dude en preguntar. El propósito de este estudio de investigación es examinar el conexión entre la memoria y el aprendizaje. La participación en este estudio será durante un periodo de tiempo de 6 semanas. El número de participantes previstos en esta parte del estudio de investigación es 500.

### PROCEDIMIENTOS

Antes de las sesiones de práctica en clase, los estudiantes trabajarán con el investigador para identificar cuáles son los conocimientos que tienen sobre la geografía del mundo. Los alumnos podrán identificar su nombre, edad, etnia y género. Este será uno-a-uno con el Sr. Matt Varnell, un director en el Distrito Escolar Independiente de Arlington. Esta sesión tendrá una duración de no más de 10 minutos. Durante tres semanas, la clase practicará una actividad en clase. Después de las actividades de la clase, el Sr. Varnell revisará su conocimiento de la geografía del mundo. Después de un período de tiempo de tres semanas sin sesiones de práctica, los estudiantes revisarán la información sobre la geografía del mundo a considerar la retención de información.

## POSIBLES BENEFICIOS

Es mi esperanza que la información recopilada se utilizará para estudiar cómo la música puede ser utilizada como una herramienta para mejorar las estrategias tradicionales de aprendizaje para todos los niños. No existen riesgos o molestias percibidas por participar en este estudio de investigación. Si su hijo experimenta cualquier molestia por favor informe al investigador, su hijo tiene derecho a salir de todos los procedimientos del estudio en cualquier momento sin consecuencias.

## CONFIDENCIALIDAD

Mientras que los nombres de estudiantes y grupos étnicos serán recogidos durante este estudio, una vez que se hayan completado todas las formas, los nombres serán oscurecidas de formularios de respuesta de los participantes. Nombres de los estudiantes se sustituye por números únicos para identificar a cada participante. Cada intento será hecho para ver que los resultados de su hijo de estudio son confidenciales. Una copia de este formulario de consentimiento firmado y las respuestas a la encuesta de este estudio se almacenará en una oficina cerrada en las instalaciones de UTA por lo menos tres (3) años después del final de esta investigación. Los resultados de este estudio pueden ser publicados y / o presentados en congresos sin nombrar a su hijo como participante. Otros estudios de investigación podrían evolucionar a partir de la información que su hijo ha proporcionado, pero la información de su hijo no estará vinculado a su hijo de cualquier manera, sino que será anónimo. Aunque los derechos del niño y de la intimidad se mantiene, el Secretario del Departamento de Salud y Servicios Humanos, la UTA Junta de Revisión Institucional (IRB), y personal propios de esta investigación tienen acceso a los registros del estudio. Los registros de su hijo se mantendrá completamente confidencial de acuerdo con las normas legales vigentes. No se revelará menos que sea requerido por la ley, o como se ha señalado anteriormente. La IRB en UTA ha revisado y aprobado el estudio y la información en este formulario de consentimiento. Si en el improbable caso de que sea necesario para que la Junta de Revisión Institucional de revisar los registros de su hijo de investigación, la Universidad de Texas en Arlington protegerá la confidencialidad de los registros en la medida permitida por la ley.

## CONTACTO PARA CONSULTAS

Preguntas acerca de este estudio de investigación se pueden dirigir a Matt Varnell, investigador, en [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com), o Barbara Tobolowsky, Ph.D., en [tobolow@uta.edu](mailto:tobolow@uta.edu).

Cualquier pregunta que usted pueda tener acerca de sus derechos como participante en una investigación o una lesión relacionada con la investigación se pueden dirigir a la Oficina de Investigación de la Administración, Servicios Regulatorios en 817-272-2723 o [regulatoryservices@uta.edu](mailto:regulatoryservices@uta.edu).

## Appendix H

### The Research Description for Parents – Vietnamese



## Appendix H

### The Research Description for Parents – Vietnamese

#### Research Description for Music and Recall Study

##### Nghiên cứu về trí nhớ học vấn (A study of academic memory)

Con em quý vị đang được mời tham dự vào một cuộc nghiên cứu với mục đích tìm hiểu thêm về cách ứng dụng những phương pháp khác nhau để làm gia tăng thành tích học tập.

Cuộc nghiên cứu này do một vị hiệu trưởng thuộc Nha Học Chánh Arlington, ông Matt Varnell, (sinh viên Tiến Sĩ tại University of Texas at Arlington, thành phố Arlington, TX) thực hiện. Là một nhạc sĩ và cũng là một nhà giáo, ông Varnell quan tâm đến việc áp dụng các phương pháp làm gia tăng thành tích học tập trong mọi lãnh vực về giáo dục.

Con em quý vị được yêu cầu tham dự một buổi sinh hoạt ngắn hạn ngay trong lớp học đầu ngày (homeroom class). Những phương pháp giáo dục khác nhau sẽ được áp dụng với nỗ lực tìm hiểu xem một hoặc tất cả các phương pháp trên đều có hiệu quả.

Tên họ, giới tính, và sắc tộc của con em quý vị sẽ được thu thập trong cuộc nghiên cứu này để khỏi lẫn lộn những bài trả lời trước và sau cuộc nghiên cứu của từng học viên. Sau cuộc nghiên cứu, tất cả tên họ của người tham dự sẽ được xóa bỏ.

Nếu quý vị có thắc mắc gì về cuộc nghiên cứu này, xin gởi điện thư cho Matt Varnell tại [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com).

**Nếu quý vị đồng ý cho con em tham dự cuộc nghiên cứu này, xin ký vào mẫu cho phép kèm theo đây. Con em quý vị cũng cần ký tên.**

Cảm ơn quý vị đã tham gia vào cuộc nghiên cứu này.

Matt Varnell  
Hiệu Trưởng, Trường Tiểu Học Sherrod  
Sinh Viên Tiến Sĩ tại U.T. Arlington

**TITLE OF PROJECT – Music and Recall**

IRB Approval Date:

1

IRB Expiration Date:

## Research Description for Music and Recall Study

### NGƯỜI NGHIÊN CỨU CHÍNH

Matt Varnell - Ph.D. student in K-16 Educational Leadership and Policy Studies, College of Education and Health Professions.  
Home Phone – 817-868-9286  
Cell Phone – 817-980-2811  
Email – [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com)

### CÓ VẤN CỦA KHOA

Dr. Barbara Tobolowsky– Professor in K-16 Educational Leadership and Policy Studies, College of Education and Health Professions.  
Office – Trimble Hall, Room 103G  
Office Phone Number - 817-272-7269  
Email – [tobolow@uta.edu](mailto:tobolow@uta.edu)

### LỜI GIỚI THIỆU (INTRODUCTION)

Con em quý vị được mời tham gia một cuộc nghiên cứu về trí nhớ trong việc học tập. Đây là một sự tham gia có tính cách tự nguyện. Quyết định không tham gia vào cuộc nghiên cứu này sẽ không bị khiển trách hoặc mất quyền lợi mà con em quý vị đang thụ hưởng. Quý vị hoặc con em có thể ngưng tham gia cuộc nghiên cứu này bất cứ lúc nào. Bất cứ lúc nào quý vị có thắc mắc gì liên quan đến cuộc nghiên cứu này, xin cứ hỏi tự nhiên. Mục đích của cuộc nghiên cứu này là để tìm hiểu vai trò của trí nhớ trong vấn đề học tập. Cuộc nghiên cứu này sẽ kéo dài khoảng trên 6 tuần lễ với số tham dự viên phỏng đoán chừng 500 người.

### THỦ TỤC (PROCEDURES)

Trước buổi thực hành trong lớp, học viên sẽ tiếp xúc với nhà nghiên cứu để xác định kiến thức của họ về địa dư thế giới. Học viên sẽ khai tên họ, tuổi, chủng tộc và giới tính của mình. Thủ tục này chỉ được một mình ông Matt Varnell, hiệu trưởng thuộc NHC Arlington, thực hiện trên căn bản mặt đối mặt với học sinh mà thôi, và chỉ kéo dài không quá 10 phút. Sau ba tuần lễ, học viên sẽ bắt đầu các sinh hoạt trong lớp. Sau những loạt sinh hoạt trong lớp đó, ông Varnell sẽ tái xét kiến thức của họ về địa dư thế giới. Sau một thời gian ba tuần không có những buổi thực hành, học viên sẽ tái xét các tin tức địa dư thế giới để quyết định khả năng tiếp nhận mà họ đã thu thập được.

### NHỮNG LỢI ÍCH CÓ THỂ ĐƯỢC (POSSIBLE BENEFITS)

Tôi hy vọng rằng những tin tức thu thập được trong cuộc nghiên cứu này sẽ được áp dụng để tìm hiểu cách làm thế nào để áp dụng âm nhạc như một phương tiện có thể cải thiện những phương pháp học tập truyền thống cho tất cả trẻ em học sinh. Sẽ không có bất cứ một sự rủi ro hay khó chịu nào trong khi tham gia cuộc nghiên cứu này. Cho nên nếu con em quý vị cảm thấy không thoải mái, xin thông báo ngay cho người thực hiện cuộc nghiên cứu, và con em quý vị có quyền ngưng tham gia mà không bị hậu quả nào cả.

## Research Description for Music and Recall Study

### **SỰ BẢO MẬT (CONFIDENTIALITY)**

Như trên đã, nói, trong khi tên và chủng tộc của học sinh sẽ được thu thập trong cuộc khảo cứu, một khi tất cả các hồ sơ đã được hoàn tất, tên học sinh sẽ được bôi đen trên các mẫu trả lời của học sinh, và thay thế vào đó là một con số duy nhất để nhận diện những học sinh tham gia cuộc nghiên cứu. Mọi cố gắng sẽ được thực hiện để bảo đảm rằng kết quả cuộc khảo cứu của con em quý vị sẽ được bảo mật. Mẫu thỏa thuận có chữ ký của quý vị và con em và những câu trả lời về cuộc khảo cứu sẽ được lưu trữ trong một văn phòng được khóa kín tại trường UTA trong thời gian ít nhất là ba (3) năm sau khi kết thúc cuộc khảo cứu. Kết quả của cuộc khảo cứu này có thể sẽ được công bố và/hoặc được trình bày tại các buổi hội thảo nhưng sẽ không nêu tên con em quý vị là người tham gia. Từ ý kiến do con em quý vị cung cấp, nhiều cuộc nghiên cứu khác có thể sẽ được thực hiện nhưng tuyệt đối những tin tức ấy sẽ không liên can gì đến con em quý vị trong mọi lãnh vực, tên con em quý vị sẽ được dấu kín. Mặc dù quyền riêng tư của con em quý vị vẫn được duy trì, Bộ Trưởng Bộ Y Tế và Nhân Sự (Secretary of the Department of Health and Human Services), Ủy Ban Tái Xét UTA (UTA Institutional Review Board (IRB)) và nhân viên đặc trách cuộc nghiên cứu này vẫn có thể tiếp cận với hồ sơ của cuộc nghiên cứu. Hồ sơ cá nhân của con em quý vị sẽ được hoàn toàn bảo mật theo sự đòi hỏi pháp lý hiện hành và chỉ được tiết lộ khi có án lệnh, hoặc trong trường hợp đã được nói đến ở trên. Văn phòng IRB của UTA đã duyệt xét và chấp thuận cuộc nghiên cứu này cũng như nội dung của bản thỏa thuận. Nếu như trong trường hợp bất khả kháng Ủy Ban Tái Xét cần tái xét hồ sơ nghiên cứu của con em quý vị, University of Texas at Arlington sẽ bảo đảm tối đa sự bảo mật của những hồ sơ ấy trong phạm vi luật định.

### **LIÊN LẠC KHI CÓ THẮC MẮC (CONTACT FOR QUESTIONS)**

Thắc mắc về cuộc nghiên cứu này có thể gửi đến ông Matt Varnell, người nghiên cứu, tại [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com), hoặc Barbara Tobolowsky, Ph.D., tại [tobolow@uta.edu](mailto:tobolow@uta.edu). Mọi thắc mắc về quyền hạn của quý vị trong tư cách một người tham gia hoặc về sự tổn thương có liên quan đến cuộc nghiên cứu có thể liên lạc với Văn Phòng Nghiên Cứu Hành Chánh; Cơ Quan Đặc Trách tại 817-272-2723 hoặc [regulatoryservices@uta.edu](mailto:regulatoryservices@uta.edu).

Appendix I

Informed Consent - English

Appendix I

Informed Consent - English

**APPROVED**

JAN 11 2013

MAR 11 2014

**INFORMED CONSENT**

Institutional Review Board

You are being asked to take part in a study. This study is looking at the way students remember information. Mr. Varnell, principal at Sherrod Elementary, is working on his doctoral degree. Mr. Varnell wants to know how different activities affect memory.

In your homeroom class, you will do an activity to learn something new. A few times a week, your teacher will repeat the activity. Mr. Varnell will work with you to see what you have learned. You will answer a few questions with Mr. Varnell on three different days. Mr. Varnell will not be giving grades.

If you have any questions, you can call Mr. Varnell (682) 867-3700, or email Mr. Varnell at [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com). If you agree to take part in this study, please sign this form and get your parents to sign as well.

**As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:**

\_\_\_\_\_  
MATT VARNELL, PRINCIPAL INVESTIGATOR

\_\_\_\_\_  
DATE

**ASSENT**

By signing, you, you are stating that you have read this paper or someone read it to you. You understand that the purpose of this study is to learn more about how memory affects learning. You have been given the opportunity to ask questions before you sign, and you can choose to stop participating at any time. Since you are under 18, your parents have also agreed that you can participate.

You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights. If you choose not to participate, that is OK. You may stop participating at any time without penalty or loss of benefits, to which you are otherwise entitled.

\_\_\_\_\_  
SIGNATURE OF MINOR STUDENT

\_\_\_\_\_  
DATE

\_\_\_\_\_  
SIGNATURE OF PARENT/LEGAL GUARDIAN

\_\_\_\_\_  
DATE

Appendix J

Informed Consent - Spanish

Appendix J

Informed Consent – Spanish

JAN 11 2013 **APPROVED**  
MAR 11 2014

**CONSENTIMIENTO INFORMADO**

Institutional Review Board

Se te pide participar en un estudio. Este estudio analiza la manera en como los estudiantes recuerdan información. Sr. Varnell, director de la Escuela Primaria Sherrod, está estudiando para su doctorado. Sr. Varnell quiere saber cómo las diferentes actividades afectan a la memoria.

En la clase de aula, van a hacer una actividad para aprender algo nuevo. Un par de veces a la semana, su maestro/a les va a repetir la actividad. Sr. Varnell trabajará contigo para ver lo que has aprendido. Vas a responder a algunas preguntas con el Sr. Varnell en tres días diferentes. Sr. Varnell no va a calificar tus respuestas.

Si tienes alguna pregunta, puedes llamar al Sr. Varnell (682) 867-3700, o por correo electrónico al Sr. Varnell en mattvarnell@hotmail.com. Si aceptas participar en este estudio, por favor firma este formulario y tus padres también firmen.

**Como representante de este estudio, he explicado el propósito, los procedimientos, los beneficios y los riesgos que están involucrados en este estudio de investigación:**

\_\_\_\_\_  
MATT VARNELL, INVESTIGADOR PRINCIPAL

\_\_\_\_\_  
FECHA

**CONSENTIMIENTO**

Al firmar, usted está indicando que ha leído este documento o que alguien se lo leó a usted. Usted entiende que el propósito de este estudio es aprender cómo la memoria afecta el aprendizaje. Se le ha dado la oportunidad de hacer preguntas antes de firmar, y usted puede elegir dejar de participar en cualquier momento. Dado que usted es menor de 18 años, sus padres también han acordado que puedes participar.

Usted acepta voluntariamente participar en este estudio. Al firmar este formulario, usted no renuncia a ninguno de sus derechos legales. Si decide no participar, está bien. Usted puede dejar de participar en cualquier momento sin sanción o pérdida de beneficios, a los que tiene derecho.

\_\_\_\_\_  
FIRMA DEL ESTUDIANTE MENOR DE EDAD

\_\_\_\_\_  
FECHA

\_\_\_\_\_  
FIRMA DEL PADRE / TUTOR LEGAL

\_\_\_\_\_  
FECHA

Appendix K

Informed Consent – Vietnamese



## Appendix K

### Informed Consent – Vietnamese

JAN 11 2013

**APPROVED**

MAR 11 2014

#### THÔNG BÁO SỰ CHẤP THUẬN (INFORMED CONSENT)

Institutional Review Board

Các bạn đang được yêu cầu tham dự vào một cuộc khảo sát nhằm tìm hiểu những phương pháp học sinh ghi nhớ bài học do Ông Varnell, hiệu trưởng trường Tiểu Học Sherrod đang chuẩn bị lấy văn bằng Tiến Sĩ, thực hiện. Ông Varnell muốn biết làm thế nào các sinh hoạt khác nhau ảnh hưởng đến trí nhớ của học viên.

Trong lớp học đầu ngày (homeroom class), các bạn sẽ học một phương pháp mới để ghi nhớ bài vở. Một vài lần trong tuần, giáo sư phụ trách lớp sẽ lặp lại những phương pháp đó. Ông Varnell sẽ tiếp xúc với các bạn để xem bạn đã học được những gì. Bạn sẽ trả lời một vài câu hỏi của ông Varnell trong ba ngày khác nhau. Ông Varnell sẽ không chấm điểm các bạn

Nếu các bạn có thắc mắc gì, xin gọi ông Varnell tại (682) 867-3700, hoặc gửi điện thư cho ông tại [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com). Nếu bạn đồng ý tham gia vào cuộc khảo sát này, hãy ký mẫu thỏa thuận dưới đây, đồng thời phụ huynh các bạn cũng phải ký vào.

Là đại diện cho cuộc khảo sát này, tôi đã giải thích mục đích, thủ tục, lợi ích cũng như những điều bất tiện liên quan đến cuộc khảo sát này:

\_\_\_\_\_  
MATT VARNELL, PRINCIPAL INVESTIGATOR

\_\_\_\_\_  
NGÀY (DATE)

#### SỰ THỎA THUẬN (ASSENT)

Bằng chữ ký này, bạn, chính bạn xác nhận rằng bạn đã đọc văn bản này hoặc đã có người đọc cho bạn hiểu. Bạn hiểu rõ mục đích của cuộc khảo sát này là để tìm hiểu thêm về trí nhớ ảnh hưởng đến khả năng học tập như thế nào. Bạn đã có cơ hội đặt câu hỏi trước khi ký tên và bạn có quyền quyết định ngưng tham gia vào bất cứ lúc nào. Vì bạn dưới 18 tuổi, bạn cần có sự chấp thuận của phụ huynh.

Bạn tự nguyện đồng ý tham gia vào cuộc khảo sát này. Khi ký văn bản này, bạn không phải từ bỏ bất cứ quyền lợi pháp lý nào của mình. Nếu bạn chọn không tham gia, cũng OK. Bạn có quyền ngưng tham gia bất cứ lúc nào và sẽ không bị phạt hoặc mất quyền lợi mà bạn có quyền thụ hưởng.

\_\_\_\_\_  
CHỮ KÝ HỌC SINH VỊ THÀNH NIÊN

\_\_\_\_\_  
NGÀY KÝ (DATE)

\_\_\_\_\_  
CHỮ KÝ PHỤ HUYNH/GIÁM HỘ PHÁP LÝ

\_\_\_\_\_  
NGÀY KÝ (DATE)

Appendix L

Treatment Instructions for Teachers

## Appendix L

### Treatment Instructions for Teachers

#### Music and Recall Teacher Instructions

Thank you for participating in this research study. For this study, it is important that each teacher follow the directions precisely so that we will know all students have received the same exact instructions. The time period for this treatment will 3 weeks (January 21<sup>st</sup> –February 8<sup>th</sup>). There should be 12 sessions occurring on Tuesday, Wednesday, Thursday, and Friday morning of each week.

During the treatment, each teacher will read the scripted introduction verbatim and play the recorded treatment. For consistency, please do not participate with the students. This will make sure that your participation does not influence the outcome. During the treatment, make sure to stay positive, but do not use any extreme expressions or gestures that will influence student's opinion of the exercise.

For the treatment, please make sure to pass out a copy of the page "The Countries." If students lose their sheet, please make sure to replace it before their session each day. This will ensure that all students have the words in front of them for each session. For each session, please read the scripted introduction below and then play the recording from your school computer using the speakers that Matt Varnell has provided for you. If students have questions about the material, you should change the subject and refocus the class on the next objective without answering the question yet still acknowledging the child's interest. It will again be important that all teachers involved in this study are following the same procedures so that student comparisons will be fair.

## Music and Recall Teacher Instructions for Sessions

### SESSION 1 –January 22, 2013

The session should occur between 8:30 a.m. and 9:30 a.m. First pass out the “The countries” handout to the class. Next, read the following statement, verbatim: *“Boys and girls, for the next few weeks we are going to learn the names of some countries. You have just received a copy of the words we will be using to remember the names of a few different countries. We are going to use a recording to help us practice learning the names of some countries. Let’s listen to the recording once.”* The teacher will play the recording once using their school computer and the speakers provided by Mr. Varnell. After the recording stops, then continue reading, *“Now let’s try it together. Please join the recording this time. I know we are just learning, so do your best.”* Play the recording a second time. This time, students will join the recording, reciting the poem, chanting with the recording, or singing along. When the recording stops, say *“Good job, everyone. We will continue to work on this for a few weeks. Now, take your handout and put it in a safe place.”*

### SESSION 2 – January 23, 2013

The session should occur between 8:30 a.m. and 9:30 a.m. Make sure every child has their handout, “The countries”. If they do not have it, please give them an additional copy. Next, read the following statement, verbatim: *“Boys and girls, remember yesterday, we practiced saying our countries along with the recording. You listened to the recording once and then we practiced together. Today we are only going to listen one time. Please join along with the recording, as I play it. Remember to do your best.* The teacher will play the recording once using their school computer and the speakers provided by Mr. Varnell. Once the recording has ended and the session is complete, say, *“Good job, everyone. We will continue to work on this. Now, take your handout and put it in a safe place.”*

## Music and Recall Teacher Instructions for Sessions

SESSIONS 3-12 - (January 24, 25, 29, 30, 31, February 1, 5, 6, 7, 8)

The session should occur between 8:30 a.m. and 9:30 a.m. Make sure every child has their handout, "The countries". If they do not have it, please give them an additional copy. Next, read the following statement, verbatim: "*It is time to practice our countries. Once everyone has their paper out, I will begin the recording. Remember to do your best.*" The teacher will play the recording once using their school computer and the speakers provided by Mr. Varnell. Once the recording has ended and the session is complete, say, "*Good job, everyone. Please put your handout back in a safe place.*"

Appendix M

Focus Group Informed Consent

Appendix M

Focus Group Informed Consent

JAN 11 2013

**APPROVED**

MAR 11 2014

INFORMED CONSENT

Focus Groups

Institutional Review Board

You are being asked to take part in a study. This study is looking at the way students remember information. Mr. Varnell, principal at Sherrod Elementary, is working on his doctoral degree. Mr. Varnell wants to know how different activities affect memory.

In order to better understand the student participation in the study, you are being asked to participate in a focus group. The focus group will last no longer than 90 minutes.

Your identity will remain confidential.

If you have any questions, you can call Mr. Varnell (682) 867-3700, or email Mr. Varnell at [mattvarnell@hotmail.com](mailto:mattvarnell@hotmail.com). If you agree to take part in this study, please sign this form and get your parents to sign as well.

**As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:**

\_\_\_\_\_  
MATT VARNELL, PRINCIPAL INVESTIGATOR

\_\_\_\_\_  
DATE

**CONSENT**

By signing below, you confirm that you are 18 years of age or older and have read or had this document read to you. You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time.

You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or loss of benefits, to which you are otherwise entitled.

\_\_\_\_\_  
SIGNATURE OF VOLUNTEER

\_\_\_\_\_  
DATE

Appendix N  
Focus Group Protocol



Appendix N

Focus Group Protocol

Music and Recall Protocol for Teacher Interviews  
Matt Varnell – Interviewer

How did the students respond to the activity they used to learn the countries?

- *Did they participate?*
- *Did they enjoy the exercises? ...and how do you know?*
- *What behaviors did you observe during the sessions?*

What do you think made the difference in the students' learning?

- *Did the repetition make a difference?*
- *Did the music / chant / poem make a difference?*

Were there any factors that could have affected the students' ability to retain the information?

- *Was there anything that happened outside the music / chant / poem sessions that might have affected the performance of the students?*
- *Were there any reports of kids using the music / chant / or poem beyond the sessions? If so, what were the reports?*
- *Can you give an example?*

Did the students' use of the word sheet throughout the sessions change?

Is there anything else you would like to share?

Appendix O

University of Texas at Arlington IRB Approval

## Appendix O

### University of Texas Arlington IRB Approval



Matthew Varnell  
Dr. Barbara Tobolowsky  
Educational Leadership and Policy Studies  
Box 19575

January 29, 2013

#### EXPEDITED APPROVAL OF HUMAN SUBJECT RESEARCH

Office of Research  
Administration  
Box 19188  
202 E. Border St., Suite 214  
Arlington, Texas  
76019-0188

T 817.272.3723  
F 817.272.1111  
<http://www.uta.edu/research>  
[Expertise at UT Arlington](http://www.uta.edu/expertise)  
<http://www.uta.edu/expertise>

**IRB No.:** 2013-0159  
**TITLE:** *Music and Recall*  
**Effective Date:** January 11, 2013  
**Expiration Date:** January 11, 2014

**Approved Number of Participants: 530 (Do not exceed without prior IRB approval).**

The University of Texas Arlington Institutional Review Board (UTA IRB) has made the determination that this research protocol involving human subjects is eligible for expedited review in accordance with Title 45 CFR 46.110(a)-(b)(1), 63 FR 60364 and 63 FR 60353, Category (7). The IRB Chairman (or designee) approved this protocol on January 11, 2013. IRB approval for the research shall continue until January 11, 2014.

#### APPROVED NUMBER OF PARTICIPANTS:

This protocol has been approved for enrollment of a maximum of **530** participants and is not to exceed this number. If additional data are needed, the researcher must submit a modification request to increase the number of approved participants **before** the additional data are collected. Exceeding the number of approved participants is considered an issue of non-compliance and will result in the destruction of the data collected beyond the approval number and will be subject to deliberation set forth by the IRB.

#### INFORMED CONSENT DOCUMENT:

The IRB approved and stamped informed consent document (ICD) showing the approval and expiration date must be used when prospectively enrolling volunteer participants into the study. The use of a copy of any consent form on which the IRB-stamped approval and expiration dates are not visible, or are replaced by typescript or handwriting, is prohibited. The signed consent forms must be securely maintained on the UT Arlington campus for the duration of the study plus a minimum of three years after the completion of all study procedures (including data analysis). The complete study record is subject to inspection and/or audit during this time period by entities including but not limited to the UT Arlington IRB, Regulatory Services staff, OHRP, and by study sponsors (if the study is funded).

#### MODIFICATION TO AN APPROVED PROTOCOL:

Pursuant to Title 45 CFR 46.103(b)(4)(iii), investigators are required to, "promptly report to the IRB any proposed changes in the research activity, and to ensure that such changes in approved research, during the period for which IRB approval has already been given, are **not initiated without prior IRB review and approval** except when necessary to eliminate apparent immediate hazards to the subject." Modifications include but are not limited to: Changes in protocol personnel, number of approved participants, and/or updates to the protocol procedures or instruments and must be submitted via the electronic submission system. Failure to obtain approval for modifications is considered an issue of non-compliance and will be subject to review and deliberation by the IRB which could result in the suspension/termination of the protocol.

BoA/Mark

**ANNUAL CONTINUING REVIEW:**

In order for the research to continue beyond the first year, a Continuing Review must be completed via the online submission system within 30 days preceding the date of expiration indicated above. A reminder notice will be forwarded to the attention of the Principal Investigator (PI) 30 days prior to the expiration date. Continuing review of the protocol serves as a progress report and provides the researcher with an opportunity to make updates to the originally approved protocol. Failure to obtain approval for a continuing review will result in automatic *expiration of the protocol* all activities involving human subjects must cease immediately. The research will not be allowed to commence by any protocol personnel until a new protocol has been submitted, reviewed, and approved by the IRB. Per federal regulations and UTA's Federalwide Assurance (FWA), there are no exceptions and no extensions of approval granted by the IRB. The continuation of study procedures after the expiration of a protocol is considered to be an issue of non-compliance and a violation of federal regulations. Such violations could result in termination of external and University funding and/or disciplinary action.

**ADVERSE EVENTS:**

Please be advised that as the principal investigator, you are required to report local adverse (unanticipated) events to The UT Arlington Office of Research Administration; Regulatory Services within 24 hours of the occurrence or upon acknowledgement of the occurrence.

**HUMAN SUBJECTS TRAINING:**

All investigators and key personnel identified in the protocol must have documented Human Subjects Protection (HSP) training or CITI Training on file with The UT Arlington Office of Research Administration; Regulatory Services. Completion certificates are valid for 2 years from completion date.

**COLLABORATION:**

If applicable, approval by the appropriate authority at a collaborating facility is required prior to subject enrollment. If the collaborating facility is *engaged in the research*, an OHRP approved Federalwide Assurance (FWA) may be required for the facility (prior to their participation in research-related activities). To determine whether the collaborating facility is engaged in research, go to: <http://www.hhs.gov/ohrp/humansubjects/assurance/engage.htm>

**CONTACT FOR QUESTIONS:**

The UT Arlington Office of Research Administration; Regulatory Services appreciates your continuing commitment to the protection of human research subjects. Should you have questions or require further assistance, please contact Robin Dickey by calling 817-272-9329.

Sincerely,

  
Maria Martinez Cosio  
Associate Professor  
UT Arlington IRB Chair

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Matt Varnell graduated from The University of Texas at Arlington in 1998 with a Bachelor's of Music degree including a focus on Jazz Studies. In 1998, he completed a second Bachelor's of Music degree focused on Music Education. After teaching middle school band for several years, he completed a Master's of Education in K-16 Educational Leadership and Policy Studies. Matt completed his PhD in K-16 Educational Leadership and Policy Studies from the University of Texas at Arlington on 2013. He is currently an elementary principal in a North Texas are school district. His research interests include educational achievement, fine arts instructional strategies, and cognitive neuroscience. He plans to continue his educational leadership as a practitioner and a researcher, seeking to gain academic achievement through the use of the integration of fine arts with the general curriculum.