

THE RELATIONSHIP BETWEEN MUSIC PARTICIPATION AND MATHEMATICS  
ACHIEVEMENT IN MIDDLE SCHOOL STUDENTS

by

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Liberty University

A Dissertation Presented in Partial Fulfillment  
Of the Requirements for the Degree  
Doctor of Education

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ABSTRACT

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A comparative analysis was used to study the results from a descriptive survey of selected middle school students in Grades 6, 7, and 8. Student responses to the survey tool was used to compare multiple variables of music participation and duration of various musical activities, such as singing and performing on instruments, to the mathematics results from Georgia Criterion-Referenced Competency Test (Georgia Department of Education, 2011). The results were analyzed with the use of the Pearson  $r$  correlation coefficient. The intensity of relationships was assessed with analysis of variance (ANOVA). A final  $t$ -test of means was conducted to compare the mathematics achievement of students, who reported that they participated in musical activities vs. students, who reported no participation in musical activities. It was found that there was a positive correlation between students' participation in music and their achievement in mathematics. In addition, there was a positive correlation between the variables of participation in vocal music and brass music, respectively, and mathematics achievement. The greatest correlation was between years of vocal music participation and mathematics achievement. The results from the ANOVA indicated that, when students participated in music for 3 years or more, there was a significant increase in mathematics scores. A final  $t$ -test of means indicated that there was no significant difference in the means of

mathematics scores between students who had participated in musical activities in comparison to students who did not participate in musical activities.

Descriptors: Relationship, Music, Music Participation, Academic Achievement, Mathematics Achievement, Musical Intelligence, Economically Disadvantaged

## **DEDICATION**

This work is dedicated to my bride, Rachael Boyd. She supported me and worked hard behind the scenes to allow me the freedom to complete my work. She helped me every step of the way through ideas, encouragement, and undying love. The Bible in the book of Proverbs describes her best:

An excellent wife who can find? She is far more precious than jewels. The heart of her husband trusts in her, and he will have no lack of gain. She does him good, and not harm, all the days of her life. (Proverbs 30:10-12)

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I would also like to thank Dr. Leonard Parker, Dr. Joan Fitzpatrick, and Dr. Laurie Barron for serving as my dissertation committee and mentors through the dissertation process. Their wealth of knowledge, never ending prayers, and unwavering support served to guide and encourage me.

I am blessed to come from a great family that loves and supports each other, My father is a minister, my mother an educator, my brother a Chef, and my sister a counselor, and all have carried me at some point in this process. In a world that is constantly redefining family, I am thankful to be a part of a traditional family, one where God, country, and family come first. The Bible has a great passage that reminds me of my family:

And now these three remain: faith, hope and love. But the greatest of these is love. (I Corinthians 13:13)

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## CHAPTER ONE: INTRODUCTION

As citizens of the United States continue to suffer through economic turmoil, many are concerned that the arts may be the first programs in the public school to lose funding (Buchanan, 2008). The intention of the lawmakers under the Elementary and Secondary Education Act (ESEA), commonly known as No Child Left Behind (NCLB; U.S. Department of Education [USDOE], 2010), was to require the use of high stakes testing in the core academic areas. Under the ESEA, the lawmakers acknowledged that the arts are a core subject, yet they did not require a measure of testing accountability. Therefore, in the NCLB, there is no assurance that all students have equal access to the arts as a part of a well-rounded education. In many situations, arts programs, such as music, are poorly funded. This can be detrimental to U.S. students, because participation in these programs is vital to the development of language and listening skills and are important to a student's academic growth (Miche, 2002).

To counter this trend, many organizations have been formed to protect the arts in public schools. Organizations, such as Americans for the Arts, the National Association for Music Education, and the Music Teachers National Association, consist of members, whose goal is to advocate and defend the presence of music in schools as well as the advancement of the arts in U.S. culture as a whole (Buchanan, 2008). As reported by Foran (2009), some members of the medical community recognize the profound effect that music has on children and their ability to memorize and recall information. Furthermore, the presence of music can aid in the transfer of information from one hemisphere of the brain to the other (Stein, 2004). When students perform music, it has

been found that the brain synapses fire at a much faster rate (Hall, 2007). However, the presence of music affects more than the speed of synapse firing in the brain. The longer a student plays an instrument, the brain assigns more of the cortex to the control of the motor movements of the tips of the fingers and wrist (Strickland, 2002). This type of exposure to music can notably assist in the development of spatial reasoning, which can be transferred to mathematical understanding (Shaw, 2003; Strickland). Since it has been found (Hall, 2007; Shaw; Stein; Strickland) that the presence of music has positive effects on the brain, it is likely that it can have a positive affect on students' academic achievement. For this reason, it is important for researchers to be aware of the relationship between a student's level of participation in music and academic achievement.

## **Background**

National lawmakers designed the Elementary and Secondary Education Act (ESEA; USDOE, 2010) in order to require accountability of local school districts to demonstrate adequate yearly progress (AYP) in the academic areas of: (a) reading, (b) English, (c) language arts, and (d) mathematics. There is a demonstration of AYP, when students show growth in the academic areas tested. As a further statute of this law, school staff must look at test scores for individual subgroups such as: (a) Black, (b) White, (c) special education, and (d) economically disadvantaged students (USDOE). This requirement has placed a huge burden on school officials as they seek to close the achievement gaps in the respective subgroups while they work with limited school budgets.

Currently, many school officials put much of their resources into programs that are intended to increase student test scores in the ESEA (USDOE, 2010) content areas (Buchanan, 2008). Buchanan reported that the original draft of the ESEA, which was signed into law in 2001, caused many school administrators to narrowly focus only on subjects that were given high-stakes accountability measures. These high-stakes accountability measures are still included in the 2010 revision of ESEA (USDOE, 2010). This emphasis on fiscal responsibility has placed the arts under careful scrutiny as district officials are forced to decide which programs are essential to the development of a better academic student vs. those programs that serve secondary functions such as social or fun purposes (Buchanan). Although the arts are specifically noted as part of the ESEA core content, there is no evaluation component in the requirements. This lack of an objective accountability measure may cause district administrator to overlook the importance of the arts in education.

If school district officials make decisions to decrease funding for arts programs in order to allow more seat time to the ESEA (USDOE, 2010) test-required subjects, students may be deprived of music as a critical component of the improvement of academic achievement (Huber, 2009). The presence of and access to music benefits many types of students (Pica, 2009). According to Daniel (2006), participation in music participation can have numerous positive effects on subgroups of students, who traditionally do not perform well in an academic setting. Often, being involved in arts programs helps students, who would struggle academically, to outperform their peers.

According to several theories (Cox, 2006; Gardner, 1993; Hanna, 2007) of learning, there may be a connection between music participation and mathematics

achievement for middle school students. Gardner (1993), in his theory of Multiple Intelligences (MI), indicated that students have an innately preferred learning style, and among those is musical intelligence. Musical intelligence is most important, because it is considered to be related to all eight of the known intelligences. The idea that musical intelligence is related to other forms of intelligence seems to support the work of Cox (2006) and Shaw (2003), who demonstrated that music is related to spatial and temporal reasoning. Furthermore, creativity, a key component of music, is the highest form of cognitive processing (Hanna, 2007). Since participation in music is centered in the process of creativity, the act of music creation may guide a student into a higher cognitive level of processing information, which could have positive effects on academic achievement. The Bible states, in the book of Colossians, that music should be used as a tool to impart wisdom:

Let the message of Christ dwell among you richly as you teach and admonish one another with all wisdom through psalms, hymns, and songs from the Spirit, singing to God with gratitude in your hearts. (Colossians 3:16)

The ability of the student to utilize higher order thinking skills, as a result of music participation, may have a positive benefit in the mathematics classroom.

### **Problem Statement**

Much research has been conducted in order to examine the relationship between music participation and increased academic performance for elementary and high school students (Catterall, 2011; National Association for Music Education, 2007). However, there is a gap in the literature in regard to the effects of music participation on middle school students; specifically, there are few empirical studies. Furthermore, typically, the



focus of these few studies have been in regard to its effect on English language arts (Angle, 2002; Huber, 2009). Angle included mathematics and science with English in his study of music electives and eighth grade achievement. However, studies, which are specific to the relationship between mathematics achievement and music participation in Grades 6-8, are scarce. Since mathematics is also a required testing subject under ESEA (U.S. Department of Education, 2010), it is important to determine whether a relationship exists between music participation and mathematics achievement in middle grade students, Grades 6-8.

Researchers (Angle, 2002; Cox, 2006; Fitzpatrick, 2006; Gadberry, 2010; Olson, 2012), who examined the relationship between students' academic achievement and music participation, found a relationship between music participation and increased standardized test scores. In some of these studies (Angle; Cox; Fitzpatrick), the authors found a relationship between mathematics achievement and music participation. However, little research has been conducted to investigate the nature and intensity of the relationship between mathematics achievement and music participation in middle school students. This researcher examined the relationship between active music participation and mathematics achievement in middle school students.

### **Purpose Statement**

A positive relationship has been observed between music participation and increased English language arts test scores (Angle, 2002; Huber, 2009). This relationship may exist because music is an intelligence that incorporates and increases learning in other intelligences (Gardner, 1993). Many aspects of musical intelligence are found in other intelligences. For example, logical and spatial awareness are involved in music

intelligence and, also, they are their own independent forms of intelligence, which are important in mathematics processing (Cox, 2006; Shaw, 2003). Since participation in music increases spatial awareness, it may have a positive relationship with mathematics achievement.

The purpose of this research study was to study the relationship between music participation and mathematics achievement in middle school students. Likely, educators can benefit from knowledge about the effect of music participation, which may be an integral component for students who perform poorly in mathematics. Also, members of school boards will benefit from this knowledge as it relates to their financial accountability to their respective communities. Understanding the relationship between ]music participation and mathematics achievement can help administrators make important decisions related to support services and funding for music programs.

### **Research Questions and Null Hypothesis**

RQ1. Is there a relationship between the study of music and mathematics achievement in middle school students?

H<sub>0</sub>1. There is no significant correlation between the number of years a student has been involved in music participation as shown by the Music Participation Questionnaire (MPQ) and mathematics achievement as indicated by the Georgia Criterion Referenced Competency Test (CRCT; Georgia Department of Education [GaDOE], 2011).

RQ2. What is the nature of the relationship between the study of music and mathematics achievement in middle school students?

H<sub>0</sub>2. There is no significant correlation between years of music participation in

instrumental performance as determined by the MPQ and mathematics achievement in middle school students as determined by the the Georgia mathematics CRCT (GaDOE, 2011).

H<sub>03</sub>. There is no significant correlation between the number of years middle school students participate in vocal performance as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2001).

H<sub>04</sub>. There is no significant correlation between the number of years a student participates in brass performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

H<sub>05</sub>. There is no significant correlation between the number of years a student participates in percussion performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

H<sub>06</sub>. There is no significant correlation between the number of years a student participates in woodwind performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

RQ3. What is the intensity of the relationship between the study of music and mathematics achievement in middle school students?

H<sub>07</sub>. There is no significant difference in the means of students who have participated in music for zero years, 1-2 years, or 3 or more years as determined by

theMPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2011).

RQ4. Is there a difference in mathematics achievement between middle school students who have participated in music in comparison to middle school students who have not participated in music?

H<sub>0</sub>8. There is no significant difference in the means of students who have participated in music in comparison to students who have not participated in music as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2011).

### **Definitions**

*Achievement:* a measurement based on the quantifiable results of what the student knows.

*Active participation:* a gauge of participation that is determined according to a student's regular participation and frequently scheduled activity in a specified area.

*Brass Performance:* the result of music learning that includes simultaneous demonstration of the acquired musical skills of notation, rhythm, harmony, pitch, communication, and motor skills through performance with use of a brass instruments as the primary instrument.

*Correlation coefficient:* a number between -1.00 and +1.00 that indicates whether, and to what degree, a relationship exists between two or more variables. For example, a correlation coefficient of .00 indicates no relationship between the variables. Coefficients near -1.00 imply a negative relationship, while coefficients near +1 imply a positive relationship. As one variable increases, the other decreases.

*Georgia Criterion Referenced Competency Test (CRCT; GaDOE, 2011):* test used in State of Georgia to measure how well a student acquires skills and knowledge in specific content areas.

*Economically Disadvantaged:* students who have qualified, under federal guidelines, to receive free or reduced lunch.

*Intensity:* strength of a relationship as it changes over time.

*Mathematics Achievement:* attainment of a score that falls within an acceptable range or it meets or exceeds the required category on the state mandated CRCT (GaDOE, 2011) mathematics examination.

*Middle School:* Grades 6, 7, and 8, as designated in this school system.

*Multiple Intelligence (MI):* as described by Gardner (1993), it is the seven forms of intelligence that all humans use to acquire information and view the world.

*Musical Intelligences:* as described by Gardner (1993), musical intelligence is a form of acquiring information that is based in right brain processing in which a person perceives the world and acquires information through music.

*Music:* the art of creating sound in meter that expresses ideas and emotions stylistically through the elements of rhythm, melody, pitch, harmony, and color with the use of tools such as: (a) brass instruments, (b) percussion instruments, (c) woodwind instruments, (d) the piano, and (e) the voice.

*Music Performance:* the result of music learning that includes simultaneous demonstration of acquired musical skills of: (a) notation, (b) rhythm, (c) harmony, (d) pitch, (e) communication, and (f) motor skills through the production of music.

*Pearson r*: also known as the product moment correlation coefficient; a technique used when two variables, which are to be correlated, are expressed in terms of ratio. This is the most appropriate method to measure the linear dependence of two variables.

*Percussion Performance*: the result of music learning that includes simultaneous demonstration of the acquired musical skills of: (a) notation, (b) rhythm, (c) harmony, (d) pitch, (e) communication, and (f) motor skills through performing using percussion instruments as the primary instrument.

*Performance*: see music performance.

*Piano Performance*: the result of music learning that includes simultaneous demonstration of the acquired musical skills of: (a) notation, (b) rhythm, (c) harmony, (d) pitch, (e) communication, (f) and (g) motor skills through performing using a piano as the primary instrument.

*Statistical Program for the Social Sciences (SPSS; IBM, 2011)*: computer software which is used to perform numerous functions to help professionals in the fields of: (a) social sciences, (b) business, and (c) statistics understand and interpret data.

*Standard Deviation*: a number that serves as an indicator of how spread out a specific set of information is from the mean of the total scores. Standard deviation measures the distance of a point from the mean score.

*Vocal Performance*: the result of music learning that includes simultaneous demonstration of the acquired musical skills of: (a) notation, (b) rhythm, (c) harmony, (d) pitch, (e) communication, and (f) motor skills through performing using the voice as the primary instrument.

*Woodwind Performance:* the result of music learning that includes simultaneous demonstration of the acquired musical skills of: (a) notation, (b) rhythm, (c) harmony, (d) pitch, (e) communication, and (f) motor skills through performing using woodwind instruments as the primary instrument.

## **Chapter Summary**

Many people in the U.S. are concerned that tough economic circumstances may force school officials to decrease funding to arts programs (Buchanan, 2008). As a response to these concerns, many play active roles in their advocacy for the survival of arts programs. Lawmakers designated arts programs, such as music, as having an important role in U.S. education; however, they did not create a measure of accountability under the ESEA (USDOE, 2010). For this reason, school officials, when faced with tight budgets, often choose to redistribute money from the arts programs to other academic programs that were given a testing mandate (Buchanan). However, this could be detrimental to students' arts programs, particularly music, which may have positive effects on students (Pica, 2009). In many cases, music programs have positive effects on students who do not traditionally perform well in the classroom (Daniel, 2006). Since theories of learning (Gardner, 1993; Hanna, 2007) and brain based medical research (Cox, 2007; Shaw, 2003) support the notion that music may have a positive effect on the cognitive ability of a student, this study was conducted in order to understand whether a relationship exists between music participation and academic achievement.

Presented in Chapter 2 is the review of the literature, which is focused on how music can be used to assist learners in the current modern classroom. Furthermore, music

will be considered as it relates to many forms of learning theory such as Experiential Learning theory (Dewey, 1938), and MI theory (Gardner, 1993), as well as how it assists with higher order thinking (Bloom et al., 1954). Each of these areas are discussed in detail as they relate specifically to the needs of middle school students. Finally, previous research is presented to describe the gap in the literature for which this author sought to bridge.



## CHAPTER TWO: LITERATURE REVIEW

### Introduction

According to Buchanan (2008), many people consider that music education is an important part of the curriculum in the United States. Members of the U.S. Congress confirmed this importance in the public schools, when they included music in the *core curriculum* under the Elementary and Secondary Education Act (ESEA; USDOE, 2010). However, in the ESEA, although high stakes testing components were linked to other subjects, no measure of accountability was assigned to the arts. This lack of accountability has caused the arts to be examined under a “microscope” (Buchanan, p. 36) of public scrutiny. Unfortunately, it is difficult for school administrators to determine the value of music programs, since they fall outside the realm of standardized testing (Hanna, 2007). This lack of understanding as to how participation in the arts positively affects a student’s academic achievement has caused school system officials to marginalize the importance of music and arts education in the classroom (Buchanan).

What school officials should consider is that intelligence consists of seven basic types (Gardner, 1993), with which humans are innately born. Furthermore, the presence of musical intelligence directly influences and engages many of the other forms of intelligence simultaneously. The ability of music to influence other intelligences leads one to believe that students, who participate in music, may score higher on standardized tests than students who do not regularly participate in music.

There are several reasons why students, who participate in music, score higher on achievement tests (Bicknell, 2009; Covino, 2002). When students are engaged in music, they are able to process information on a higher cognitive level. Similarly, when students

are engaged in both concrete and abstract reasoning at an early age, they are better able to develop and implement a sound moral and ethical framework (Bicknell). Covino (2002) reported that the findings from brain science have shown that students, who are engaged in music production, are better able to use all regions of the brain simultaneously. Certain physical parts of the brain are found to be larger in people, who participate in music production. Simpson (2010) and Fitzpatrick (2006), respectively, provided empirical evidence that, when students with disabilities and those, who are economically disadvantaged, are engaged in music participation, they show greater academic gains than students who are not engaged in music. Also, Huber (2009) found a relationship between middle school students and their English Language Arts scores. However, only two studies (Angle, 2002; Fitzpatrick, 2006) were found, in which there was a relationship between middle school students' participation and mathematics achievement; therefore, there was a need for this study to be conducted.

## **Background**

Use of the traditional approach of teaching has not been effective for all students, which is clearly indicated by the 50% dropout rate in the U.S. (Snyder, 1999). Even though many students, who leave school, will still go on to obtain some form of degree later in life, many of them do not (USDOE, 2010). The status dropout rate is the percentage of students 16-24 years of age, who dropped out of the educational system and never returned to complete any secondary education program. As of 2009, that rate was still 8.1% of all U.S. youth, and more than 43.5% of those students were members of a minority group (USDOE, 2010). As, increasingly, there are more members of U.S.

communities, who lack sufficient educational credentials, there is a void of economic growth and trained talent (Adelman, 2011).

Also, the problems of the U.S. education system are evident in the number of schools, whose staff fail to meet expectations; however, there is no consensus among lawmakers as to how to effectively solve this dilemma (Adelman, 2011). Staff of the U.S. Department of Education (USDOE) (2008) reported that there were 10,676 schools in 2006, which were designated as “needing improvement,” and 2,302 schools, which “needed additional restructuring” (para. 4). The ESEA (2001, as cited in USDOE, 2010) is used by lawmakers to hold school officials accountable for failures, such as underperforming subgroups and dropout rates.

The ability of a school system to survive is largely based on the ability of the staff to identify student challenges and their capacity to meet those challenges (Adelman, 2011). However, there is no clear way to solve the issues that face educators. Today, a large issue in the classroom is student motivation. In consideration of student motivation, the ability of the school system to succeed is largely based on school officials’ ability to bring resources together and use them in a way that matches the motivation of the students. A possible reason, why many school systems are identified as failing, is because their administrators’ resources are stretched thin, and they have become unable to respond to the demands of student motivation.

In addition, there is the issue of ethics and values in the public classroom. Since 1999, there has been an increase in the number of students between the ages of 12-18 who have experienced a violent attack at school rather than at home (USDOE, 2010). Between July 1, 2009 and June 20, 2010, there were 33 school-associated violent deaths

in U.S. public schools. Also, there is a new threat of cyber-bullying, which has affected 6% of U.S. students. These issues of violence and school safety are important because they directly affect the learning of a student. If a student does not feel safe, it is difficult for him or her to focus on academic achievement.

Educators in the U.S. are feeling the effects of increased accountability in a world of increased problems. According to Amrein-Beardsley (2010), this is obvious, in that, a number of teachers have felt so overwhelmed by the requirements that they made the poor ethical decision to cheat on high stakes testing. As lawmakers increase the penalties for low performing scores, many educators feel as if they have no choice but to cheat. Also, the line between what is cheating and what is acceptable has become blurred. In some situations, such as the officials at the Delaware Department of Education, data coaches have been hired and paid as much as \$100,000 per year to help students increase their standardized test scores so that teachers can receive increased performance compensation. While this may not be considered cheating by some, it does establish the fact that school officials are highly concerned and involved with the academic progress of students.

In response to the problems of the educational system, the members of the federal government have established four possible solutions (Adelman, 2011). First is the transformation model, this is when state officials become involved, and they: (a) fire the principal, (b) strengthen staffing, (c) implement research-based instructional programming, (d) extend learning time, and (e) implement new governance. Next, there is the turnaround model. In the turnaround model, the principal is replaced, no more than 50% of the school staff are rehired, and efforts are made to implement research-based

instructional programming and new school governance. Then, there is the restart model, in which underperforming schools are converted or closed. Subsequently, they are reopened under new management by a charter operator or other management organization. The fourth solution is the school closure model, in which the school is closed, and students are enrolled in nearby schools that perform better. The problem with this solution is that many communities do not have the additional education leaders or teachers to re-staff and revamp underperforming schools. To put it simply, there are not large pools of highly qualified teachers and leaders in every city in the U.S.

The solution for the issues in the educational system is not an easy one to solve; however, these issues have been present in the U.S. for generations. While, historically, many forms of educational reform have been visible, Experiential education (Dewey, 1938) has been widely accepted as a means by which any student can acquire knowledge (Russell, 1998). As school officials begin the search for programs that support academic achievement and student motivation, they should explore how the use of earlier programs can serve the experience and knowledge of the individual student (Roberts, 2003).

As demonstrated by Gardner (1999), all students do not think and learn in the same way; it is clear that learning would be improved, when individual differences are acknowledged. Education reformers have long argued that the use of traditional education approaches were not effective with every student, because the focus was only on the needs of the teacher and not the needs of the students. In response to this premise, Dewey (1938) developed the Experiential model. A central idea, upon which Experiential learning is based, is that imagination is the key to increasing the capacity to acquire information. The use of imagination and real world context are the keys to

unlocking memory and a child's educational potential. Reflective thinking is an important part of the development of the social mind (Dewey; Russell, 1998). Children are interested in experimentation, not to solve problems, but rather to establish cause and effect relationships (Dewey). Early implementers of the Experiential movement recognized that reflective thinking occurs because the child willingly employs deeper thought and age appropriate metacognition (Russell). According to one researcher (Roberts, 2003), reflective thinking is the close study "into facts, or scrutiny and revision of evidence, of working out the implications of various hypotheses, and of comparing these theoretical results with one another with known facts" (para. 27). When students participate in experiential activities, they have the opportunity to: (a) establish hypotheses based on established facts, (b) test these hypotheses, and (c) then consider how the results supported or rejected their hypothesis.

To this end, the role of the educator is to help students acquire knowledge through experimentation with ideas encompassed in their own understanding of the world. (Dewey, 1938). Central to the philosophy of Experiential education philosophy is the idea that all learning occurs within the social context (Dewey; Roberts, 2003). Experiential learning takes place in seven areas (Dewey; Roberts, 2003). For learning to occur at its maximum potential, an educational intervention must meet the demands of the seven areas. The first area is social environment. Students live in a world surrounded by people and other objects that provide them with their own unique human experience. Therefore, learning is a part of the social process (Dewey).

The second area is knowledge, because knowledge is an essential part of Experiential learning (Dewey, 1938). Specifically, one must focus on how students

acquire knowledge (Roberts, 2003), because this is what students learn from their experiences. In order to increase the intake of knowledge for the student, one must provide meaningful experiences for the student. Students find meaning in their experiences. Deep meaning refers to those actions or feelings, which drive a person and govern his or her sense of direction (Achilles, 1992).

The third area is content (Dewey, 1938). Content should be organized into learning from real life situations (Roberts, 2003). In traditional learning, where content is divided into subject clusters, there is no provision for the better learning of personal experience (Roberts). When students learn in real time, they are better able to apply their learning to different situations (Dewey). Skills, such as mathematics, are better learned through the process of actual experience rather than as a stand-alone subject cluster (Roberts).

The fourth component of the Experiential model of education is the understanding of the role of the teacher (Roberts, 2003). The role of the teacher is to create educational experiences that allow the student to experience things on a first hand basis. These student-led experiences must be designed so that students can explore or experience the content in self-regulated ways.

Learner readiness is the fifth focus of Experiential learning model (Roberts, 2003). Learning should be based on the prior experiences of the student (Dewey, 1938). Education should begin with the natural mental and physical stage of the child in mind (Roberts). The best way to assess learner readiness is to understand the learner's experience.

While it is referenced in all of the tenets of the Experiential model of learning, experience is the sixth tenet, in and of itself (Roberts, 2003). Dewey (1938), the founder of Experiential learning stated that, “I assume that amid all uncertainties there is one permanent frame of reference: namely the organic connection between education and personal experience” (p. 25). Experience is more than just an educational tool; it is the foundation for everything in life. However, not all experiences are educational (Roberts). For something to be educational, it must be associated with a real world scenario (Dewey). Furthermore, the student must have time to reflect in order to make the connection between what has occurred and the desired learning from the experience (Roberts).

The final area of experiential learning is learning outcomes (Roberts, 2003). Similar to the taxonomy of learning (Bloom et al., 1956/1972), Experiential theorists believe that the acquisition of knowledge does not necessarily mean that a student will be able to apply the information to similar situations. Something else is needed to make certain that a student is able to move from knowledge to higher levels of thinking, such as analysis and creation (Dewey, 1938; Hanna, 2007).

Based on the Experiential model of education, it is clear that social environment, knowledge, content organization, role of the teacher, learner readiness, and learning outcomes are critical areas to consider in successful educational programs (Dewey, 1938; Hanna, 2007; Roberts, 2003). Even more important to consider is the idea that these areas, upon which Experiential education is based, apply across racial, economic, and other boundaries across the U.S. As programs or interventions are suggested by officials



to help educators to meet the demands of accountability, they must be viewed through the lens of the seven Experiential areas.

### **Middle school education.**

While the middle school model was formed to serve the special needs of the middle school aged child (Anfara, 2003), the anecdotal literature, which is related to the state of the middle school movement, has been less than encouraging over the past few years (Huss, 2011; Jackson, 2010). This lack of achievement is troubling since the emergence of the middle school model was an attempt to serve the unique growth and development of the emerging adolescent (Akos, 2008). Perhaps this is why members of the Southern Regional Education Board reported that middle schools were a weak link in the educational system (Anfara).

There are several distinct factors that influence a middle school student's actions, that is, choices and behaviors (Daniels, 2011). Middle school students need to explore themselves inwardly in order to determine their personal identity (Akos, 2008). Frequently, this internal exploration causes them to experience several emotional and social changes. It has been suggested that the social environment is one of the most important factors, which determines how a student will acquire new information (Suizzo, 2000). Often, the social or peer group has a huge influence on what traits the students will exhibit later in life (Akos). The physical and emotional changes can be disruptive for students as they transition to and from middle school; therefore, there is an increased risk of dropout during these periods, especially in ethnic minority youth, who make up an increasingly large part of the current urban classroom (Benner, 2009).

Middle school students experience physical changes, which are caused by the onset of puberty (Akos, 2008). Often, the presence of these changes amplifies problems, which are associated with the personal and social development in adolescents. Daniels (2011) reported that, frequently, there is a lag between the cognitive and physical abilities of middle school students. Mood swings, raging hormones, acne, and clumsy bodies are a few of the difficulties that many middle school students face (Smith, 2005). The shift in pubertal changes is magnified by the changes in sexual and social stresses (Cohen, 2009). Healthy adolescents are those, who have acquired the basic skills needed to survive these physiological changes, and are able to: (a) interact with peers, (b) master language, and (c) develop empathy (Cohen). However, public school educators must strive to reach and motivate students, who are healthy as well as those who have not developed in all of these areas.

The peer group of middle school students becomes the focus of much of their attention as students determine with whom they will associate (Akos, 2008). The socialization of the adolescent is important because it serves as an indicator of traits the student will develop over time. The development of identity is critical, as both peers and authoritarian figures have an effect on the student. Akos articulated this idea and stated that “Middle school students are often in a period of foreclosure or diffusion, where they either accept the identity prescribed by authority figures, lack commitment to a specific group, or avoid the exploration of identity altogether” (p. 26). Students, who are encouraged to explore their identity, or who have achieved a formed identity, tend to have a greater sense of self-worth and have a greater sense of moral processing.

Therefore, the purpose of successful middle school programs should be to encourage students to not only develop academically but also help them to achieve a self-identity.

Typically, in middle school, students start to develop large social networks and social cliques (Cohen, 2009). Students feel as if they are preparing for adulthood, and they start to explore how they will contribute to their families, local communities, and culture as a whole (Cohen). It can be difficult for these students to learn how they fit into society, especially because they are between stages; they are not children and not yet adults. The changes, which are caused by puberty, are even more difficult for the student to overcome when he or she is required to fit into a group of peers, who are experiencing similar physical and emotional change (Smith, 2005). Smith observed that, also, the media has a great effect on students' perception of self. While middle school students experience a body image crisis, simultaneously, they are bombarded by media self-images that are most likely unattainable. Educators should not ignore the effect, which the media has on the middle school student, because this influence can create a rift between their in-school and out-of-school lives (Smith). However, the media can be a motivational factor for students (Williams, 2006). In Williams' case study, it was found that students in the sample devoted an average of 42.2 hours per week to: (a) watching TV, (b) playing computer and video games, (c) listening to music, and (d) talking on the telephone. When the students were asked to limit their use of media to 30 minutes per day for an extended amount of time, two-thirds of the students withdrew from the study. However, Williams maintained that self-reflection can be used to encourage students to engage with media in a positive manner rather than as a negative influence of self-perception. Middle school educators, who can incorporate programs into the class day,

which are focused on self-reflection skills, may see a greater impact on academic achievement, as students are able to regulate their social and emotional patterns

The middle school is a place where the pressure of physical, social, and emotional stresses can become notable problems for adolescents (Thoman, 1999). Teen drinking, smoking, and sexual promiscuity are negative behaviors that face middle school students as a result of societal stress as they attempt to develop their sense of identity (Thoman). In addition, the issues of eating disorder and low self-esteem may be present as adolescents attempt to perceive their changing bodies as the flawless images, which are apparent in the media (McCarthy, 2000).

Motivation is a key factor for middle school students, as they try to achieve success and achievement (Daniels, 2011). Often, it is a struggle for middle school teachers to persuade their students to care enough to want to learn (Daniels). It is important to identify programs for middle school students, which can encourage them to choose to engage. Student engagement is influenced by a variety of factors, including: (a) the physical characteristics of the environment, (b) the interactions they have with peers and adults, and (c) the activities they are asked to do. A key motivator for middle school students is decision making. When teachers allow students to be autonomous, they are more likely to be engaged in the learning process.

The struggle for academic achievement and increased accountability in middle schools is made apparent by the formation of groups, such as the National Forum to Accelerate Middle-Grades Reform (Jackson, 2010). This group was created because of: (a) the decline in test scores, (b) increased school violence, and (c) debates over what the purpose of middle school should be (Jackson). The focus of this group is to make certain

that all educators create experiences that serve all learners in the classroom through: (a) increased academic achievement, (b) the provision of safer schools, and (c) the provision of a clear purpose that benefits all student.

### **Music participation.**

School educators are required by lawmakers to increase test scores in the ESEA (USDOE, 2010) content areas. While there are no clear directions as to how to accomplish this task, it is clear that educators should focus on the support of school programs and initiatives that foster higher test scores in these areas. One intervention that appears to provide notable benefits, in relation to increased academic performance, is student participation in music (Buchanan, 2008; Shaw, 2003; Strickland, 2002).

According to Merriam (1964), music is a universal language for all learning. Also, music is present in all stages of human development (Campbell, 2007). For example, the importance of music in the lives of middle school students is demonstrated in the multi-billion dollar industry based on the consumption of popular music (Geter & Streisand, 1995). If students spend large amounts of their personal time, energy, and finances on popular music then, also, it is possible that adolescents use music to assign their personal identities (Campbell, 2007). Music has its own aesthetic and social values, and it has the potential to bridge the gap between academic content and the everyday lives of the students.

As educators struggle to find ways to solve educational problems, often, the opportunities for participation in music programs are lost as a result of the pressure to comply with federal, state, and local laws (Gerber, 2007). The requirements in the ESEA (USDOE, 2010) have forced principals and other school officials to devote more time to

reading and mathematics in order to accomplish the required testing gains for students. There is no easy solution to the issue of increased accountability. Even when each academic class period is extended by only 10 minutes, over the course of the day, the result is the loss of an entire class period, and the limitation of available electives. Just as high schools have felt the crunch of higher standards and tighter schedules, the crunch will become increasingly evident in the middle schools as well (Gerber). To understand the positive effects of music participation on middle school students, one must first understand how music participation relates to learning theory. Next, it is important to see how music participation meets the demands of the seven areas of Experiential learning. Finally, an examination of how music participation meets the needs of varied learners is necessary.

### **Theoretical Framework**

#### **Multiple Intelligences.**

Music participation is grounded in five basic learning theories. The first is the theory of Multiple Intelligence (MI). Gardner (1993) stated that intelligence is “the ability to solve problems, or to fashion products, that are valued in one or more cultural or community settings” (p. 7). With the use of this definition, one should recognize that people solve problems in different ways. This ability to learn the same information, but through different ways, is the framework for MI.

There is more to intelligence than a given Standard Intelligence Quotient (IQ) because it is used to measure only one type of intelligence. However, there are seven basic types of intelligences (Gardner, 1993). The intelligences are: (a) Linguistic, (b) Logical-Mathematical, (c) Spatial, (d) Musical, (e) Bodily Kinesthetic, (f) Interpersonal,

and (g) Intrapersonal. Since cognition is based on a person's type of intelligence, the role of the educator should be to develop a student's particular intelligence.

The renowned violinist, Yehudi Menuhin, was an example of how musical intelligence is one of the seven basic forms of intelligence (Gardner, 1993). Menuhin was a professional international performer by the time he was 10 years old; however, his musical abilities were apparent before he had extensively practiced with a violin.

Gardner noted that Menuhin was able to master the violin almost instantly and without much practice. Menuhin's ability to develop musically was clearly biological. In fact, Gardner reported that some students, who have severe mental disabilities and are unable to speak, are able to perform masterfully on an instrument. This suggests that the right side of the brain is heavily used to make music. However, music cognition is not clearly *localized* in any one central location. While damage to specific regions of the brain has negative effects on the associated cognitive functions of that brain region, music cognition can be negatively affected regardless of which area of the brain may be damaged. Gardner believed that this indicated that musical intelligence is associated with all areas of the brain.

Music is a universal language that is present in every culture (Gardner, 1993; Hall, 2007). While reading music, the brain can access symbols and create a system of relationships based on objects (Covino, 2002). A relationship between music participation and academic performance may exist, not only because many students learn through their musical intelligence, but also because music intelligence may be linked to other intelligences (Hall). An example of music intelligence, which is linked to another intelligence, is the violinist who: (a) employs musical intelligence to learn and perform

the music, (b) uses bodily-kinesthetic intelligence to be able make the quick and rapid physical adjustments, and (c) employs interpersonal skills to relate the message of the music to the audience. Within each of the intelligences are many sublevels of cognition. These sublevels help the mind create a notation system by which symbols have meaning (Hall). Examples of these sublevels are mathematics, reading, and music notation.

According to Gardner (1993), music students have greater spatial-logical reasoning and kinesthetic intelligences because the focus of music is on movement and the interpretation of various muscle and motor movements, which are required to sing or perform on an instrument. Music intelligence relates to interpersonal intelligence, such as when a musician communicates with other musicians as he or she performs a selected composition. Musical intelligence is linked to logical-mathematical intelligence, in that, music consists of organized patterns, sounds, and regularities, which are a necessity for mathematical patterns (Nolan, 2003)

The theory of MI (Gardner, 1993) is important because it presents the idea that some students may learn academic content through music. If a student perceives the world through his or her born intelligence, the potential for maximum learning primarily occurs when the student is actively engaged in his or her respective intelligence. Students are born with all intelligences even if they have a preferred intelligence (Chapman, 1993). When music participation is a part of a student's daily life, more academic progress can be made (Pica, 2009).

### **The Bloom et al. (1956/1972) taxonomy of cognitive development.**

The second learning theory, which is related to music participation and increased academic performance, is the Bloom et al. (1956/1972) taxonomy of cognitive



development. As teachers engage students in the intelligences, they can guide them toward the use of higher order thinking skills. Bloom et al. created a taxonomy of cognitive development, the focus of which is on what a student could do, not just what the student could remember. The Bloom et al. taxonomy of cognitive learning is a scaffolding of domains in which certain processes lead to higher processes. Recently, the original taxonomy was updated in 2000 in order to place the act of creation as a higher cognitive process than evaluation (Anderson, 2000). The goal of the teacher is to create activities that move the student from lower level processes, such as knowledge, to higher levels of thinking, such as creation (Hanna, 2007). In the taxonomy of cognitive development, the processes of thinking are placed in this order: (a) recall, (b) understand, (c) apply, (d) analyze, (d) evaluate, and (e) create (Anderson). Each of these processes has subgroups of processes. For example, the process of Understanding includes: (a) interpret, (b) exemplify, (c) classify, (d) summarize, (e) infer, (f) compare, and (f) explain.

There are many ways in which a music student works through the cognitive process (Hanna, 2007). First, procedural skills form the basis of ensemble performance. Then, motor skills are combined with content knowledge for performance production. Finally, the music student participates in metacognition through the formation of logical conclusions. Hannah stated that, “In music learning, a key aspect of meta-cognition is strategic knowledge” (p. 12). Creativity involves the ability to: (a) generate, (b) plan, and (c) produce. Music students function in all three of these areas through their: (a) improvisation, (b) composition, and (c) performance. A critical theme here is that the student will use the processes of: (a) knowledge, (b) application, (c) inference, and (d)

synthesis to successfully perform music. Often in music making, these processes occur simultaneously. Of particular importance is the fact that all of these cognitive processes are used in reading comprehension and mathematical reasoning. Another example is when students sing the American musical style, known as the Blues. Students are encouraged to move while they play the Blues to foster a combination of personal, social, and kinesthetic growth (Savitz, 1999). Inherently, they are able to develop in these areas while, also, they are engaged in their musical, spatial, and interpersonal intelligences (Savitz). One could assume that as a student develops in music, so does his or her ability to function at a higher cognitive level in other subjects.

#### **Piaget's (1973) stages of development.**

In a third theoretical view of music participation, one must consider how students learn in relation to their physical growth. Piaget (1973) encouraged educators to consider how students learn, based on their age and physical development. As students progress over time, also, they move through various stages of development (Dolgin, 2011; Piaget). Theorists, such as Dolgin and Piaget, maintained that students learn best when the needs of their respective stage of development has been respected. Also, one must realize that students will not learn at the same high rate when they are between learning levels, developmentally. As students move from the Grades 1-12, they move from concrete to abstract thinking, respective to their learning stage. Since students experience puberty at different times within the frame of the middle school years, educators in the middle grades may have students in their classroom who demonstrate concrete, abstract, and those thinkers in between levels. Something is needed to close this cognitive gap so that learning can occur in all students. Typically, during Grades 6 and 7, students begin to

move from the concrete to the formal stage of development. As part of this progression, students begin to use their moral reasoning to override logic (Dolgin; Piaget). For example, it is logical for a student to stay out of fights at school so as to not suffer from the consequences of a no tolerance policy. However, students may choose to enter in the fight, regardless of the consequence, if they feel that they must protect a friend who is being bullied. In this example, a student's need to stand up for a friend overrides the logic of staying out of trouble. It may be that students' participation in music could bridge the gap between these stages. Since Perlmutter (2009) held that music participation develops creativity, and Bicknell (2009) held that it assists a student in the development of moral deference, it may be that, potentially, it can assist students in the development of their moral compass. Students, who are actively engaged in music, are more likely to think in creative, higher order patterns, regardless of their stage of cognitive development (Hanna, 2007). Reasoning is an abstract process that occurs in the formal stages of development (Dolgin; Piaget); however, musicians at an early age are guided through this process as a part of music evaluation (Hanna). When students read music, they learn to interpret symbols based on their intrinsic value and use that emotion to form an extrinsic expression. As a person develops the ability to create, also, he or she hones the skills of reasoning.

#### **Maslow's (1943) hierarchy of needs.**

A fourth theoretical consideration of the impact, which music participation can have on academic achievement, is how it can support students' learning (Dolgin, 2011). Participation in music can encourage the use of higher order thinking processes and serve the needs of the whole child (Dolgin). At the most basic level of learning, there is the

need for a child to feel safe and valued (Maslow, 1943). Students cannot progress to higher order thinking until their basic needs are met. Unfortunately, the focus of every classroom is not on the intrinsic needs of students. Kimbel and Protivnak (2010) stated that music “is central to a student’s life through self- expression, emotional release, and peer relationships” (p. 25). Today, students are highly involved in social media outlets such as: (a) iPods, (b) YouTube videos, (c) Facebook, and (d) MySpace accounts. Each of these outlets places music in the daily lives of the students. Kimbell and Protivnak found that 90% of students in their study listened to music on a daily basis. This finding suggests that music should be used as a tool for academic development in school. Students’ participation in music classes can promote values and citizenship (Perlmutter, 2009). Since students are constantly engaged in music (Kimbel & Protivak), if one combines citizenship objectives within the music the students find relevant, it may be possible to promote better outcomes in these areas. Furthermore, the group setting of a music class can be more useful for helping students to learn than only drilling key points in the academic classroom. When students apply learning outcomes to music, they are more involved in their learning and are able to absorb skills and concepts more quickly (Perlmutter). Vitale (2009) found that student participation in a band program (i.e., a cooperative setting) encouraged students to value themselves and the contributions of their team members. These are key components to learning, since they promote an environment of safety and trust. Gadberry (2010) found that participation in a chorus program resulted in the students’ increased test scores; this was linked to improvements in their citizenship.

### **Brain-based learning theory.**

Finally, brain-based learning theory and data from the medical sciences provide support for the affect of music on learners. The provision of quality music instruction can have an impact on students' test scores (Johnson, 2006). Both Covino (2002) and Shaw (2003) reported that participation in music can increase the spatial reasoning ability of the brain through: (a) movement, (b) development of motor skills, and (c) memory. Also, there are findings from brain research (Covino), which indicate that a music student is able to process information more efficiently than a non-music student. The corpus callosum is the part of the brain that connects the right and left hemispheres, and Cox and Stephens (2006) found that music students developed a larger corpus callosum than non-music students. According to Ellison (2001), as students learn, synaptic connections form in the brain. In this forming of synaptic connections, students, who are involved in music, form more synapses between brain cells. As these synapses develop, the capacity of the brain to retain information is increased.

The early years of a child's life are important because the brain grows dramatically, and over 1,000 trillion synapses are formed (Ellison, 2001). Once a student reaches age 3, certain synapses are erased from the brain, although approximately one-half will remain consistent through adulthood (Strickland, 2002). The process, whereby synapses are eliminated, is important because it brings order to the human brain. However, many students, who are not able to successfully delete the excess synapses, will suffer from cognitive disorders (Ellison, 2001). Music is an important part of early childhood growth, because it exposes children to increased emotional and aesthetic qualities. As these sounds and emotions stimulate the brain, along with the interpretation

of the senses that perceive them, new brain synapses are formed. Furthermore, music can be used as a tool to help a student learn to create and, in doing so, bring order to an adolescent's chaotic reasoning. Music can assist in the deletion of synapses and possibly serve to help the student create a better working order to classify new information.

As reported by Covino (2002), in the conduct of brain research, Functional Magnetic Resonance Imaging (fMRI) scanners are used to detect when the blood flows to the major regions of the brain. With the use of this technology, scientists can direct patients to perform certain tasks to see which hemisphere or region is being used to process the activity. When scanning the brain of a student, who is engaged in music, all areas of the brain light up the fMRI scanner. This brain action means that music is a rare activity, which uses all areas of the brain simultaneously. The brain can use music to promote psychomotor, affective, and cognitive processing through the highest process, creativity (Hanna, 2007). Young students learn better and remember more, when their studies are combined with: (a) music and drama, (b) experience, (c) emotion, and (d) real-world context (Covino). When more regions of a student's brain are involved and their emotions are more engaged, there are more means for the recall information. Since it has been noted that the study of music greatly impacts a student's spatial reasoning, music students may perform better in mathematical areas such as reasoning and symmetry (Covino).

The findings from brain research and the effect of multiple intelligences should be important to educators (Hall, 2007). The study of brain science and MI makes it clear that there is no direct formula for a specific type of intelligence, but rather there are many different forms of intelligences, and there are many different ways to develop

intelligence. Currently, many educators perceive intelligence as a multifaceted filter and have become aware of the learning potential that exists within all children (Burgess, 2000).

### **Music and values.**

While it is not a theory of learning, the focus of much of the current study of music participation is on values and ethics. Axiology is the study of values (Creswell, 2007), and ethics is the term used to define a person's search for the best way to live (Bicknell, 2009). A discussion of music participation in relation to academic achievement should be grounded in ethical considerations. The focus of standards in music standards is not only in regard to creativity, the highest order thinking process, but also on the moral obligations associated with the performance of music. It is not enough to creatively make sounds, one must also consider how those sounds are arranged. Performers must question whether the music is performed true to the intent of the composer, the characteristic sounds of the instrument or voice, the tone of the piece, as well as whether the music is a true depiction of its meaning. These are questions grounded in ethics, that is, the performer's ethical obligation to perform music within established guidelines. The performer has to value the music above his or her personal interpretations, which is moral deference. Performers must constantly check themselves to make sure they are true to these intentions. In doing so, they are trained to take personal responsibility. When students participate in music, not only do they employ higher thinking skills (Hanna, 2007) but, also, they are taught to place more value on the process (Bicknell).

Listening to music is an emotional and educational experience that can shape a person's worldview. Since the average person may spend hours in listening to music, it could be argued that music is a determining factor in a person's perception. In one example, Levy and Byrd (2011) pointed out that lyrics in the WAR song, "Why Can't We Be Friends," has a clear effect on the social constructs of an individual. When a student participates in an organized music program at school, it is an opportunity for school staff to impact the student's development of his or her worldview. Students should be able to connect the content across the curriculum (Block, 2012). There are themes in music, and there are themes in English. Teachers can integrate the use of music, which students find relevant, with educational objectives, as a means to make other academic content accessible to the student. Furthermore, when this is combined with key concepts based on morality and ethical behavior, there is an opportunity to create a more rounded student. God himself used Music in the Bible to teach and instruct the children of Israel in the way in which they should live their life. God told Moses:

Now therefore, write down this song for yourselves, and teach it to the children of Israel; put it in their mouths, that this song may be a witness for Me against the children of Israel. (Deuteronomy 31:19)

### **Music and the seven areas of Experiential learning.**

Now that the theoretical framework of music participation has been established, it is appropriate to review the seven areas of Experiential learning. Participation in music meets addresses each of these areas: (a) social environment, (b) knowledge, (c) content organization, (d) role of the teacher, (e) learner readiness, (f) experience of the student, and (g) learning outcomes. Each these areas are important to consider in the



determination of successful educational programs (Dewey, 1938; Hanna, 2007; Roberts, 2003).

The first area of Experiential learning is the social environment. Learning is the result of a social process (Dewey, 1938). A vital part of participation in music is when students are allowed the freedom to develop their social skills within a controlled environment. The idea of music as a means of socializing can be found throughout the Bible. An example is in the book of Job: “They sing to the tambourine and harp, And rejoice to the sound of the flute” (Job 21:12). Salend (1999) noted that the use of music can increase relationships and social interactions among students. This increase in relationships and interactions is because music is a social activity, and social skills are a normal part of the music classroom (Gooding, 2009). In the average music classroom, students learn to communicate with each other in an articulate and expressive manner, both verbally and nonverbally. It is through the verbal and nonverbal exchanges that the presence of music enhances the social engagement of the student and encourages better relationships. Furthermore, Gooding maintained that the social aspects are a major reason why students involve themselves in music programs. In music programs, students gather information about themselves and their social relationships (Parker, 2007). What is different about the social interactions in music programs is that they are more personal in nature. The Bible has examples of the personal nature of music’s social interaction. In the book of I Samuel, it is stated that:

Whenever the spirit from God came on Saul, David would take up his lyre and play. Then relief would come to Saul; he would feel better, and the evil spirit would leave him. (I Samuel 16:23)

An example in the classroom today, is when one sings a difficult passage in chorus in front of one's peers. Since the voice is the most personal instrument of a student, adolescents are very socially and emotionally vulnerable when they sing in front of their peers (Parker). However, as students work their way through blunders and mistakes, they are encouraged through positive interactions with the teacher and with their classmates. This encouragement and positive interaction is unique to participation in a chorus, because peers react to a feature of the student's persona, his or her voice. This process causes these students to be encouraged to take more risks as well as learn to treat their struggling peers in a positive manner.

The second area of Experiential learning is knowledge (Dewey, 1938). Specifically, the focus of Experiential learning focuses is on how students acquire knowledge. According to Dewey, students acquire knowledge as they derive meaning from an experience. This deep meaning is an experience, which refers to those actions or feelings that drive a person and govern his or her sense of direction (Achilles, 1992) and, frequently, students are able to derive deep personal meaning and purpose in their life through their participation in music. Since music is a tool that learners of all ages can use to derive meaning from activities, it can be related to all areas of students' lives, because humans have always had a special relationship with audible sound (Foran, 2009). Therefore, music should be a part of the daily lives of students (Kimbels, 2010). When students participate in music, they connect themselves to something, in which they choose to engage. If music were incorporated into the school, as a part of the learning process, it is possible that an increase in academic success would follow.

The third area of Experiential learning is content organization (Dewey, 1938; Roberts, 2003). Students learn content through real world situations and personal experience. According to Kirk (2011), many educators have found that the integration of music into the curriculum can increase student achievement in areas such as: (a) history, (b) science, (c) language arts, and (d) mathematics. Music is unobtrusively present in all subject areas. For example, when students are involved in music, they: (a) actively create and organize patterns, (b) produce sounds and use physics to change intonation and tone, (c) recognize and interpret symbols, (d) analyze the historical context and social implications of performed compositions, and (e) participate in many other actions that are cross discipline in nature (Kirk).

Also, the focus of Experiential education is on a fourth area that is likewise activated by music participation. This area has to do with the role of the teacher (Dewey, 1938; Roberts, 2003). The role of the teacher is to be a facilitator of students as they learn in real time. Therefore, some state officials, such as those in New Jersey, have determined that one of the purposes for music education is experiential learning (New Jersey Department of Education [NJDOE], 1998). In this state, students can be selective about the arts program in which they are involved, and the programs are designed so that students can gain greater experience and mastery of the arts content. In New Jersey, the concept of the arts are expanded as a benefit to work place readiness, which is another way that arts programs such as music are used to give students a first hand connection to experiential learning. In the NJDOE curriculum guide, there is a distinction between the performing arts as enjoyment and the performing arts as education. It is stated that arts education should be an “integral, sequential curricular program of knowledge and skills

to be acquired and applied” (p. 24). The key emphasis here is that the performing arts, such as those which involve participation in music, provide students with the experience of hands on learning so that they can acquire and apply their skills.

A fifth area of Experiential learning is learner readiness (Roberts, 2003). The idea that learning begins with an understanding of learner readiness is an important part of the music classroom (Gordon, 1989). Gardner (1993) observed that music creativity cannot be taught, but rather that the music classroom is the place of to engage and encourage student readiness toward the potential of music creativity. Learners come to the music classroom with varied experiences and backgrounds. Quality music educators individually assess readiness levels and use this knowledge to drive student instruction. What differentiates the music classroom in the engagement of student readiness is that all students have a certain level of music potential and readiness when they enter the classroom (Geter & Streisand, 1995). All students have some form of music aptitude, which is not affected by race, gender, or nationality. For this reason, music participation has the potential to connect with student readiness and assist in cross-disciplinary learning.

Sixth, a part of learner readiness is student experience, as it is related to the individual student’s ability to access information (Dewey, 1938; Roberts, 2003). Music contributes to the experience of students because it can help students understand and evaluate real world scenarios. Music study contributes to a student’s real life through practical ways such as the: (a) transmittal of cultural heritage, (b) learning of self-discipline and team work, (c) development of creativity and self-expression, (d) development of multiple intelligences, (e) engagement in problem solving and abstract

thinking, and (f) positive influence on academic achievement (Kindall-Smith, 2010). Furthermore, it provides experiences that relate to students in simultaneous understanding of individual and group learning. Typically, the purpose of music classes is for an individual to develop musical skill and then integrate that development within the framework of the ensemble. This musical independence leads directly to a student's development of real world independence. As students participate in musical activities, they are able to find deeper meaning in each experience (Kindall-Smith). As the students discover deeper meanings, ultimately, they will be able to better engage in the learning process (Dewey). Kindall-Smith described a music student, who reported that memory of a musical activity helped his brain to be more creative, a further support of the idea that participation engages students at a deeper level of thinking.

Finally, the focus of Experiential education is on learning outcomes (Roberts, 2003). The focus of music is centered in creativity, the highest order of the cognitive process (Hanna, 2007). In music programs, such as band, choir, and orchestra, there is little instant gratification (Duff, 2009). Constantly, students work to compose new ideas, create new sounds, and create new themes as they perform music. The composition of music is an act of imagination and represents the highest order of thinking (Duff). In music participation, students cognitively problem solve as they learn (Blair, 2009). The independent acquisition of knowledge is important since students must do more than acquire knowledge to be academically successful; also, they must transfer their learning toward the acquisition of new knowledge. As they play, sing, create, listen, and move, music students can demonstrate "informed doing" (Blair, p. 41). For instance, in the composition of music, students create music with a specific number of notes and

measures, organize these notes and measures into a conceptual framework, and mindfully consider the abilities of the performers. Since creativity is the highest form of cognitive processing (Hanna, 2007), the creation within parameters (i.e., informed doing) is an even greater cognitive process (Blair).

### **Music participation and the needs of all learners in the classroom.**

The participation of students in music supports academic success because it has the ability to assist with many different types of learners in a single classroom (Gardner, 1993). In many classrooms, there are students with differing learning abilities such as: (a) gifted students and average students, (b) students with disabilities who are included in the general classroom, as well as (c) students who are economically disadvantaged. The challenge of the teacher is to create experiences that actively engage the knowledge and experience of all learners, regardless of their differences in learning ability or needs. This can be especially challenging in a middle school setting when the learners are in various stages of cognitive development (Piaget, 1973). Originally, the middle school model was envisioned to be a unique place to accommodate the unique intellectual, creative, and social needs of students as they experienced puberty (Gerber, 2007). The purpose of middle schools was to support rather than to judge and make every student feel known and important while they worked toward their academic goals (Gerber). In this sense, music participation is an activity that promotes the vision of the true middle school model, that is, participation in music promotes positive behaviors, both personally and socially (Robinson, 2007).

Music participation is a tool, which can be used to address many of the problems, which face middle school students as they transition from childhood to adulthood (Shaw,

2003). Furthermore, it is a good way to address the problems of motivation. Shaw observed that students, who are involved in some form of music training, scored notably higher in spatial-temporal reasoning. This increase in spatial-temporal reasoning is important because a high level of spatial-temporal processing has been shown to be correlated with higher levels of science and mathematics achievement (Shaw).

As previously discussed, many middle school students experience a lack of motivation (Daniels, 2011). However, music can be used as a tool for cognitive development because it is an activity, in which they choose to engage (Nolen, 2003). There are several effective tools that can be used to support the learning environment, but none can serve more students at the same time as music. Music can be used as a motivational factor because students choose to involve themselves as a part of the learning process. Although many middle school students struggle to cope with society, media, and how their emotions influence their identity (Akos, 2008; Cohen, 2009; Smith, 2005), their participation in music can help them to interpret and understand their emotional responses (Nolen; Perlmutter, 2009). Even though there is evidence (Angle, 2002; Huber, 2009; Johnson, 2006; Kinney, 2008; Savitz, 1999) that music participation may bridge the gap between academic performance and the inherent needs of middle school students, there has been little growth in music participation in U.S. middle schools since 1997 (National Center for Education Statistics [NCES], 2008). According to staff of the NCES, only 57% of eighth grade students in the U.S. attended a school where music instruction was offered three to four times a week. Only 34% of these students reported that they had the opportunity to participate in a musical performance based activity at their school in 2008.

The results from multiple studies (Angle, 2002; Huber, 2009; Johnson, 2006; Kinney, 2008; Savitz, 1999) indicated that there was an increase in academic performance when students were engaged in music making. Kinney noted general increases in test scores when comparisons were made between music students and non-music students, particularly in urban schools. Also, band students have been found to outscore non-band students in most subjects on standardized tests when individually compared to their pretreatment scores in fourth grade and posttreatment scores in Grades 6-8 (Kinney). In addition, Johnson found that students with a musical background scored higher on the ACT in mathematics. Furthermore, this increase in test scores was found regardless of outlier factors, such as socioeconomic status (SES), in the area of mathematics.

The needs of many gifted and advanced learners are being served through an emphasis on science, technology, engineering, and mathematics (STEM) initiatives (Block, 2012). According to Block, students' participation in music develops the same creativity and critical thinking skills that are accomplished in these programs. While some students may be intimidated by STEM courses, they may enjoy arts courses, which promote the same skills of higher order thinking. At the heart of STEM courses is the highest of higher order thinking skills, creativity. Creativity is a key component in the music classroom, as well. At schools with strong arts programs, many students are able to demonstrate improvement in attendance. In addition, frequently, test scores improve because of the emphasis on left- and right-brain thinking (Block).

Olson (2010), at the University of North Carolina Wilmington, found that fifth grade students, who were given opportunities for critical thinking in their music



classroom, scored better on a unit test than students, who studied the same material but received only activity based instruction. The students, who scored better, were taught through the use of the four Cs: (a) critical thinking, (b) creativity, (c) communication, and (d) collaboration. These skills can be used across the curriculum and can facilitate a whole school approach to student learning which should include music programs (Olson). Also, these skills are related to the idea that music students are better able to self-regulate their behaviors (Leon-Guerrero, 2008). These self-regulated behaviors are: (a) identification strategies, (b) planning and evaluation strategies, and (c) systematic thinking. According to Leon-Guerrero, all of these behaviors are related to increased achievement.

Scheib (2006) assessed the importance of music in the lives of middle school students. Scheib conducted a case study with a student, who was selected because she was an *average* band student. Average was the term used to describe her because she was not the best performer or musician in the band, and she was not the worst. Scheib identified several important themes. First, the student wanted to be in control of her academic destiny. Second, she reported her participation in band motivated her to be competitive. Third, the student observed that achievement in band was measured according to: (a) individual accomplishment, (b) evaluation, and (c) the development of technical skills. She noted that band was not only competitive, but it was task achievement and assessment based. Scheib found that participation in traditional band class reinforced other important factors to learning that a middle school student needs in his or her day, such as following rules and procedures.

Campbell (2007) found five key themes in middle school students, who engaged in music: “identify formation in and through music, emotional benefits, music’s life benefits, including character-building and life skills, social benefits, and positive and negative impressions of school music programs and their teachers” (p. 1). The students in this study mentioned several benefits beyond increased musical aptitude. They reported that the study of music helped them to understand other disciplines, such as knowing and understanding other civilizations and societies through the influence of music and music history. Campbell stated that, “In various ways, students expressed their sense of music as culture, and as a means of knowing their own and other cultural histories and beliefs” (p. 8). The middle school students in this study reported that their participation in music helped them to achieve an emotional focus. This emotional awareness can help students to negotiate their emotional responses and cope with difficult situations. In an essay written for the study, one girl reported that music helped her to negotiate the negative emotions in her life. In particular, the girls reported that music was an important controlling agent in their life. Also, some students reported that music helped them to develop character. For other students, music gave them a positive behavior to exhibit in middle school rather than negative behaviors such as drugs and alcohol. It was clear from these qualitative data, that these students felt that music participation was important in their development.

In many situations, students with various disabilities are served in the classroom along with gifted and average learning level students (Simpson, 2010). The use of music in these classrooms may increase academic achievement, because it can be used with all students, including students with disabilities. Frequently, students with disabilities need

additional support in order to process information. While each individual disability is different, and there is no one-size-fits-all approach in the provision of accommodations, music can be used as a tool to help these students learn. Simpson found that the use of song, combined with symbols, greatly assisted students with autism to recall information. One of the characteristics of students with autism is lack of motivation; however, music can be used as a tool to bridge this gap between content and motivation. In addition, the use of music has been found to increase social engagement in students with autism. Since music incorporates a lot of movement, it can help students with special needs to stay focused. The playing of instrumental music can be used to increase communication and response.

McPherson (2000) reported that music can be used to meet the needs of students with disabilities within a general education setting, specifically, those with separation anxiety. During periods of separation, whether from parents, friends, or a known environment, students need to be supported to explore self-reliance and autonomy. When students are involved in extracurricular activities, they are more likely to remain involved in school and active in the learning process. Chorus was one of the activities identified in the McPherson study, which provided a sense of structure and balance for students. A main point, which McPherson emphasized, is that teachers should not necessarily target the areas where students underperform academically, instead, they should focus on the areas of student interest and use these interests to increase achievement. Music provides key elements that may assist students and parents with separation anxiety. Music is a tool, which can be used to assist every student in learning, including students with special

needs. Music could be the reason that most students in the music classroom learn; it offers interpretation, remediation, and enrichment (McPherson).

Also, music can be an effective tool for classrooms, which include students who are economically disadvantaged (Buchanan, 2008; Fitzpatrick, 2006). The removal of band and chorus programs is especially frequent at economically disadvantaged schools. At schools with a large population of low income students, there may be many students, who struggle in traditional settings, but who can succeed in music (Buchanan). At many schools, which serve economically disadvantaged students, academic gains are not being made, and they are labeled as schools, which need improvement under the ESEA (USDOE, 2010). Buchanan reported that, at schools with large numbers of students in poverty, often, the students spend five times as much time involved in the reading curriculum as they do in the arts. In fact, in the Buchanan study, it was reported that, in 30% of these districts, time in the arts has been reduced. This loss of seat time in band and chorus may be detrimental to all students, but it is especially detrimental to economically disadvantaged students, who already struggle in the ESEA content areas.

According to Buchanan (2008), it has been found that student participation in band and chorus programs increase student academic performance. Economically disadvantaged students have special needs and, therefore, are considered an official required subgroup under the ESEA (USDOE, 2010) law. However, not only do economically disadvantaged students, who participate in music, score significantly ( $p < .05$ ) higher than other disadvantaged peers who do not participate in music, but they have closed the achievement gap with nondisadvantaged students (Fitzpatrick, 2006). An

understanding of the value of the band and chorus experience may help administrators and teachers to close this gap further.

Economic status is the largest factor in the determination of access to a program (Albert, 2006). Economically disadvantaged students may not have the same access to music programs as their more advantaged counterparts. However, participation in music programs can assist in the retention of economically disadvantaged students (Albert). The increased retention rates may be because these economically disadvantaged students experience more support and attachment to the school.

Often, economically disadvantaged students come from single parent households and score lower on most state certified achievement tests (Kinney, 2008). According to Kinney, academic achievement and family structure may play a role as predictors of student enrollment in band programs. Factors, which affect access to music programs, are demographics such as: (a) economic status, (b) ethnicity, and (c) school size. McCarthy (2007) found that SES status was a predictor of retention in band for fifth and sixth grade urban band students. Often, minority students struggle to afford the required music materials such as an instrument, texts, and the maintenance materials required to be in a program such as band. Teachers in urban schools emphasized that it is difficult to both recruit and retain students because of their large minority populations (Kinney). In addition, parental involvement can be lacking in many economically disadvantaged households (McCarthy). Kinney observed that mobility might be an issue which affects economically disadvantaged students and their music participation, although he cautioned that more study should be conducted to understand its affect. Similar effects have been found for students, who are economically disadvantaged and participate in chorus,

although many students, who struggle in other academic areas, are successful in chorus (Murphy, 2009).

Fitzpatrick (2006) conducted a study on the effect of instrumental music participation and SES with the proficiency test results for Ohio fourth, sixth, and ninth grade students. She found that instrumental music students scored higher than non-instrumental students in every subject. Students, who were economically disadvantaged, attained higher scores than students who were not economically disadvantaged in the fourth grade. Also, there was a pattern of increased achievement by economically disadvantaged students as they progressed through their music program. Eventually, the economically disadvantaged students outscored their nondisadvantaged peers, who were not involved in instrumental music by the ninth grade, in all subjects. These findings support the idea that music participation assists both economically disadvantaged and nondisadvantaged peers, in that, they can attain higher achievement in academic areas outside of music.

The findings from several studies (Angle, 2002; Huber, 2009; Johnson, 2006; Kinney, 2008; Savitz, 1999) supported the idea that music participation benefits the academic progress of all students in the classroom. As students progress through middle school and completion of high school, often, they are required to take standardized tests, which provide an indicator of college readiness. As noted by Cox and Stephens (2006), this final indicator of college readiness demonstrated that students, who were engaged in music participation, were more prepared for college. Scores on the College Entrance Board Exam (1995, as cited in Cox & Stephens) showed that students, who had some form of music performance on their transcript, scored 39 points higher on the

mathematics section of the Scholastic Aptitude Test (SAT) in comparison to those students who did not participate in music. Similarly, students, who had music performance and appreciation courses listed on their transcript, scored 46 points higher on the mathematics portion of SAT in comparison to those who did not have music performance or participation.

### **Music participation and mathematics.**

The main goal of the ESEA (USDOE, 2010) is that students in all schools are to reach 100% proficiency in the reading and mathematics content areas by the year 2012. However, some researchers (Caillier, 2007; Ediger, 2005; Spencer, 2012) maintained that it will be a struggle for the U.S. to meet this goal of 100% achievement in mathematics by the year 2012. Out of 35 states, which were studied in 2007 (Caillier), only 2 demonstrated AYP in both reading and mathematics in the elementary, middle, and high school grades. Of the 35 states studied in 2007, including Georgia, students in Grades 6-8 scored 70.3% proficient or higher on the reading test, while only 60.8% scored proficient or higher in mathematics. These data represent a major concern that students do not adequately increase achievement in the area of mathematics in comparison to reading. Of the areas Caillier studied, reading and mathematics in elementary, middle, and high schools, she found that the lowest increase in achievement rates was in middle school mathematics. In regard to state gains toward the yearly goals, 60% of the states achieved their goal in reading in every subgroup, while only 40% achieved their goal in mathematics.

Also, there is increased concern about the large differences between racial and ethnic minorities in comparison to their White counterparts (Spencer, 2012). This means

that the level of mathematics education varies, not only between school systems but across economic and racial boundaries. Spencer suggested that ESEA (USDOE, 2010) has had an unintended consequence in academic areas such as mathematics. While the law linked Title I funding to student performance on standardized exams, in many states and grade levels, it resulted in 70 or more mathematics standards to be tested. This has decreased the focus on mathematics concepts, as well as higher order thinking. This caused educators to focus on more basic concepts, such as procedural knowledge, in order for students to correctly answer standardized mathematics questions. According to Spencer, this sacrifices the real mathematics learning for more “superficial, fleeting gains” (p. 78).

The data clearly indicate that there is a need to make mathematics thoughtful and relevant to students today (Spencer, 2012). Since the classroom is diverse in learning styles, it is in the best interest of the teacher and student to consider high quality instruction that benefits the learning styles of all children in the learning environment (Ediger, 2005). One way to increase mathematics proficiency is to consider the ideas of relevance and rigor as it applies to student motivation. Furthermore, quality mathematics instruction is increased when it is taught with consideration of student learning styles.

Gardner (1993) clearly established that there are multiple intelligences within a single classroom, and the theory of MI applies to the mathematics classroom equally (Ediger, 2005). Specifically, since many students have a musical intelligence, and since musical intelligence is related to all other forms of intelligence, as music participation increases, mathematics scores may increase respectively. The musical intelligence, which is focused on how lyrics are set to music, is an especially effective tool in the



mathematics classroom, because these changes assist students in the acquisition of information (Ediger). The main goal of ESEA is that all school students reach 100% proficiency in reading and mathematics content areas by the year 2012 (USDOE, 2010). Also, the concept of numbers, when they are placed in a rhythmical setting, increases retention. Since it is clear that students engage in music as a part of their normal social lives (Kimbel & Protivnak, 2010), this is a good opportunity to increase student motivation and provide a positive benefit to mathematics achievement.

In Georgia, state mandated testing is required at all middle school grade levels (GaDOE, 2011). This mandated testing has required the provision of mandated remediation and intervention classes and decreased music classes, respectively (Gerber, 2007). The increase in academic classes and loss of music participation could have an adverse effect on Georgia middle school students, since Huber (2009) found that English language learner (ELL) students, who participated in band and chorus, scored higher on state standardized tests. The findings from these studies correspond with the idea that musical intelligence is directly related to language aptitude. Music and rhythm are powerful aids to learning and the acquisition of language skills (Fonseca-Mora & Toscano-Fuentes, 2011). Infants start to acquire language skills while in their mother's womb through constant auditory stimuli. Since learners cannot learn a second language in the same context, learning a second language does not occur as easily. Interaction in the appropriate context is an integral part of language acquisition. Interaction between the parent and the child or teacher and the student is very similar. During interactions, speakers use inflections, volume, repetition, expression, and expansion to code the information being delivered. In this manner, the language is a melody, which is being

used to deliver a main idea or thought through expression (Savitz, 1999). When music is incorporated into the acquisition of other skills, auditory inflections become important concepts, which may assist in the reaction to the stimuli and storage of the information. Exaggerated melodic contours in the day-to-day interactions of adults with infants have a definite impact on their acquisition of their language skills (Savitz). With the use of music as the vehicle, melodic contours and phrase shaping may help students acquire other skills, such as the memorization of a: (a) new language, (b) historical theme, or (c) mathematical formula. If music participation supports a positive correlation to increased language arts achievement, it may be that a similar positive relationship exists between music participation and academic achievement.

### **Chapter Summary**

The traditional approach to teaching has not been effective for all students (Snyder, 1999). For this reason, laws, such as the ESEA (USDOE, 2010), were written to make certain that educators are accountable for the academic progress of all learners in their classroom. While lawmakers included arts programs, such as music, as a core subject area under ESEA guidelines, there were no measures of accountability. For this reason, many school officials provide students with less time in music programs in favor of other academic content, which have ESEA required testing components (Gerber, 2007). However, this may not be the best decision, since music programs have demonstrated correlations with various forms of academic achievement (Angle, 2002; Huber, 2009; Johnson, 2006; Kinney, 2008; Savitz, 1999). This may occur because educators, who incorporate music into their programs, engage students who are born with musical intelligence (Gardner, 1993). This is important because music intelligence

appears to be linked to other forms of intelligence (Gardner). Music programs are also assistive in moving learners to acquire higher order thinking skills (Bloom et al., 1956/1972; Hanna, 2007). Furthermore, music programs are assistive in helping younger learners move from various stages of development (Dolgin, 2011). According to Piaget's (1973) stages of physical development, students in the middle grades are moving from concrete to abstract reasoning. Music can help students bridge the gap between these two phases of development (Dolgin). Most importantly, students must feel safe before they can learn (Maslow, 1943). Since music is central to a modern student's life (Kimbel & Protivnak, 2010), it may help students to feel safe and accepted.

Brain-based learning theory from the medical field may support the idea that participation in music increases academic achievement (Covino, 2002; Cox & Stephens, 2006; Johnson, 2006; Shaw, 2003). Students who participate in musical activities have been found to have: (a) increased spatial reasoning (Covino; Shaw); (b) a larger corpus callosum (Cox & Stephens); and (c) better regulation of brain synapse deletion (Ellison, 2001).

Educators today focus on Experiential education (Dewey, 1938) or learning in the social realm. The use of music programs can effectively assist with Experiential learning objectives (Gooding, 2009; Parker, 2007). Furthermore, participation in music helps middle school students to bridge the gap between childhood and adulthood (Shaw, 2003). This may be because educators can use music to improve student motivation and engagement (Daniel, 2011; Nolem, 2003). Empirical research studies (Angle, 2002; Huber, 2009; Fitzpatrick, 2006) have also shown a correlation between music participation and various forms of academic achievement. However, there are few

studies that are focused on the correlation between music participation and mathematics achievement specific to middle school students in Grades 6, 7, and 8. In the following chapter, the specific research questions and null hypothesis are detailed, and the outline of the research design is described.

## CHAPTER THREE: METHODOLOGY

### Introduction

The purpose of this research study was to examine the relationship between music participation and the level of mathematics achievement in middle school students.

Reading music, understanding music notation, and interpreting music symbols are related to music production, tone quality, and harmony, which serve as indicators that learning has occurred (Huber, 2009). Music is a performance based learning model that can occur in solo performance, small ensemble performance, and large ensemble performance. Students can perform music using a variety of means, but most accessible to the middle school student are the voice and musical instruments. Music participation increases spatial reasoning and full brain processing, both of which are key cognitive areas that increase mathematic ability and aptitude (Cox, 2005; Shaw, 2009). A standardized criterion referenced test is used to measure achievement in this area.

### Research Design

The design for this study was correlation research, which is the most appropriate design, since the researcher sought to analyze the relationship between mathematics achievement (Georgia Criterion Referenced Competence Test [CRCT]; Georgia Department of Education [GaDOE], 2011) test scores, and 14 variables of music participation, which are associated with music performance as determined by the Music Participation Questionnaire (MPQ). The results were analyzed with use of a Pearson  $r$  correlation coefficient. Also, two additional tests were conducted. An analysis of variance (ANOVA) was used to study how the intensity of the relationship between music participation and mathematics changed over time. A  $t$ -test was then used to

compare the mathematical means of students, who had participated in musical activities, to students who had not participated in musical activities. The data were collected to answer the following research questions and corresponding null hypothesis.

### **Research Questions with Null Hypotheses**

RQ1. Is there a relationship between the study of music and mathematics achievement in middle school students?

H<sub>0</sub>1. There is no significant correlation between the number of years a student has been involved in music participation as shown by the Music Participation Questionnaire (MPQ) and mathematics achievement as indicated by the Criterion Referenced Competence Test (CRCT; Georgia Department of Education [GaDOE], 2011).

RQ2. What is the nature of the relationship between the study of music and mathematics achievement in middle school students?

H<sub>0</sub>2. There is no significant correlation between years of music participation in instrumental performance music as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

H<sub>0</sub>3. There is no significant correlation between the number of years middle school students participate in vocal performance as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2001).

H<sub>0</sub>4. There is no significant correlation between the number of years a student participates in brass performance as determined by the MPQ and mathematics

achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

H<sub>05</sub>. There is no significant correlation between the number of years a student participates in percussion performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

H<sub>06</sub>. There is no significant correlation between the number of years a student participates in woodwind performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

RQ3. What is the intensity of the relationship between the study of music and mathematics achievement in middle school students?

H<sub>07</sub>. There is no significant difference in the means of students who have participated in music for zero years, 1-2 years, or 3 or more years as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2011).

RQ4. Is there a difference in mathematics achievement between middle school students who have participated in music in comparison to middle school students who have not participated in music?

H<sub>08</sub>. There is no significant difference in the means of students who have participated in music in comparison to students who have not participated in music as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2011).

## **Participants**

Every student at the school, a total of 788 students, was invited to participate in this study. Of these students, 263 returned both the signed guardian permission form and the student assent form. All 263 of these students were included in this study. This number of participants closely replicated the number of participants used in the Huber (2009) study, which compared the results from the MPQ and English Language Arts standardized test results.

The 788 students were sent home with a guardian permission form. Of these, 276 returned the guardian permission form. Each of the 276 students, who returned the guardian permission form, was given an explanation of the study and asked to sign a student assent form. Of the 276 students, who returned a guardian permission form, 270 returned a signed student assent form. All of these 270 students were administered the MPQ. Of the 270 who answered the questionnaire, 7 students were eliminated due to incomplete data, or they had no mathematics CRCT (GaDOE, 2011) data recorded.

## **Setting**

The school curriculum included music participation, which was available to students in the areas of band, chorus, and music keyboarding. Music classes are electives, which students can freely choose to take or not to take. Student in the band and chorus programs participated in the Georgia Music Educators Association Large Group Performance Evaluation (LGPE) to evaluate the quality of music instruction and aptitude of the respective programs. The LGPE requires highly educated adjudicators to rate the programs on a scale of 1 to 4. A ranking of 1 is considered a Superior Rating, and a ranking of 3 or 4 is considered Needs Improvement. Both band and chorus programs



received a ranking of 1 during the 2011 school year, an indication that the programs provided an adequate and Superior opportunity for students to participate in music.

### **Instrumentation**

Two research instruments were used to determine and manipulate the variables in this study. The test scores from the CRCT (GaDOE, 2011) for mathematics, taken in April 2012, were compared to the student responses, which were recorded on MPQ (see Appendix A). The CRCT is a state required standardized test, and the researcher developed the latter. For the MPQ, several questions were slightly reworded in order to make the questions readable at a sixth grade reading level.

Staff of the Georgia Department of Education (GaDOE) oversees the development of the CRCT. The test adheres to the standards of educational and psychological testing as established by the American Education Research Association (2011, as cited in GaDOE, 2011). The mathematics CRCT test is designed to measure the mathematics performance of students in Grades 3-8. The assessments provide information about the academic score of the individual student, class, school, system, and other state level identifiers. The validity of the CRCT is reliant upon how well the test matches the intended curriculum, and how well the scores are reported for various stakeholders.

Students are assessed on their understanding of and achievement on the Georgia Performance Standards (GPS) for mathematics at their respective grade level. Two documents are used in the development of this test. The first is the content domain specifications, which indicate how specific standards or elements of the curriculum will be grouped into strands. The second is the test item specifications that give additional

detail about what kind of items will be written (GaDOE, 2011). The content domain specifications are converted into another document called the CRCT Content Descriptors, which are posted on the GaDOE website for all stakeholders to be informed of the test content and method of assessment.

With use of these documents, qualified, professional assessment specialists write items for the test, and these items are reviewed by committees of Georgia educators for alignment with the curriculum, suitability, as well as review for bias and sensitivity concerns. The committees can accept, review, or deny the acceptance of any item on the test. The items are then field-tested through trial runs with students to help ensure that items are functional and appropriate for the students. Once the field tests have been completed, another committee of Georgia educators reviews the test items with the data from the field test. Also, the review includes data in relation to how various groups of students performed on the test in order to prevent any bias (GaDOE, 2011). The tests are then equated to make sure that all versions of the test are equally difficult. Students, who score below 800, are labeled as “does not meet expectations.” Students, who score 800-849, are labeled as “meeting expectations” (p. 4). Students, who score 850 or higher, are labeled as “exceeds expectations.” The reliability coefficient is a unit-less index that is compared between tests with a range of 0 to 1. The 2011 CRCT test ranged from .085 to .094. The reliabilities for the 2011 CRCT were determined to be sufficiently reliable indicators in demonstrated achievement of the mathematics GPS.

Johnson (2006) was the first to use a questionnaire to determine to what degree students participate in music. Responses in the Johnson (2006) study were compared to standardized test scores in English to establish a correlation between music participation

and reading achievement. Huber (2009) adapted the Johnson (2006) questionnaire in order to obtain information pertaining to the levels of experience within the realm of music participation. Student responses indicated the number of years and type of participation in music. The responses to the questions were used to test the different ways in which students participate in music including: (a) instruments played; (b) the duration of years in public and/or private lessons; (c) association with bands, orchestras, and choral programs; as well as (d) participation in community, church, and civic organizations. Termination of music participation was also included in the study.

This researcher considered the Huber (2009) Questionnaire when creating the MPQ used in this study. This instrument was adapted from the Johnson (2006) study, but the results were tested against the Georgia mathematics section of the CRCT (GaDOE, 2011) rather than a standardized English Language Arts test.

### **Procedures**

After the research proposal was approved by the researcher's dissertation committee, the researcher applied for permission to conduct the study from the members of the Liberty University Institutional Review Board (IRB). For the application to the IRB, the researcher responded to questions in relation to the potential harmful effects the study may have on students. After review, the Chair of the IRB notified the researcher through email (see Appendix B) that permission to conduct the study was granted. The IRB granted this permission for a 1 year period of time. The study was conducted in the allotted time, and no further extension was required.

Two weeks before the collection of data, each student in the middle school was given a parent/guardian consent letter that explained the purpose of the study (see

Appendix C). Parents were asked to sign a guardian consent form stating that they give their permission for their student to participate in the study. Only students who returned a signed guardian permission form were included in the study. The time period for the return of the form was 1 week. The weekend before the data collection began, all students, who were eligible to participate and had parental consent, were given a student assent form. This allowed the students a weekend to determine if they had any questions about the study and have ample time to have these questions answered before they agreed to participate in the study. The assent form is provided in Appendix D.

Students, who returned a guardian permission form and signed a student assent, form were administered the questionnaire. This occurred 2 weeks after the initial guardian permission forms were sent home with students. Students were administered the MPQ during homeroom, which was a period of designated noninstructional time. The participants were called to the school cafeteria during homeroom. The cafeteria was sectioned into three groups, one for each respective grade level. The students were provided sharpened pencils to complete the questionnaire as needed. The researcher went to each group separately and administered the survey.

Students were asked to print their first and last name on the questionnaire in the space provided. This information was later removed by the principal and replaced with the student's mathematics CRCT (GaDOE, 2011) score to protect anonymity. This researcher did not see the names on the questionnaires during its administration. Students had approximately 15 minutes to complete the questionnaire, although a few students required 10 additional minutes, which was allowed by the Principal. Students with

disabilities had a faculty member assigned to assist them with the questionnaire if necessary. Faculty members and volunteers collected the materials.

The protection of student identity was an important part of the study. In order to protect the anonymity of students, the school Principal matched the individual mathematics CRCT (GaDOE, 2011) scores with the appropriate MPQ. Once each MPQ had been paired with the respective mathematics CRCT score, the names were cut off the questionnaires. The Principal then gave the questionnaires, with the mathematics CRCT scores and no identifying information, to the researcher for the study.

The researcher entered the data into the Statistical Package for Social Scientists (SPSS; IBM, 2011) software. With use of the SPSS, the data collected from the questionnaire were compared to the mathematics CRCT (GaDOE, 2011) score. The descriptive statistics were reported, and a Pearson  $r$  coefficient was used to test and report the findings.

### **Data Analysis**

The data were analyzed with use of a Pearson product-moment correlation coefficient, most often referred to as the Pearson  $r$  coefficient. The Pearson product-moment coefficient is the most commonly used tool to measure the correlation between two variables (Howell, 2011). The reason for using the Pearson product-moment coefficient was to establish the possibility of an existing relationship without determining that the relationship existed in a cause and effect situation. The collected data were separated into two primary variables; the years spent in active participation in music and the mathematics CRCT (GaDOE, 2011) results. These two variables were the  $x$  and  $y$  used in the Pearson product-moment correlation coefficient test. After these two primary

variables were analyzed, the other variables of desired study were substituted individually and independently for the years of music participation and observed in relationship to mathematics achievement scores. In this manner, each relationship was studied in a two variable, x and y relationship. The formula of the Pearson  $r$  was  $r = \text{cov}(xy)/s(x)S(y)$ . The results yielded a point on a scale between -1.00 and 1.00. The closer the result was to one of these two limits, the stronger or weaker the relationship was determined to be.

With use of the responses from the MPQ, 12 variables from student responses were entered into SPSS 20.0 (IBM, 2011). Twelve of the variables were represented by the number of years that the student had been actively engaged in music participation. These variables were: (a) total years of music instruction (i.e., 1-3); (b) instrumentation (i.e., brass, percussion, woodwinds, and voice); (c) school ensembles (i.e., band, chorus); and (d) ensembles outside of the school (i.e., church groups, community organizations, private lessons). The mathematics CRCT (GaDOE, 2011) score was another variable. Current status, as it related to the students' current level of music participation, was also a variable to in order determine if the students were still actively involved in music participation or if they had terminated this participation. The CRCT mathematics scores were taken from the results of the April 2012 mathematic CRCT assessment.

### **Chapter Summary**

The purpose of this study was to identify the direction and magnitude of the relationship between two primary variables, students' time spent in active participation in music and the assessment scores from the mathematics CRCT (GaDOE, 2012) assessment. Other variables were observed by substitution of the variable for the years of active music participation. The Pearson  $r$  correlation coefficient was used to test the

relationship between the variables. An ANOVA was used to test the intensity of the relationship. A final *t*-test was used to compare the means of students who had participated in musical activities with students who had not participated in musical activities. Presented in Chapter Four are the findings from this current research study.

## CHAPTER FOUR: RESULTS OF DATA ANALYSIS

### Overview

The purpose of this study was to determine whether there was a relationship between music participation and mathematics achievement in middle school students. To determine if a correlation exists, an analysis of the data was conducted with use of the statistical software package, Statistical Package for Social Scientists (SPSS 20.0; IBM, 2011). The SPSS software is used to generate reports through charts, tables, and plots to help researchers observe phenomena within a sample. Typically, researchers are able to obtain information in regard to: (a) distributions, (b) descriptive statistics, and (c) other forms of analysis from a given data set. The data from this study were organized into an SPSS variable chart as identified by the results from the Music Participation Questionnaire (MPQ). Also, each student's individual mathematics Criterion-Referenced Competency Test (CRCT; Georgia Department of Education [GaDOE], 2011) score was included as a variable in the SPSS variable chart.

Responses from the 263 participants, who answered the MPQ, were divided into 12 variables based on students' involvement in musical activities. These variables were then correlated with each student's test score from the CRCT (GaDOE, 2012). A score below 800 represented a student who "does not meet expectations," and scores 850 and above represented a student who "exceeds expectations" (p. 4) in the mathematics content for his or her respective grade level.

### Results

The primary focus of this study was to determine if there was a correlation between the total number of years each student actively participated in musical activities



and his or her standardized mathematics CRCT (GaDOE, 2011) score. Preliminary observations of data showed that 91 students exceeded expectations according to the CRCT score reports. Of this number, 72 participants reported that they actively participated in music at the time the study was conducted.

**Descriptive statistics.**

Displayed in Table 1 are the descriptive statistics for all of the 263 students. It was found that the average number of years a student actively participated in musical activities was slightly more than 2.5 years. The mathematics test scores ranged from a minimum of 761 to a maximum test score of 990. The average test score was 837.928.

Table 1

*Descriptive Statistics for Years of Student Participation in Musical Activities and Mathematics CRCT*

	<i>N</i>	Minimum	Maximum	Mean
Years Participated in Music	263	0.000	11.000	2.529
Mathematics CRCT Scores	262	761.000	990.000	837.928

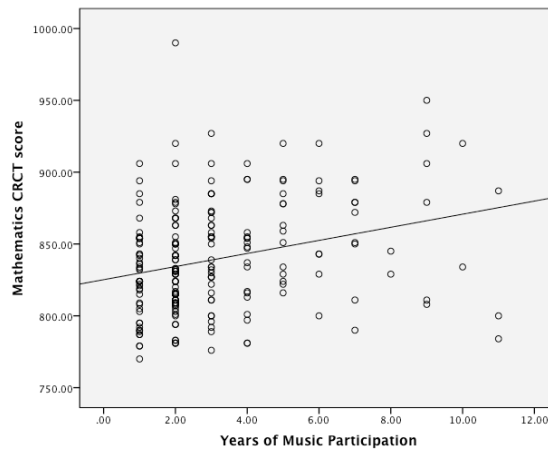
RQ1. Is there a relationship between the study of music and mathematics achievement in middle school students?

H<sub>0</sub>1. There is no significant correlation between the number of years a student has been involved in music participation as shown by the MPQ and mathematics achievement as indicated by the CRCT (GaDOE, 2011).

First, the correlation between the number of years a student had participated in music and mathematics CRCT scores was examined. The results were calculated with use of a Pearson Product-Moment Correlation Coefficient  $r$ . The purpose of the Pearson Product-Moment Correlation Coefficient, most commonly known as Pearson  $r$ , is to assess the degree that quantitative variables are linearly related in a given sample. The Pearson  $r$  is the most appropriate formula for the study of a correlation between two variables (Green & Salkind, 2011). There are two assumptions that must be met before the Pearson  $r$  correlation may be used.

Assumption 1 is that the variables of mathematics CRCT (GaDOE, 2011) scores and years of music participation were bivariately distributed across the x and y axis. As shown in Figure 1, the variables had a linear relationship.

*Figure 1.* Scatterplot using the variables of mathematics CRCT scores and years of music participation



Assumption 2 was that the case represented a random sample from the population, and the scores of variables for one case were independent of scores of the variables for other cases. In this study, all students in the school were given an equal opportunity to

participate in the study. Selection in the study was determined by students who met the criteria of guardian consent, student assent, and present at school on the day the questionnaire was administered. Every student had an equal chance of inclusion in the study, which was not influenced by the researcher. The factors, years of music participation and individual mathematics CRCT (GaDOE, 2011) scores of students, were independent of the respective results for other students. The requirements of Assumption 2 were fulfilled.

After both assumptions were satisfied, the Pearson product-moment  $r$  test for correlation was conducted with the 211 students who had participated in musical activities for 1 year or more. Displayed in Table 2 are the results. The correlation  $r$  between years of music participation and mathematics CRCT (GaDOE, 2011) scores was .277, an indication that, as years of music participation increased, the mathematics CRCT scores increased as well ( $r (.277) = .000, p < .01$ ).

Table 2

*The Correlation Between Years of Music Participation and Mathematics CRCT Score*

	Years of Music Participation		
	$r$	$p$	$N$
Mathematics CRCT Scores	.277	.000	211

RQ2. What is the nature of the relationship between the study of music and mathematics achievement in middle school students?

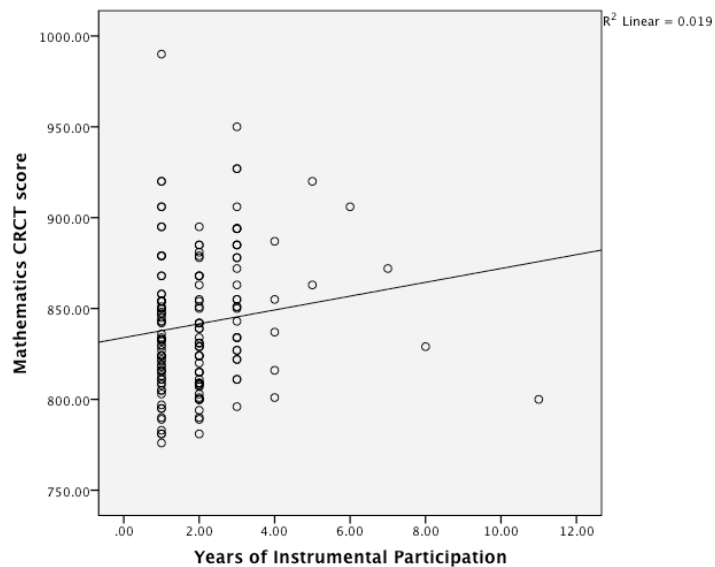
H<sub>0</sub>2. There is no significant correlation between years of music participation in instrumental performance as determined by the MPQ and mathematics achievement in

middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

Next, the correlation between years of instrumental music participation and mathematics CRCT (GaDOE, 2011) scores was examined. The relationship between years of instrumental music participation and mathematics achievement was tested with use of the Pearson  $r$  correlation coefficient. Before the correlation was computed, the assumption test was conducted.

Assumption 1 was that the variables of mathematics CRCT (GaDOE, 2011) scores and years of instrumental music participation were bivariate distributed across the x and y axis. As noted in Figure 2, the variables had a linear relationship.

*Figure 2.* Scatterplot of the variables of mathematics CRCT scores and years of instrumental music participation



Assumption 2 was that the case represented a random sample from the population, and the scores of variables for one case were independent of scores of the variables for

other cases. As previously stated, all students had an equal chance to participate in this study. Values from one student had no affect on the values from another student.

A Pearson product-moment correlation coefficient was conducted to determine the relationship between the variables, years of instrumental participation and the mathematics CRCT (GaDOE, 2011) score. As noted in Table 3, the results from the Pearson  $r$  test indicated that no statistically significant relationship existed between these variables ( $r = .139, N = 160, p = .080$ ). In the scatterplot, these results are summarized (see Figure 2). In summary, more years of instrumental music participation did not associate with higher (i.e., or lower) mathematics CRCT scores.

Table 3

*The Correlation Between Years of Instrumental Music Participation and Mathematics CRCT Scores*

	Years of Instrumental Music Participation		
	$r$	$p$	$N$
Mathematics CRCT Score	.139	.080	160

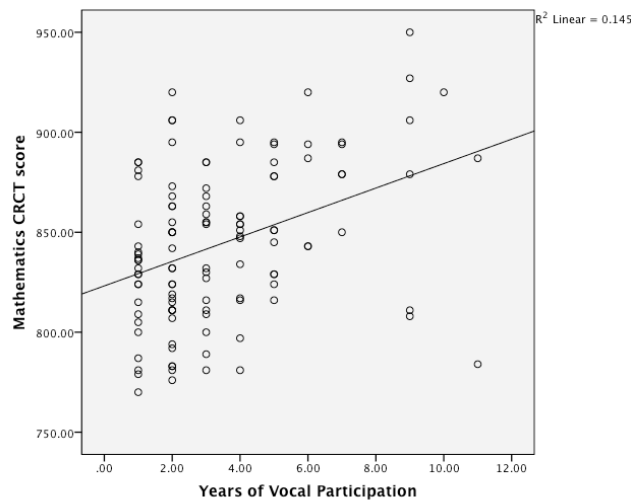
H<sub>03</sub>. There is no significant correlation between the number of years middle school students participation in vocal performance as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2001).

Next, the correlation between years of vocal music participation and mathematics CRCT (GaDOE, 2011) scores was studied. The relationship between years of vocal music participation and mathematics achievement was tested using the Pearson  $r$

correlation coefficient. Before the correlation was computed, the assumption test was conducted.

Assumption 1 was that the variables of the mathematics CRCT (GaDOE, 2011) scores and years of vocal music participation were bivariately distributed across the x and y axis. As noted in Figure 3, the variables had a linear relationship.

*Figure 3.* Scatterplot of the variables of mathematics CRCT scores and years of vocal music participation



Assumption 2 was that the case represented a random sample from the population, and the scores of variables for one case were independent of scores of the variables for other cases. All students had an equal chance to participate in this study. Values from one student have no affect on the values from another student.

After both assumptions were satisfied, the Pearson  $r$  test for correlation was conducted. As noted in Table 4, the following results were identified. The correlation  $r$  between years of vocal participation and mathematics CRCT (GaDOE, 2011) scores was

.380, an indication that, as years of vocal participation increased, the mathematics CRCT scores increased as well ( $r(.380) = .00, p < .01$ ).

Table 4

*The Correlation Between Years of Vocal Music Participation and Mathematics CRCT*

*Scores*

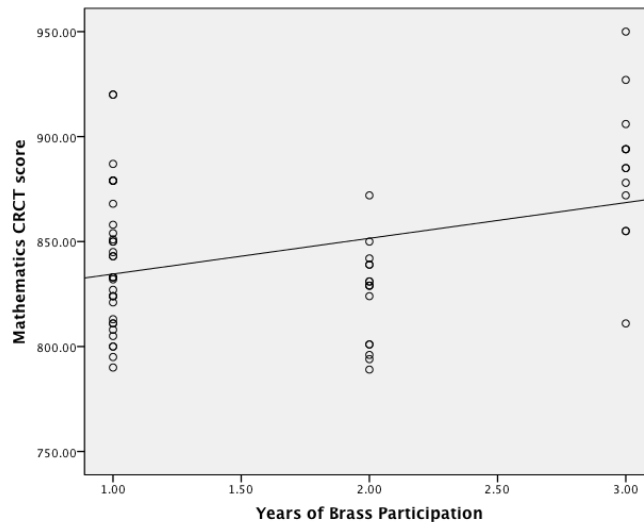
	Years of Vocal Music Participation		
	<i>r</i>	<i>p</i>	<i>N</i>
Mathematics CRCT	.380	.000	117
Score			

H<sub>0</sub>4. There is no significant correlation between the numbers of years a student participates in brass performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

Next, the correlation between years of brass instrument participation and mathematics CRCT (GaDOE, 2011) scores was examined. The relationship between years of brass instrument music participation and mathematics achievement was tested with use of the Pearson *r* correlation coefficient. Before the correlation was computed, the assumption test was conducted.

Assumption 1 was that the variables of mathematics CRCT (GaDOE, 2011) scores and years of brass instrument music participation are bivariate distributed across the x and y axis. As displayed in Figure 4, the variables had a linear relationship.

Figure 4. Scatterplot of the variables of mathematics CRCT scores and years of brass instrument music participation



Assumption 2 was that the case represented a random sample from the population, and the scores of variables for one case were independent of the scores of the variables for other cases. All students had an equal opportunity to be included in the study. Values from one student had no affect on the values from another student.

After both assumptions were satisfied, the Pearson  $r$  test for correlation was conducted. As noted in Table 5, the findings for the correlation  $r$  between years of brass instrument music participation and mathematics CRCT (GaDOE, 2011) scores was .366, an indication that, as years of brass instrument music participation increased, the mathematics CRCT scores increased as well ( $r(.366) = .003, p < .01$ ).



Table 5

*The Correlation Between Years of Brass Instrument Music Participation and Mathematics CRCT Scores*

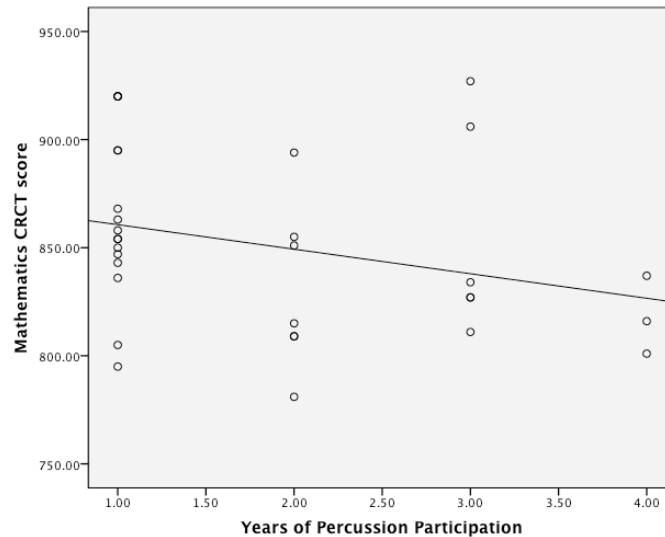
Years of Brass Music Participation			
	<i>r</i>	<i>p</i>	<i>N</i>
Mathematics CRCT Scores	.366	.003	63

H<sub>05</sub>. There is no significant correlation between the number of years a student participates in percussion performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

Then, the correlation between years of percussion instrument music participation and mathematics CRCT (GaDOE, 2011) scores was studied. The relationship between years of percussion instrument music participation and mathematics achievement was tested using the Pearson *r* correlation coefficient. Before the correlation was computed, the assumption test was conducted.

Assumption 1 was that the variables of mathematics CRCT (GaDOE, 2011) scores and years of percussion instrument music participation were bivariately distributed across the x and y axis. As noted in Figure 5, the variables had a linear relationship.

Figure 5. Scatterplot of the variables of mathematics CRCT scores and years of percussion instrument music participation



Assumption 2 was that the case represented a random sample from the population, and the scores of variables for one case were independent of scores of the variables for other cases. All students had an equal chance of participation in this study. Values from one student had no affect on the values from another student.

A Pearson product-moment correlation coefficient was conducted to determine the relationship between the variables, years of percussion performance, and mathematics CRCT (GaDOE, 2011) score. As noted in Table 6, the results from the Pearson  $r$  test indicated that no statistically significant relationship existed between these variables ( $r = -.289, N = 32, p = .108$ ). In the scatterplot, these results are summarized (see Figure 6). In summary, more years of percussion music participation did not associate with higher or lower mathematics CRCT scores.

Table 6

*The Correlation Between Years of Percussion Instrument Music Participation and Mathematics CRCT Scores.*

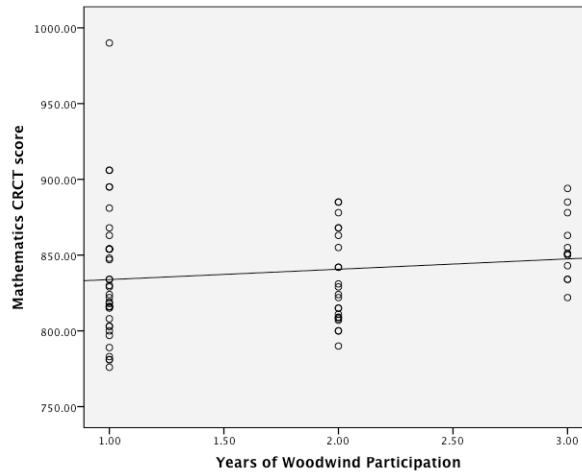
Years of Percussion Music Participation			
	<i>r</i>	<i>p</i>	<i>N</i>
Mathematics CRCT Scores	-.289	.108	32

H<sub>0</sub>6. There is no significant correlation between the number of years a student participates in woodwind performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

Finally, the correlation between years of woodwind instrument music participation and mathematics (GaDOE, 2011) scores was examined. The relationship between years of woodwind music participation and mathematics achievement was tested with the use of the Pearson *r* correlation coefficient. Before the correlation was computed, the assumption test was conducted.

Assumption 1 was that the variables of mathematics CRCT (GaDOE, 2011) scores and years of vocal music participation were bivariately distributed across the x and y axis. As displayed in Figure 6, the variables had a linear relationship.

Figure 6. Scatterplot of the variables of mathematics CRCT scores and years of woodwind music participation



Assumption 2 was that the case represented a random sample from the population, and the scores of variables for one case are independent of scores of the variables for other cases. All students had an equal opportunity to participate in this study. Values from one student had no affect on the values from another student.

A Pearson product-moment correlation coefficient was conducted to determine the relationship between the variables of years of woodwind performance and mathematics CRCT (GaDOE, 2011) score. As noted in Table 7, the results of the Pearson  $r$  test indicated that no statistically significant relationship existed between these variables ( $r = .138$ ,  $N = 71$ ,  $p = .251$ ). In Figure 6, these results are summarized. In summary, more years of woodwind performance did not associate with higher or lower mathematics CRCT scores.

Table 7

*The Correlation Between Years of Woodwind Instrument Music Participation and Mathematics CRCT Scores*

	Years of Woodwind Music Participation		
	<i>r</i>	<i>p</i>	<i>N</i>
Mathematics CRCT Scores	.138	.251	71

RQ3. What is the intensity of the relationship between the study of music and mathematics achievement in middle school students?

H<sub>0</sub>7. There is no significant difference in the means of students who have participated in music for zero years, 1-2 years, or 3 or more years as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2011).

In order to further study the intensity of the relationship between music participation and mathematics CRCT (GaDOE, 2011) scores, the researcher split the data into three groups based on total years of music participation. Huber found that, as students reached eighth grade, the intensity of language arts achievement had lessened. In this study, the researcher established three groups based on years of participation in musical activities. Group 1 consisted of students who had zero years of musical activities. Group 2 were students who had 1-2 years of participation in musical activities. Group 3 consisted of students who had participated in 3 years or more of musical

activities. As displayed in Table 8, 8 students were in Group 1, 112 students were in Group 2, and 99 students were in Group 3.

Table 8

*Descriptive Statistics of Three Groups Based on Years of Participation*

Dependent Variable: Mathematics CRCT Score

Music Participation Group	<i>M</i>	<i>SD</i>	<i>N</i>
1	831.346	34.218	52
2	830.107	34.005	112
3	850.232	38.790	99
Total	837.928	37.048	263

To compare the mean scores between groups, a one-way analysis of variance (ANOVA) was conducted. The dependent variable was the mathematics CRCT (GaDOE, 2011) score. The independent variable was the three groups or levels of participation, which was split into three fixed factors. As displayed in Tables 9 and 10, the test was significant ( $F(2, 260) = 9.33, p = .000$ ). This finding supports the rejection of the null hypothesis. There was a correlation between the years of music participation and increased mathematics CRCT scores. The strength of the relationship between years of music participation and mathematics CRCT score, as assessed by  $n^2$ , was strong; the years of music participation counted for 7% of the variance in the dependent variable.

Table 9

*Levene's Test of Equality of Error Variances*

Dependent Variable: Mathematics CRCT Score

<i>F</i>	<i>df</i> <sup>1</sup>	<i>df</i> <sup>2</sup>	Sig.
2.383	2	260	.094

*Note.* Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

Table 10

*Tests of Between-Subjects Effects*

Dependent Variable: Mathematics CRCT Score

Source	Type III Sum of Squares	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	Partial Eta Squared
Corrected Model	24091.487	2	12045.744	9.334	.000	.067
Intercept	164885175.594	1	164885175.594	127772.198	.000	.998
Music Participation Groups	24091.487	2	12045.744	9.334	.000	.067
Error	335520.140	260	1290.462			
Total	185017941.000	263				
Corrected Total	359611.627	262				

Follow-up statistical analysis tests were conducted to evaluate pairwise differences among the mean scores. Because there was a large range of variance among the three groups, it was assumed that the variances were not homogenous, and post hoc comparisons were conducted with the use of the Dunnett's C test, a test in which equal variance is not assumed among the three groups. There was a significant difference in the means between Group 2, which had 1-2 years of music participation, and Group 3, which had 3 years or more of music participation. In addition, there was a significant difference between Group 3, which had 3 years or more of music participation and Group 1, which had zero years of music participation. However, there was no significant difference between Group 2, which had 1-2 years of music participation and Group 1, which had zero years of music participation. Group 3, which had 3 years or more, showed a greater increase in mathematics CRCT (GaDOE, 2011) scores than the groups with 2 or less years of music participation. The 95% confidence intervals for the pairwise differences, as well as the means and standard deviations for the three music participation groups, are displayed in Table 11.



Table 11

*95% Confidence Intervals of Pairwise Differences in Mean Changes in Years of Music Participation*

Dependent Variable: Mathematics CRCT Score

Music Participation Groups	Music Participation Groups	Mean Difference (I-J)	SE	<i>p</i>	95% Confidence Interval for Difference <sup>a</sup>	
					Lower Bound	Upper Bound
1	2.00	1.239	6.028	.837	-10.631	13.109
	3.00	-18.886*	6.152	.002	-31.001	-6.771
2	1.00	-1.239	6.028	.837	-13.109	10.631
	3.00	-20.125*	4.955	.000	-29.883	-10.367
3	1.00	18.886*	6.152	.002	6.771	31.001
	2.00	20.125*	4.955	.000	10.367	29.883

*Note.* Based on estimated marginal means. \*The mean difference is significant at the .002 level. <sup>a</sup>Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

RQ4. Is there a difference in mathematics achievement between middle school students who have participated in music in comparison to middle school students who have not participated in music?

H<sub>0</sub>8. There is no significant difference in the means of students who have participated music in comparison to students who have not participated in music as

determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2011).

Assumption 1 was that the difference scores are normally distributed in the population. The values included in the *t*-test were normally distributed according to guidelines. Assumption 2 was that the cases represent a random sample from the population and the difference scores are independent of each other. All students had an equal opportunity to participate in this study. Values from one student had no effect on the values from another student.

An independent samples *t*-test was conducted to evaluate the hypothesis that students who participated in music activities had a higher score on the Georgia mathematics CRCT (GaDOE, 2011) as opposed to students who did not participate in musical activities. The test was not significant ( $t(261) = .217 > .05$ ). Students who participated in musical activities ( $M = 831.346, SD = 34.218$ ) had no significant difference in means in comparison to students who had not participated in musical activities ( $M = 839.550, SD = 37.612$ ). In table 11, the 95% confidence interval was quite wide and ranged from -19.475 to 3.069.

Table 12

*Descriptive Statistics Between Students Who Participated in Music and*

*Students Who Did Not Participate in Music*

Group	n	Mean	SD	SE
Participated in Music	211	831.346	34.218	4.745
No Participation in Music	52	839.550	37.613	2.589

Table 13

*t-Test of Students Who Participated in Music in Comparison to Students Who Did Not Participate in Music*

<i>Mean</i>	<i>SE</i>	<i>df</i>	<i>t-stat</i>	<i>p value</i>
-8.204	5.724	261	-1.433	.217

**Chapter Summary**

The results from the Pearson product moment correlation test showed a positive correlation between years of music participation and the CRCT (GaDOE, 2011). The findings from ANOVA demonstrated that, for students who participated in music for 3 years or longer, there were stronger correlations with higher mathematics CRCT scores than for students, who participated in music 2 years or less. This was an indication that the strength of the correlation between years of music participation and mathematics achievement strengthens over time. Further tests were conducted on the correlation

between the independent variables of years of instrumental, vocal, brass, woodwind, and percussion forms of music participation and mathematics CRCT scores. The results showed positive correlations independently between vocal and brass years of music participation and mathematics CRCT scores. No significant correlation was observed between years of instrumental, woodwind, or percussion forms of music participation and mathematics CRCT scores. A *t*-test of means was conducted to determine if the students who participated in musical activities did, in fact, have a higher mean on the Georgia mathematics CRCT test. The results of the *t*-test yielded no significant difference; that is, there was no significant difference in the mean test scores between students who participated in musical activities and those students who did not participate in musical activities. The null hypothesis was accepted.

Presented in Chapter 5 is a discussion of the procedures and results from the study. Then, the results are analyzed and reported. Several limitations to the study are considered. Finally, recommendations are made for future study.

## CHAPTER FIVE: SUMMARY AND DISCUSSION

### Introduction

Presented in this chapter is the research problem as well as a review of the methodology used in this current study. Finally, the results are summarized, the implications of the results are discussed, as well as recommendations for continued research.

### Reiteration of the Problem

As discussed in Chapter Two, music education is considered to be an important part of the United States curriculum (Buchanan, 2008). The Bible establishes music as an important tool in the lives of individuals in the book of Habakkuk:

The LORD God is my strength. . . To the Chief Musician. With my stringed instruments. (Habakkuk 3:17)

In this scripture, God is referred to as “the Chief Musician.” In society, today, recent federal laws, such as the Elementary and Secondary Education Act (ESEA; 2011), the legitimacy of arts programs, such as music, are recognized; however, no accountability measures were placed on the arts programs. These same laws require rigorous testing and mandated reporting in other academic areas (Buchanan). For this reason, many district officials may choose to sacrifice seat time in music programs in order to place students in extended hours of subjects that require high stakes testing. The loss of seat time in the arts is a concern, since it is theorized that music intelligence is an important means by which students learn academic information (Gardner, 1993). The idea that loss of time in music participation is detrimental to a student is further supported through recent developments in brain science, in which simultaneous regional brain activity

during music production has been observed (Covino, 2002). It appears that participation in music helps the transfer of information from one hemisphere of the brain to the other (Stein, 2004), as brain synapses fire at a much faster rate when music is present (Hall, 2007). Also, Fitzpatrick (2006) and Huber (2009) reported that students, who participated in music programs, demonstrated greater academic gains. Specifically, Huber found a correlation between music participation and language arts aptitude in middle school students. Cox (2005) and Shaw (2009) suggested that music students' increased spatial and logical reasoning may be the reason for these academic gains. Another suggested cause of the correlation between increased academic gains of music students is the focus on creativity, a skill that represents the highest cognitive process (Hanna, 2003). While these attributes have been observed to have a positive effect on language arts aptitude (Huber), also, they could be transferred to mathematical understanding (Shaw; Strickland, 2002). For this reason, this researcher sought to determine whether a correlation exists between years of music participation and mathematics achievement.

The purpose of this study was to fill the gap in the literature in relation to music participation and its correlation to mathematics and middle school students. If one understands this relationship, it may be possible to better evaluate and understand the effect of music participation on the mathematical achievement of middle school students.

### **Review of the Methodology**

The purpose of this study was to determine whether a correlation exists between two primary variables, years of music participation and mathematics CRCT (Georgia Department of Education [GaDOE], 2011). Additional variables were then extracted

from student responses to the questionnaire and tested for their correlation with the mathematics CRCT scores.

The collected data were based on student responses to the music participation questionnaire (MPQ). The questionnaire was changed to utilize mathematics achievement as a primary variable. Also, the questionnaire was adapted to be readable at the current sixth grade level as determined by the appropriate Lexile score (MetaMetrics, 2012). The students responded to the questions and reported their various degrees of music participation, if any, and they identified the number of years that they had participated in their respective musical activities. In addition, students were asked to list areas of music participation that included both in and out of school activities. Analysis of the data was performed with use of the Statistical Package for Social Scientists (SPSS 20.0; 2011) software. The results were calculated with use of the Pearson product-moment correlation coefficient  $r$ . Once the overall years of music participation was tested against the individual mathematics CRCT (GaDOE, 2011) scores for correlation, student scores were placed into three groups: (a) Group 1 consisted of students who had zero years of music participation, (b) Group 2 had 1-2 years of music participation, and (c) Group 3 had 3 or more years of music participation. An analysis of variance (ANOVA) was conducted between the three groups to test the means between degrees of music participation. Finally, a  $t$ -test of means was conducted to compare the mathematics scores of students who had participated in music with students who reported that they had not participated in music according to the MPQ.

## Summary of the Findings

The collected data were analyzed to study the relationship between music participation and mathematics achievement in middle school students. The findings data indicated a correlation coefficient as well as indicator of the intensity of the associations. The following results were found after testing each of the eight null hypotheses.

H<sub>01</sub>. There is no significant correlation between the number of years a student has been involved in music participation as shown by the MPQ and mathematics achievement as indicated by the Georgia CRCT (GaDOE, 2011).

A total of 211 participants in Grades 6-8 were included in this study. A Pearson product-moment  $r$  test for correlation was conducted. A significant positive correlation ( $p = .000$ ) was found between the two variables, years of music participation and mathematics CRCT (GaDOE, 2011) scores ( $r = .277$ ). Based on these results, the null hypothesis was rejected. There was a positive correlation between years of music participation and mathematics achievement in middle school students.

H<sub>02</sub>. There is no significant correlation between years of music participation in instrumental performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

A total of 160 participants in Grades 6-8 were analyzed according to their years of instrumental music participation and their respective mathematics CRCT (GaDOE, 2011) score. A Pearson product-moment  $r$  test for correlation was conducted. No significant correlation ( $p = .080$ ) was found between the two variables, years of instrumental music participation and mathematics CRCT scores ( $r = .139$ ). Based on these results, the null



hypothesis was accepted. There was no significant correlation between years of instrumental music participation and mathematics achievement.

H<sub>03</sub>. There is no significant correlation between the number of years middle school students participate in vocal performance as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2001).

A total of 117 participants in Grades 6-8 were analyzed according to their years of vocal music participation, which ranged from 0-11 years, and their respective mathematics CRCT (GaDOE, 2011) score. A Pearson product-moment  $r$  test for correlation was conducted. A significant positive correlation ( $p = .000$ ) was found between the two variables, years of vocal music participation and mathematics CRCT scores ( $r = .380$ ). This was the highest correlation observed in the study. Based on these results, the null hypothesis was rejected. There was a correlation between vocal music participation and mathematics achievement in these middle school students.

H<sub>04</sub>. There is no significant correlation between the number of years a student participates in brass performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

A total of 63 participants in Grades 6-8 were analyzed according to their years of brass music participation, which ranged from 0-3 years, and their respective mathematics CRCT (GaDOE, 2011) score. A Pearson product-moment  $r$  test for correlation was conducted. A significant positive correlation ( $p = .003$ ) was found between the two variables, years of brass music participation and mathematics CRCT scores ( $r = .366$ ).

Based on these results, the null hypothesis was rejected. There was a correlation between brass music participation and mathematics achievement in middle school students.

H<sub>05</sub>. There is no significant correlation between the number of years a student participates in percussion performance as determined by the MPG and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

A total of 32 participants in Grades 6-8 were analyzed according to their years of percussion music participation, which ranged from 0-4 years, and their respective mathematics CRCT (GaDOE, 2011) score. A Pearson product-moment  $r$  test for correlation was conducted. No significant correlation ( $p = .108$ ) was found between the two variables, years of percussion music participation and mathematics CRCT scores ( $r = -.289$ ). Based on these results, the null hypothesis was accepted. There was no significant correlation between years of percussion music participation and mathematics achievement.

H<sub>06</sub>. There is no significant correlation between the number of years a student participates in woodwind performance as determined by the MPQ and mathematics achievement in middle school students as determined by the Georgia mathematics CRCT (GaDOE, 2011).

A total of 71 participants in Grades 6-8 were analyzed according to their years of woodwind music participation, which ranged from 0-3, and their respective mathematics CRCT (GaDOE, 2011) score. A Pearson product-moment  $r$  test for correlation was conducted. No significant correlation ( $p = .251$ ) was found between the two variables, years of woodwind music participation and mathematics CRCT scores ( $r = .138$ ). Based

on these results, the null hypothesis was accepted. There was no significant correlation between years of woodwind music participation and mathematics achievement.

H<sub>07</sub>. There is no significant difference in the means of students who have participated in music for zero years, 1-2 years, or 3 or more years as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2011).

Further statistical analysis was conducted to understand how the intensity of music participation changes over time. Each of the participants was placed into a group based on his or her total years of participation in musical activities: (a) Group 1, zero years of music participation; (b) Group 2, 1-2 years of music participation; and (c) Group 3, 3 years or more of participation in musical activities. A one-way ANOVA was conducted to determine the difference in intensity between the three groups. The results for Group 1 ( $M = 831.35$ ,  $SD = 34.33$ ), Group 2 ( $M = 830.12$ ,  $SD = 34.05$ ), and Group 3 ( $M = 850.23$ ,  $SD = 38.79$ ) indicated that the students in Group 3 (i.e., 3 years or more of music participation) scored significantly higher than students with 1-2 years, or students with zero years of participation in musical activities. There was no significant difference between the group of students, who had 1-2 years of music participation and the group with zero years of music participation. These results suggested that only 1-2 years of participation in musical activities did not correlate with increased mathematics standardized test scores. However, a correlation did exist between mathematics achievement and music participation when the student has participated in musical activities for 3 or more years. This finding suggests that, as students increase their years

of participation in music, the relationship between years of music participation and mathematics achievement intensifies.

H<sub>08</sub>. There is no significant difference in the means of students who have participated in music in comparison to students who have not participated in music as determined by the MPQ and mathematics achievement as determined by the Georgia mathematics CRCT (GaDOE, 2011).

An independent samples *t*-test was conducted to evaluate the hypothesis that students who have participated in music activities have a higher score on the Georgia mathematics CRCT test (GaDOE, 2011) as opposed to students who have not participated in musical activities. The test was not significant ( $t(261) = .217, > .05$ ). Students, who participated in musical activities ( $M = 831.346, SD = 34.218$ ) had no significant difference in means in comparison to students who did not participate in musical activities ( $M = 839.550, SD = 37.612$ ). The null hypothesis was accepted.

### **Discussion of the Findings**

According to Howell (2011), correlations are reported in relation to their statistical significance. The level of significance is reported in the form of a probability or *p* value. For a correlation to be significant, the *p* value must be less than or equal to .05. While associations can still be observed at greater or less than .05, the level of significance is present only in this range. This level of significance is a measure of whether the results are likely to be true. Negative numbers in the same range indicate a negative correlation between two of the variables. According to this statistical measure, there was a significant correlation between years of participation in musical activities and increased mathematics achievement.

Of the eight null hypotheses that were studied four were accepted based on the data from this study. No significant positive or negative correlations were observed between mathematics CRCT (GaDOE, 2011) scores and years of instrumental, woodwind, or percussion music participation. The results were an indication that there was no relationship between years of instrumental, percussion, or woodwind musical activities and increased mathematics achievement. Also, there were no significant differences in the means of students who had participated in musical activities in comparison to students who had not participated in musical activities.

The remaining four null hypotheses were rejected. Overall years of music participation, regardless of type, years of vocal music participation, and years of brass music participation, all were correlated with increased mathematics CRCT (GaDOE, 2011) scores. These results suggested that there was a positive relationship between years of music participation in these areas and increased mathematics achievement. The largest correlation was between vocal participation and mathematics CRCT scores. A key component to these results may be that the range of years of vocal participation was significantly larger than the other areas studied, 0-11 years. It could be that the vocal students tested higher for correlation because, on average, they were involved in vocal musical activities longer than brass, percussion, and woodwind students.

These findings are similar to and supported those from studies conducted by Fitzpatrick (2006), Gay and Airasian (2000), Huber (2009), Johnson (2006), Kinney (2008), Savitz (1999), Shaw (2003), and Simpson (2010), who found a correlation between music and academic achievement. These findings supported a strong correlation in the areas of vocal and brass musical activities.

One factor, which may have been related to the correlation between music participation and increased mathematics achievement in middle school students, was the years of participation. Based on the findings from ANOVA, there were few differences between the mathematics CRCT (GaDOE, 2011) scores of students, who participated in music for 0-2 years; however, when a student had participated in musical activities for 3 years or more, the test scores were significantly greater. This finding suggests that, the longer a student participates in music, it is more likely that he or she will attain an improved mathematics achievement score. Also, this difference in intensity supported the finding that vocal music students had the highest association with increased mathematics scores ( $r = .380$ ), while the weakest significant association was for music participation, which included both vocal, instrumental, brass, percussion, and woodwind forms of music participation ( $r = .277$ ). The most notable difference between these two groups was the years of involvement. The mean years of involvement for vocal students was 1.54, and the mean years of involvement for instrumental students was 1.23. While the difference between means does not appear high, it could be considered large enough to suggest that, as a student continues to participate in musical activities, the association with higher mathematics achievement will intensify. The focus of this study was on student participants in Grades 6-8. The findings for older students (Cox, 2006; Fitzpatrick, 2006; Johnson, 2006) suggested that the relationships intensify more over time.

The collected data were examined to determine the degree of the significant relationships observed in the study. According to Howell (2011), as well as Gay and Airasian (2000), correlation coefficients below .35 suggest weak or low correlations,

regardless of their significance. The findings from the study indicated strong correlations in the areas of vocal music participation ( $r = .380$ ) and brass music participation ( $r = .366$ ).

The findings from this study indicated that the factors of overall years of music participation ( $r = .277$ ) was also significant, but the association was weak with increased mathematics CRCT (GaDOE, 2011) scores. The weakness of the association could be due to the grade level restrictions of the study. If this researcher had included students in Grades 6-12, the relationship might have been more intense.

The findings from this study answered the four research questions, which were stated in Chapter Three.

RQ1. Is there a relationship between music participation and mathematics achievement in middle school students?

A positive relationship was found for years of music participation and mathematics achievement in these middle school students. The relationship tested at a significant level ( $p = .000$ ) and can be considered true, rather than caused by chance.

RQ2. What is the nature of the relationship between music participation and mathematics achievement in middle school students?

Significance ( $p = .000$ ) for mathematics achievement favored vocal students, who reported that they participated longer in musical activities than the other students in the study.

RQ3. What is the intensity of the relationship between music participation and mathematics achievement in middle school students?

There was no difference in the intensity of the relationship between years of music participation and mathematics achievement when a student participated in musical activities for 2 years or less. It was found that the intensity strengthened between music participation and mathematics achievement when the student participated in musical activities for 3 years or more. The longer a student participated in music, the more likely he or she was to increase his or her mathematics standardized test scores.

RQ4. Is there a difference in mathematics achievement between middle school students who have participated in music in comparison to middle school students who have not participated in music?

There was no difference in the mean test scores of students who participated in musical activities in comparison to students who had not participated in musical activities. The lack of difference in mean test scores between the two groups indicates that students who had participated in musical did not score higher on the mathematics CRCT (GaDOE, 2011).

### **Unanticipated Findings**

An unexpected finding was that the years of instrumental, woodwind, and percussion music participation did not significantly correlate with mathematics achievement. Woodwind, brass, and percussion are all families of instruments that are commonly used in Georgia middle school instrumental programs; therefore, guitar and piano were not included in study. An explanation for this finding may have been linked to the average years of music participation; the years of woodwind music participation ( $M = .45$ ), percussion music participation ( $M = .23$ ), and average years of instrumental music participation ( $M=1.23$ ) were significantly less than years of vocal music



participation ( $M = 1.54$ ). This finding supports the consideration that the intensity of correlation strengthens over time. The years of brass music participation ( $M = .4$ ) were still correlated with higher test scores, even though the overall years of participation was still significantly lower. This discrepancy suggests that further study should be conducted in order to understand the nature of the increased intensity over time between musical activities and mathematics achievement.

### **Outline of Limitations**

There were areas in which there were limitations to this research study. The study was conducted at a school where the researcher was a teacher. To safeguard against bias, other teachers and administrators conducted the questionnaires and collected them from the students in this study; the Principal removed the names of students before the data were provided to the researcher. However, this procedure does not negate the fact that the researcher was a music teacher at the school during the time of study. Most of the students, who reported that they were instrumental students, were under the instruction and influence of the researcher.

The MPQ is a form of self-report in which students are allowed to freely answer questions without guidance from the researcher. This may present issues with validity as students could exaggerate or underreport their answers. Also, students may lack the ability to evaluate their participation in music effectively since the term, music participation, may have a different meaning across social groups. Social influence could be a large reason that a student may choose to exaggerate or underreport their answer. Societal influences affect learning in unique ways. For this reason, it is difficult to know if the results from this study can be applicable to a much larger population. Furthermore,

the students included in this study represented very diverse levels of achievement. For this reason, some students may have had trouble answering questions accurately due to difficulty in interpreting the questionnaire directions. The school studied was a fully funded Title I school, which serves a large numbers of students from lower economic backgrounds. This unique set of needs and concerns may be different than those of a more affluent student in a more advantaged community, as differing motivations are a key consideration in learning (Adelman, 2011; Daniels, 2011). These specific needs could affect the relationship between academic achievement and the suggested variables. As discussed in Chapter Two, often, students from economically disadvantaged backgrounds do not have access to music programs in their school (Albert, 2006). This lack of access could have affected the results from this study.

The focus of this study was on instrumental and vocal music participation and did not include other genres of music participation such as active music listening, which is an integral part of music appreciation classes offered in some elementary and middle school programs. There is a wide range of opportunities for students to participate in musical activities in their daily lives. It would be impossible to include all avenues of music participation in one study.

Another limitation to the study was that the focus was on mathematics CRCT (GaDOE, 2011) scores as an overall numerical indicator. Since music affects all areas of the brain, a more comprehensive study could be used to consider the affects of music on the different mathematic cognitive domains, which are related to the processing of various mathematics equations. While, overall, the relationships were weak by

association, it may be that large correlations exist in individual mathematical learning domains.

It is difficult to determine if the correlation was between years of music participation and mathematics achievement or if the correlation was between years of quality music participation and mathematics achievement. Even though the vocal and instrumental program of the school has been recognized by the state music association as being of superior quality, it is difficult to say if any of these qualities actually influenced student academic achievement.

This researcher sought only to discover whether or not a statistical significance existed between the variables of music participation and mathematics achievement. More study should be conducted to understand the value or practical significance of having avenues of music participation in school. Kirk (1996) observed that practical significance is being concerned with whether or not the result of something statistically significant is useful in the real world. Just as providing a free house to every student would instantly cure homelessness, it does not mean that the solution is necessarily practical. In a similar fashion, school decision makers must decide if providing means of music participation for students is practical even if statistically significant. Staff of the U.S. Department of Education (2011a) reported that the average school dropout in 2007 cost the tax payers \$292,000 in lost tax revenues. This cost makes a competitive argument for the practicality of having programs in schools, such as music, that can meet the needs of struggling learners in a more cost efficient manner.

Finally, this researcher tested only correlation and not causation. There are other factors that could be involved in the uncovered relationships. It was established that correlations exist, not whether one variable causes mathematics achievement to increase.

### **Implications**

The results from this study clearly established a relationship between years of music participation and mathematics achievement in middle school students. The presence of statistically significant ( $p < .05$ ) relationships were found between mathematics and years of: (a) overall music participation, (b) vocal music participation, and (c) brass instrument participation. The relationship between vocal music participation ( $r = .380$ ) and brass music participation ( $r = .366$ ) are considered strong associations as they were greater than .35. These findings could be used to initiate vital discussions about the value of music programs in the public school setting.

It was found that participation in music enhanced these students' mathematics achievement. This finding supports several key ideas that are present in the literature. Gardner (1993) reported that musical intelligence is one of the main intelligences by which students learn and interact with the world. Commonly, students who participate in musical activities activate their musical knowledge through the use of songs, patterns, rhythms, pitch recognition, muscle memory, movement, reading of notation symbols, as well as through comprehension, application, and synthesis of each of these respective concepts. Ultimately, students who participate in musical activities will use all of these aspects and concepts to create new musical ideas. Vital to students, who engage in learning objectives with musical intelligence, is that they are able to convey their emotions easily (Nolen, 2003). Gardner emphasized that musical intelligence is very

important because it is related to all other forms of intelligence, especially in the area of mathematical intelligence due to the ability of music to help one encounter and understand ratio and regularity (Nolan). The findings in this study suggest that these statements by Gardner may be true, although it is important to study a causal relationship in the future.

The results from this study indicated that, as a student increased his or her years of participation in musical activities, likewise, he or she increased the opportunity for increased mathematics test scores. While it cannot be stated that increased musical activity causes one to score higher in mathematics, there is a clear connection between increased time in music and higher test scores. According to Albert (2006) and McCarthy (2007), typically, the more advantaged students favor and participate in music programs. However, this fact should not discount the clear correlation between music and increased academic scores. Several researchers (Albert; Buchanan, 2008; Fitzpatrick, 2006) found this correlation, even when they studied economically disadvantaged students, who scored statistically lower than their more advantaged counterparts. Since this current study was conducted at a Title I school, the results supported the findings of these researchers who found that music participation is correlated with increased academic scores, regardless of economic status.

The findings from this study supported previous research, which indicated that years of music participation were correlated with increased academic success (Buchanan, 2008; Cox, 2006; Fitzpatrick, 2006). The main implication is that music programs are a vital part of the U.S. classroom. As students increase their time in music programs, they increase their chances of higher achievement in academic areas such as mathematics.

The correlation of music to higher test scores is an important consideration in a time when the U.S. educators struggle to meet the goal of 100% proficiency in certain academic areas (Callier, 2007; Ediger, 2005; Spencer, 2012). Even more notable are the differences in achievement between various subgroups in schools (Spencer). Music is a tool that can be used to bridge the learning gaps of: (a) economic class (Kinney, 2010; McCarthy, 2007); (b) motivation (Spencer); and (c) racial differences (Ediger; Spencer). As the focus of educational objectives begin to move to college and career readiness, this researcher supports the idea that access to participation in music may better prepare a student for future goals (Cox, 2006). In this study, the students, who participated in musical activities, scored higher on a middle school mathematics standardized test. This correlation supported Cox's finding that students, who participated in music and graduated from high school, scored 139 points higher on the SAT than those who did not participate in music. School officials should consider the use of music programs as a means to positively influence mathematics achievement as indicated by standardized test scores.

### **Recommendations for Future Research**

The focus of this study was on years of music participation and mathematics achievement, but the researcher did not differentiate by varying degrees of individual student achievement in musical activities or varying differences in mathematical domains. Future research should be conducted to understand how achievement in music affects individual mathematics scores. For example, does quality of music instruction or level of music participation have an effect on mathematics achievement? Many state tests, such as the Georgia mathematics CRCT (GaDOE, 2011), separate mathematical

score reports by individual domains. In a future study, one could compare how music participation affects individual domains of mathematics achievement or how it affects certain mathematical domains over others. Finally, only correlations were examined in this study. Future researchers should study whether, quantifiably, music participation increases mathematics achievement. This study would be difficult because of the subjective nature of music and the numerous extraneous variables; however, such a study would unify this work and previous correlations and provide a cause and effect relationship.

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**Appendix A**

Name \_\_\_\_\_

**What do you do in music?**

**START HERE: 1. Are you involved in music right now (Examples are band and chorus)?**

\_\_\_\_\_ YES \_\_\_\_\_ NO

*If you answered "no," skip to question 5.*

**2. List the instrument you play and the number of years you have played it. COUNT THIS YEAR.**

Instrument or chorus

Number of Years

A) \_\_\_\_\_

A) \_\_\_\_\_

B) \_\_\_\_\_

B) \_\_\_\_\_

C) \_\_\_\_\_

C) \_\_\_\_\_

**3. How many years have you been in band or chorus at your school?**

\_\_\_\_\_ number of years

**4. How many years have you been in a musical group outside of school?**

\_\_\_\_\_ number of years

**5. If you stopped playing an instrument or singing in the chorus, what did you use to play before you quit? How long did you play or sing before you quit? If you are still playing your instrument or singing in the chorus, skip to question 6.**

Instrument or chorus

Number of Years

A) \_\_\_\_\_

A) \_\_\_\_\_

**6. List the number of years you have been in each of the following musical groups (at school, community group, or home). If you have not been in band or chorus please skip to number 7.**

Chorus \_\_\_\_\_

Band \_\_\_\_\_

**7. List the number of years you have been in any musical group outside of school.**

Group

Number of Years

\_\_\_\_\_

\_\_\_\_\_

## Appendix B

**To:** Boyd, Josh

**Cc:** IRB, IRB; Garzon, Fernando; Parker, Leonard Wayne

**Subject:** IRB Approval 1403.101112: The Relationship between Music Participation and Mathematics Achievement in Middle School Students

Dear Joshua,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases are attached to your approval email.

Thank you for your cooperation with the IRB and we wish you well with your research project.

Sincerely,

**Fernando Garzon, Psy.D.**

*Professor, IRB Chair*

**Counseling**

**(434) 592-4054**

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## Appendix C

### CONSENT FORM

The Relationship between Music Participation and Mathematics Achievement in Middle School Students  
Joshua Boyd  
Liberty University  
Department of Education

Your student has been invited to be in a research study on the relationship between music participation and mathematics achievement in middle school students. Your student was selected as a possible participant because he or she is a middle school student that has taken the Georgia Criterion Referenced Competency Test. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Joshua Boyd as a Doctoral student in the Liberty University school of Education.

#### **Background Information:**

The purpose of this study is to observe if students who participate in music score higher or lower than students who do not participate in music on a mathematics achievement test. There is also a chance that there will be no observable differences between those students who participate in music and students who do not participate in music and mathematics achievement.

#### **Procedures:**

If you agree for your student to participate in this study, we would ask you to do the following things:

1. Return this form if you wish for your student to participate in the study.
2. Students will be explained the details of the study on Friday and given an opportunity to ask questions pertaining to the study. Students who feel comfortable participating will be asked to sign a student assent form stating that they are aware of what the study is about and they agree to participate.
3. The following Monday the students who agree to participate will be given a questionnaire that will ask them questions about the areas that they participate in music or do not participate in music. It is important that we also include students who have no participation in musical activities. It will take approximately 15 minutes to complete the questionnaire.
4. The questionnaires will be collected and given to the principal who will code each questionnaire with the student's mathematics CRCT score. After the scores have been added, the students' names will be removed from the questionnaires before they are given to the researcher.

5. No person other than the principal will have access to any identifying information of your student.
6. The researcher will enter the data (without names) into a computer statistics program that will calculate the results.
7. The results will be given in the researcher's dissertation.

**Risks and Benefits of Being in the Study:**

The risks are no more than the student would encounter in everyday life. The study will take place in a period of non-instructional time.

The students who participate in this study will benefit by being able to assist researchers with understanding if a relationship between music participation and mathematics achievement exists. If a relationship is discovered, researchers could come back and study if music participation causes increased mathematics achievement. This information could be useful in helping educators create musical activities that assist in helping students score higher on mathematical achievement tests. The discovery of a positive relationship between music participation and mathematics achievement may also help supporters of the arts advocate for more opportunities for music in school. There is no financial benefit to participation in the study

**Compensation:**

There is no financial compensation for participation in this study.

**Confidentiality:**

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records.

When students have filled out the questionnaire, the questionnaires will be given to the principal. The principal will code the questionnaires with the students' mathematics CRCT test scores and then remove their names. The names will be thrown away and not recorded or given to the researcher. No person, other than the principal will have access to identifying information at any time.

**Voluntary Nature of the Study:**

Participation in this study is voluntary. Your decision whether or not to allow your student to participate will not affect yours or your student's current or future relations with Liberty University or the Coweta County School System. If you decide to allow your student to participate, your student is free to not answer any question or withdraw at any time without affecting those relationships.

**Contacts and Questions:**

The researcher conducting this study is Joshua Boyd. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at: Joshua Boyd, Smokey Road Middle School. 965 Smokey Road. Newnan, Ga. 30263. Phone number (770) 254-2840. Email address is [Josh.Boyd@cowetaschools.net](mailto:Josh.Boyd@cowetaschools.net) The supervising chair is Dr. Leonard Parker. He can be contacted at 1971 University Blvd, Suite 1582, Lynchburg, VA 24502 or email at [lwparser@liberty.edu](mailto:lwparser@liberty.edu)

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24515 or email at [fgarzon@liberty.edu](mailto:fgarzon@liberty.edu).

*You will be given a copy of this information to keep for your records.*

**Statement of Consent:**

**Accept:**

I have read and understood the above information. I have asked questions and have received answers. I give consent for my student to participate in this study.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of parent or guardian: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of Investigator: \_\_\_\_\_ Date: \_\_\_\_\_

**IRB Code Numbers:** 1405

**IRB Expiration Date:** 10/13/2013

## Appendix D

### Assent of Child to Participate in a Research Study

**What is the name of the study and who is doing the study?**

“The relationship between music participation and mathematics achievement in middle school students” by Mr. Joshua Boyd

**Why are we doing this study?**

We will be completing this study at your school during a period of non-teaching time. The purpose of this study is to see if there is any difference in mathematics achievement between middle school students who participate in music and students who choose not to participate in music.

**Why are we asking you to be in this study?**

You are being chosen for this study because you are a Coweta County Middle School student who has made a choice to either participate in music or not to participate in music. You are also enrolled in mathematics courses and take the mathematics CRCT.

**If you agree, what will happen?**

If you are in this study, you will be asked to complete a questionnaire. This questionnaire asks you questions related to you participating in music and if so, in what way and for how long. It will take you about 15 minutes to answer the questions. Once you turn in your questionnaire, your mathematics CRCT scores will be added to the questionnaire and then your name will be removed so that no person will know who you are. Your identity will be confidential. The answers and your mathematics CRCT scores will be compared using a mathematical procedure to test correlation.

**Do you have to be in this study?**

No, you do not have to be in this study. If you want to be in this study, then tell the researcher. If you don't want to, it's OK to say no. The researcher will not be angry. You can say yes now and change your mind later. It's up to you.

**Do you have any questions?**

You can ask questions any time. You can ask now. You can ask later. You can talk to the researcher. If you do not understand something, please ask the researcher to explain it to you again.

Signing your name below means that you want to be in the study.

---

Signature of Child

---

Date



Joshua Boyd, Researcher  
965 Smokey Road, Newnan , GA 30263  
Or email at [Josh.Boyd@cowetaschools.net](mailto:Josh.Boyd@cowetaschools.net)

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