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The effects of classical music on children with learning disabilities in a sixth grade mathematics classroom

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**THE EFFECTS OF CLASSICAL MUSIC ON CHILDREN WITH LEARNING
DISABILITIES IN A SIXTH GRADE MATHEMATICS CLASSROOM**

By
Amy C. McKeever

A Thesis

Submitted to the
Department of Interdisciplinary and Inclusive Education
College of Education
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at
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Thesis Chair: S. Jay Kuder, Ed.D.

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I would also like to thank my parents for their unwavering love and support throughout this endeavor.

Abstract

Amy McKeever

THE EFFECTS OF CLASSICAL MUSIC ON CHILDREN WITH LEARNING
DISABILITIES IN A SIXTH GRADE MATHEMATICS CLASSROOM

2016-2017

S. Jay Kuder, Ed.D.

Master of Arts in Special Education

The purposes of this exploratory investigation were to (a) determine if sixth grade students would improve their math performance (in areas of staying on task, focusing, and completing work) while classical music was being played, (b) determine if students will report they feel differently and more successful in the mathematics classroom while classical music was being played, and (c) determine if students with learning disabilities will improve their mathematical performance (in areas of staying on task, focusing, and completing work) while classical music is being played. In this study, there were 19 students. The results show that classical music had an overall positive effect on the students in the classroom.

Table of Contents

Abstract.....	iv
List of Tables	vi
Chapter I: Introduction.....	1
Chapter II: Literature Review	4
Math Difficulties of Students with Learning and Attention Problems	4
Music as an Intervention for Behavior and Learning Difficulties	7
Music for Improving Math for Students with ADHD	12
Chapter III: Methodology	14
Setting and Participants.....	14
Procedure	15
Method	18
Chapter IV: Results.....	19
Chapter V: Discussion	24
Limitations	30
Practical Implications.....	31
Future Studies	31
Conclusion	32
References.....	33

List of Tables

Table	Page
Table 1. Results for Skills Worksheet.....	20
Table 2. Results for Off-Task Behavior.....	21
Table 3. Results for Student Survey	23

Chapter I

Introduction

Mathematics can be a very challenging subject for students, especially those with learning and attention disabilities. In recent years, more students are diagnosed with ADD than ever before, for example, in the USA, up to 10% of all children are now labeled ‘hyperactive’ and 10–12% of all boys are on Ritalin, with rates continuing to rise.. Although math can be challenging for some students, it is an important skill in the real world. Many jobs of varying levels and degrees require mathematical intellect (Kristjánsson, 2009).

Mathematics builds on previous concepts. For example, students are capable of learning to simplify fractions once they have learned division. Mathematics also requires students to retain information, such as basic math facts, for future and more abstract math problem solving. This can be especially challenging for students with learning disabilities, ADD, and those receiving basic skills math instruction. As a sixth grade math teacher, I have noticed that these students struggle to stay focused on problems more than other students. These students also find it harder to retain information. These students can benefit from differentiated instruction and modifications in the classroom, which help to reach the needs of each and every learner. All students benefit from the availability of a variety of methods and supports and an appropriate balance of challenge and success (Lawrence-Brown, 2004).

Over the past 10 years, the use of electronics and technology at home has increased greatly (Lei, 2009). Students are “connected” and wired to devices, music, and technology. Students today are often referred to digital natives. The digital natives are

viewed as innovative users of available technology and eager adopters of new technology (Rideout et al., 2005). They are using more kinds of technology and increasingly more sophisticated technology at an increasingly earlier age (Kaiser Family Foundation, 2003). Students today are connected to technology throughout the day. They are used to multi-tasking- for example, completing their homework while listening to music and texting. Teachers can adapt their teaching models to a more technological approach due to the way students live daily.

One adaptation that could be useful for students in classrooms is the use of music. Music has a way of connecting with many people. Music also has a way of controlling our actions and emotions. It has been proposed that basic emotions are the immediate affective responses to music (Pereira, 2011). It is interesting to discover whether music can have the same effect on students in the classroom as technology does.

To address some of the issues and challenges in a sixth grade mathematics classroom, a few studies about the effects of music on students in the classroom have been found. One example was to examine the effects of auditory stimulation on the arithmetic performance of children with and without ADHD (Abikoff, Courtney, Szeibel, and Koplewicz, 1996). There are also studies on the use of music to calm students, to focus students, and to help students think abstractly Dolegui (2013), The use of music in this particular study is to evaluate students' performance in learning math.

In this study, the effectiveness of implementing music in a sixth grade mathematics class was examined. The objective of using music is to enable students to focus on learning and to connect to math.

As a sixth grade math teacher for the past two years, I have noticed that students are most attentive during lessons involving technology. For example, when a video is being shown or when they are doing math on a laptop or a computer. Music, like technology, can be used for all students while they work in a classroom. After noticing that the interest level in the classroom rises when technology is used, I became interested in the use of and the effects of music on the students' achievement in the classroom.

The research questions in this study are:

- Do sixth grade students improve their mathematics performance (in areas of staying on task, focusing, and completing work) while classical music is being played?
- Will students report that they felt differently and more successful in the mathematics classroom when classical music was being played?
- Will students with learning disabilities improve their mathematical performance (in areas of staying on task, focusing, and completing work) more than the other students in the classroom while classical music is being played?

In this study, a control group and an experimental group were used to examine the effects of implementing classical music in the sixth grade math classroom. The students were observed several times throughout this study to determine whether the use of music in the classroom had an effect on their mathematical performance. It was hypothesized that students will feel differently about the environment of the classroom while classical music is being played. They will receive an overall higher grade on their test scores when the classical music was being played. It was also hypothesized that student behavior in the classroom will improve when classical music is being played.

Chapter II

Literature Review

Mathematics is an important subject in school as well as in life after school since math is used in every day situations. However, students with difficulties in learning mathematics can be found in almost every classroom. About 5% to 10% of the students in schools for elementary general education have difficulties with mathematics.

(Kroesbergen & Van Luit, 2003).

Math Difficulties of Students with Learning and Attention Problems

A common childhood developmental disorder diagnosed among the elementary school going population is Attention Deficit Hyperactivity Disorder (ADHD). Estimates of ADHD across the world range from 2.2 to 17.8 percent (Skounti, Philalithis & Galanakis, 2007) from (David, 2013). ADHD as defined by the American Psychiatric Association (2000) is a persistent pattern of inattention and /or hyperactivity- impulsivity that is more frequently displayed or more severe than is typically observed in individuals at a comparable level of development. Typically a triad of difficulties in the areas of attention, activity levels and impulsive behaviors form the core diagnostic features of ADHD. Students with ADHD exhibit a variety of difficulties with school functioning. Hyperactive-impulsive behaviors that may comprise ADHD often lead to disruptive behaviors in the classroom including walking around the classroom when staying seated is expected, talking out of turn, intrusive verbalizations, not following through on instructions and interrupting teacher instruction (DuPaul, Weyandt & Janusis, 2011). Children with this disorder also have difficulties in sustaining attention and exhibit significantly higher rates of off-task behavior when passive classroom activities (e.g.

listening to teacher instruction and reading silently) are required relative to their non-ADHD classmates (Abikoff, et al., 2002; Junod, DuPaul, Jitendra, Volpe & Cleary, 2006). Teachers complain that pupils suffering from ADD/ADHD have severe difficulties in maintaining focus and staying on task. Some clinicians consider this to be the most prevalent behavioral problem affecting the school-aged population; and for up to 70% of children diagnosed with ADD/ADHD these symptoms continue to be manifested later in life (Searight & McLauren, 1998).

The seriousness of these difficulties can vary from temporary difficulties in one domain (i.e., a particular area of the math curriculum) to severe learning disabilities affecting several different domains. The difficulties can also manifest themselves at different points in a child's school career, not only in the learning of basic facts or in learning to apply previously acquired knowledge but also in the learning of such preliminary mathematics skills as counting and seriation. The potential causes of these difficulties are numerous and can partly be explained by such child characteristics as intellectual functioning, motivation, problem-solving skills, memory skills, strategy acquisition and application, and vocabulary (Kroesbergen & Van Luit, 2003).

Few researchers still think of ADD as a simple behavior disorder. Increasingly, specialists are recognizing that it is a complex syndrome of impairments in development of the brain's cognitive management system, or executive functions. The disorder affects one's ability to organize and get started on tasks, attend to details and avoid excessive distractibility, regulate alertness and processing speed, sustain and, when necessary, shift focus, use short-term working memory and access recall, sustain motivation to work, and manage emotions appropriately (Brown, 2007).

Students with ADHD can have more difficulties in a math classroom than students who aren't diagnosed with ADHD. Students with learning disabilities have significant difficulty acquiring and retaining math skills. Students with learning disabilities (LD) frequently have difficulty with mathematics computation and problem solving. Problems with mathematics usually begin in elementary school and continue through secondary school into adulthood. The statistics regarding math performance among students with learning disabilities are alarming. Cawley and Miller (1989) reported that 8- and 9-year-olds with learning disabilities performed at about a first-grade level on computation and application. Likewise, Fleischner, Garnett, and Shephard (1982) found that sixth graders with learning disabilities solved basic addition facts no better than third graders without disabilities. These same researchers also found that fifth graders with learning disabilities solved one third as many multiplication problems as their peers without disabilities on timed assessments (Miller & Mercer 1997).

Evidence now shows that ADD is a highly heritable disorder, with impairments related to problems in the release and reloading of two crucial neurotransmitter chemicals made in the brain: dopamine and norepinephrine. These chemicals play a crucial role in facilitating communication within neural networks that orchestrate cognition. A massive body of evidence indicates that 8 of 10 individuals with the disorder experience significant improvement in their functioning when treated with appropriately fine-tuned medications. These treatments can compensate for inefficient release and reloading of essential neurotransmitters at countless synaptic connections in the brain (Brown, 2007). By the late 1970s, the use of medication to treat ADD/ADHD became standard procedure in the USA, a treatment which has since spread across the Western world. The most

common drug is – paradoxical as it may seem – a stimulant: methylphenidate, better known under its trade name, *Ritalin*. Up to 10% of all children in the USA are labeled ‘hyperactive’ and 10-12% of all boys are on *Ritalin*, with rate continuing to rise (Kristjánsson, 2009).

In some cases, parents are hesitant to treat their child for ADHD. They may try more holistic approaches to help their child. Some of these holistic approaches include changing the child’s diet by eliminating food colorings and preservatives, trying yoga or tai chi classes, spending time outside, and attending behavioral or parental therapy. Behavior charts and positive reinforcement used by the teacher in the classroom is also another approach.

Music as an Intervention for Behavior and Learning Difficulties

A study conducted by Abikoff, Courtney, Szeibel, and Koplewicz (1996) evaluated the impact of extra-task stimulation on the academic task performance of children with attention-deficit/ hyperactivity disorder (ADHD). The study participants consisted of two groups of boys in Grades 2 through 6: an outpatient clinic sample of children with ADHD, and nondisabled controls. Twenty boys with ADHD and 20 nondisabled boys worked on an arithmetic task during high stimulation (music), low stimulation (speech), and no stimulation (silence). The music “distractors” were individualized for each child and the arithmetic problems were at each child’s ability level. The nondisabled children performed similarly under all three auditory conditions. In contrast, the children with ADHD did significantly better under the music condition than speech or silence conditions. When music was playing, the children with ADHD increased their number of correct answers by 33% and 23% relative to their performance

during speech and silence, respectively. The authors suggested that the extra-task stimulation preferred by children for certain assignments (e.g., stereo music or TV while working on mathematics) “may be beneficial because it helps the students avoid boredom and therefore stay ‘on task’ for a longer time (Abikoff, Courtney, Szeibel, and Koplewicz, 1996). Music helps to bring out the best in young people. It nourishes self-esteem and keeps them engaged (Whyte & Mould, 2011).

Many students listen to music to alleviate the emotional effects of stress and anxiety when engaged in complex cognitive processing, such as studying for a test, completing homework assignments, or while reading and writing. In studies conducted to learn about the effects of musical distraction on cognitive task performance, the findings have demonstrated the idea of music improving cognitive performance.

In one study, thirty psychology undergraduates (17 men and 13 women) whose ages ranged from 18 to 32 years ($M=24$ yr.) participated in a repeated-measures design. This design was adopted and the order of the two conditions, music and no music, were counterbalanced. Participants were randomly assigned to an order. Order 1 participants experienced the music condition first followed by the no-music condition. This was reversed under Order 2. This study was designed to assess whether music, created by the software package Koan Plus, would lower arousal and facilitate performance scores on a cognitive test. Koan-created music is ever changing and free-flowing harmonious music, generated in real-time and not pre-composed. It is natural sounding music, which may have a stress-reduction quality. Comparisons were made with a no-music condition. As a result, while participants were listening to Koan music, they answered more questions and answered correctly than when they listened to no music. This study suggests that

intelligence test performance, in this case general intelligence, was significantly enhanced as a function of background music, which supports Rauscher, et al. (1993). (Cockerton, Moore, & Norman, 1997).

Although previous research has established that music can either distract or facilitate cognitive task performance, improved performance in the presence of music might be directly related to the type of music listened to (Cockerton, Moore, & Norman, 1997). A study conducted by Hallman, Price, and Katsarou, (2002) supported this argument. In fact, they tested the effect of calming and relaxing music on arithmetic and memory performance tests in children ranging from ages ten to twelve. They found better performance on both tasks in the calming and relaxing music condition when compared with a no-music condition. They also tested these children in an arousing, aggressive, and unpleasant music condition, and the results showed that their performance on both tasks was heavily disrupted and led to a lower level of reported altruistic behavior by the children (Hallman, Price, & Katsarou, 2002). Although these data did not find that calming music enhanced performance, one might imply that this type of music can provide a soothing environment that puts students at ease, facilitating cognitive processing (Dolegui, 2013).

In a study conducted by Dolegui (2013), thirty-two undergraduate students (twenty-five females, seven males), ranging in age from 20 to 41 years were asked to solve mathematics problems under five conditions. A repeated-measure design was used in this study. All thirty-two participants were exposed to all five conditions. This study used five different arithmetic tests to measure cognitive performance. The tests consisted of 20 different operations: 5 multiplication, 5 division, 5 addition, and 5 subtraction

problems. The researcher explained to participants that music would be played while they solved the questions on the tests. The volume at each music condition was adjusted as the experiment progressed. The participants were asked to solve five arithmetic tests with twenty different questions on each test. The first test was conducted in the soft music condition at low intensity, and the second test, in the loud music condition at low intensity. The third test was performed in complete silence. The fourth and fifth tests were conducted in soft music and loud music conditions, respectively, both at high volume intensity. The participants were allowed sixty seconds to complete each test. There was a twenty-second waiting period between each test. Results from the current study demonstrated how important it is to consider the effects of distracting music on cognitive performance. It was shown that the volume plays a crucial role and could be more important than the type of music played. However, data from this study has demonstrated that silence seems to be the best environment to maximize performance when engaging in cognitive activity. Scores were significantly higher when participants completed the tests in the silence condition. It can be implied that it is easier to process information in the presence of a minimal level of distraction. Classical music was not shown to enhance performance contrary to the study's expectations. Hence, the direct benefits of listening to music on cognitive processing are more of a distraction than a benefit.

Traditional mathematics instruction that consists of assigning the same problem to every student, lecturing from the textbook, insisting on one way to solve problems, and neglecting conceptual understanding has not only been accused of being the cause for low mathematics achievement, but also as the origin of mathematics anxiety (Furner &

Berman, 2005; TIMSS, 2003). The traditional method of instruction may be ineffective, because it is unable to reach all students and meet their needs. Thus, traditional instruction has prevented some students from making the most of their skills and abilities (Scott, 2005). In contrast, teaching mathematics using effective didactic strategies (Vinner, 1997), with the goal of developing students' conceptual understanding through the use of problem-solving activities, models, simulations, discoveries, challenges, and games, has the potential to close the achievement gap and reduce mathematical anxiety (Tobias, 1998; NCTM, 2006). In response to findings from cognitive science, which show that learning is a situated, socially-constructed, and culturally intervening procedure, educational researchers have proposed several integrated curriculum and instructional models to provide students with learning experiences that can motivate intellectual and emotional understanding (Chrysostomou, 2004; Deasey, 2002; Mansilla, 2005). Because integration of subject areas has been shown to have powerful effects on learning, arts-integrated curricula can provide students with a socially relevant democratic education that transcends disciplinary boundaries and engages learners through self-reflection and active inquiry (Parsons, 2004). According to Fiske (1999) and Erickson (2001), teaching through the arts can: (a) transform learning environments; (b) reach students who may not be easily reached; (c) promote communication among students; (d) provide opportunities for adult involvement; (e) offer new challenges to successful students; (f) address important problems, issues, and concepts; (g) decrease curricular fragmentation; (h) allow teachers and students to explore knowledge more deeply; (i) challenge higher-levels of thinking by helping students connect knowledge; and (j) connect in-school learning to the real-world (An, Caparo & Tillman, 2013).

Ellis and Fouts (2001) posited that interdisciplinary education can not only improve students' higher-order thinking skills and motivation for learning, but also provide opportunities to understand knowledge from multiple perspectives and assist in the transfer of learning (Erickson, 1998). In recent years, researchers have consistently found benefits for teaching mathematics integrated with science and language arts (Keen, 2003; Marrongelle, Black, & Meredith, 2003). These interdisciplinary connections provide students with an opportunity to make sense of mathematics and apply their mathematical knowledge in meaningful ways by connecting new knowledge to existing knowledge (Schoenfeld, 1988).

Music for Improving Math for Students with ADHD

One method for teaching mathematics is to integrate the arts into instruction (Betts, 2005). Music is an ideal form of art to be integrated in mathematics instruction. The links between music and mathematics are very rich and include melody, rhythm, intervals, scales, harmony, tuning, and temperaments. These musical concepts are related to the mathematical concepts of proportions and numerical relations, integers, logarithms and arithmetical operations and the content areas of algebra, probability, trigonometry, and geometry (Beer, 1998; Harkleroad, 2006). In the past decade, educators have implemented several different instructional strategies to provide a music-mathematics integrated curriculum, although the levels of integration have varied (An, Ma, & Capraro, 2011).

Mathematics-music integrated instruction has the potential of improving students' attitudes toward learning mathematics and of increasing students' mathematics achievement (An, Kulm, & Ma, 2008; An, Ma, & Capraro, 2011; Benes-Laffety, 1995;

Omniewski, 1999). In regard to the first point, music can be used to engage students in learning mathematics in an enjoyable but also relevant way. Secondly, music can be used as a resource by teachers to present and design mathematical problems in non-routine ways. This provides students with the opportunity to apply their mathematical knowledge in meaningful ways and connect new mathematical knowledge to existing knowledge. The overarching goal of the current study was to examine the effects of a music-mathematics integrated intervention on elementary students' mathematical abilities (An, Capraro, Tillman, 2013).

A study conducted in 2010 outlined the intrinsic and instrumental benefits of arts education for young people and the communities in which they live and develop. Research seeking evidence to support the positive impact of music education has provided equivocal findings. In this study, school, home, and community-based arts participation was shown to exert a positive impact on academic (e.g., motivation, engagement) and nonacademic (e.g., self-esteem, life satisfaction) outcomes for students (McPherson, Osborne, Barrett, Davidson, Faulkner, 2010).

Chapter III

Methodology

Setting and Participants

This study was conducted in a sixth grade math classroom that consisted of nineteen students. This classroom is located in a suburban community in southern New Jersey and is a part of a large school district. The school district is a K-8 district that consists of six elementary schools, one upper elementary school for fifth and sixth grade and one middle school for seventh and eighth grade. The school is home to approximately 1,000 students in grades five and six.

This sixth grade math class used in this study met during the same time every day from 1:04 pm to 2:26 pm. In the classroom, there were ten female students and nine male students in the classroom. Of the ten female students, seven of them were white, two were African American, and one was Asian. Of the nine male students, six of them were white, and three were African American. The students were between the ages of eleven and twelve years old. The mean age in this classroom is 11.4 years old. Nine of the students receive basic skills math instruction twice a week. These students are pulled out of physical education one day a week and they are pulled out of their special another day of the week. Two of the students have a 504 Plan and four of the students are being assessed through Intervention and Referral Services (I&RS). Some of these students will eventually be classified for additional services. Six of the students in this classroom have been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). One student has a hearing impairment; so all of his teachers use a Frequency Modulation (FM) System

while teaching which is a microphone that goes around the teacher's neck. There is a speaker located in the back of the classroom, which amplifies the teacher's voice.

There was one general education teacher in the classroom. This teacher was currently in her second year of graduate school to obtain her Masters in Special Education. Students were seated next to someone in rows and columns. There was an aisle between each pair that was grouped together. Students were all seated facing the wall-mounted projector screen in the front of the classroom. The students were seated in three rows and four columns.

The textbook used during this class was *Connected Mathematics* published by Pearson Prentice Hall. Topics that are covered include factors and multiples, fractions, decimals, percentages, solving equations, writing algebraic expressions, integers, the coordinate plane, two-dimensional measurement, and statistics. The teacher in the class taught integers and the coordinate plane for the purpose of this study.

In this classroom there are also students who are academically more advanced than the rest. This classroom consists of students of varying academic levels and disorders. The control of this study was the first quiz administered to the students without any music being played.

Procedure

This study involved students taking a pre-assessment test prior to the integers and the coordinate plane unit. After the unit was taught, the students took a post-assessment test. The tests were exactly the same and were out of sixty points. The students took the pre-assessment and the post-assessment in their regular math class and were separated by dividers.

The students completed a skill worksheet at the end of the period on different days with music and on different days without music. The worksheets were graded each day and their scores were recorded. The skill worksheets related to what was taught in the unit. The students completed the skill worksheets independently and in the classroom.

The students continued with their daily routines and procedures within the classroom as usual. A daily routine consisted of coming into the classroom, doing the warm up posted on the board, going over last night's homework, completing the math investigation lesson for the day, and then receiving homework. Students often completed their investigation with a partner and sometimes completed it individually.

The independent variable was the skill worksheet score without any music being played and the pre-assessment test. The dependent variable of this study was the difference in students' results between the pre and the post assessment. It was also the skill worksheet score with music being played. The students continued their daily routines as they usually would except the music was being played. The students received a grade for both tests to see if their scores changed from taking the test without music to when they took the test with music.

The students were also observed several times during the course of the study. Students were observed during 20 minute time periods. They were observed four times throughout a class period. Students' behaviors were recorded on how many times they were on or off task. They were observed while the music wasn't being played and also observed while the music was being played.

The music was played in the same spot of the classroom and at the same volume level each time. The volume of the music wasn't too low or too high. However, it was on the lower side rather than the higher side.

At the end of this study, students were interviewed about their thoughts on their work ethic during the time the music was playing. They were also asked about their thoughts on the classroom environment while the classical music was played. Students were asked about their concentration in the classroom, their motivation in the classroom, their feelings in the classroom, and their overall thoughts in the classroom when the music was being played. They put their name at the top of the paper and handed their answers in when they were finished.

There were only two instruments needed for this experiment. The first instrument was the CD called Bach Greatest Hits, which consists of classical music from the composer Johann Sebastian Bach. There were 11 songs on the CD with each song ranging from 2 minutes to 17 minutes long. The total playing time of the CD is 71 minutes and 41 seconds. Students listened to the CD continuously in the order of the songs listed on the CD. The next time the music was played, the students listened from the point in the CD where they last left off. The second instrument used in the study was a working CD player that was able to play the CD in the classroom. The CD player was fairly new and it also had a built in radio. The students used their everyday materials in the classroom such as their pencil, Connected Mathematics 2 textbook, and the printed investigation that went along with the day's lesson. The investigation was a typed up version of the problems that were in the textbook. Some days the students used a simple Texas Instruments calculator depending on the lesson of the day. The students also

brought their “Fast Finishers” book to class for those students who finished work at a faster pace than others.

Method

The method that was used during this experiment was a Mixed Methods Research Design. It consisted of both qualitative research and quantitative research. Through qualitative research, observations and interviews took place. The students were asked questions at the end of the study to record their overall thoughts. Through quantitative research, objective measures were counted and recorded. The students were recorded on their behavior and the amount of times they were on-task and off-task during their classwork. This was a multiple baseline design across participants. There were different participants in the design.

Chapter IV

Results

In this study, the effects of classical music on students in a sixth grade math classroom were studied. The research questions to be answered were:

1. Do sixth grade students improve their mathematics performance (in areas of staying on task, focusing, and completing work) while classical music is being played?
2. Will students report that they felt differently and more successful in the mathematics classroom when classical music was being played?
3. Will students with learning disabilities improve their mathematical performance (in areas of staying on task, focusing, and completing work) more than the other students in the classroom while classical music is being played?

The students were observed in the classroom for two weeks while music was being played and while music wasn't being played. The students completed a skill worksheet each day and their scores were recorded. Table 1 shows the mean percentage scores increased when students completed their skills worksheet without and with music. The results showed that student performance was greater when music was being played. Out of the nineteen students in the classroom, four of the students scored the same amount with music playing than without music playing, one student scored lower when music was playing than when music wasn't playing and the remaining fourteen students all increased their scores on their skill worksheet when music was playing. In fact, each of the students scored within 4 points of a perfect score on all three assessments when the music was being played. The students first took a pre-assessment on the unit about

integers and the coordinate plane. The assessment was out of 62 points. In the pre-assessment, the scores ranged from 1-41 and the mean score was 21.368 out of 62. In the post-assessment, the scores ranged from 27-59 and the mean score was 48.947. Table 1 also shows that the mean score from the pre assessment increased from 21.368 to 48.947 in the post-assessment.

Table 1

Results for Skills Worksheet

Without Music Skill Worksheet Score			With Music Skill Worksheet Score			Pre-Assessment Score	Post- Assessment Score
18-Jan	23-Jan	8-Feb	19-Jan	26-Jan	31-Jan		
Mean: 97%	Mean: 89%	Mean: 89%	Mean: 97%	Mean: 98%	Mean: 98%	mean: 21.368	mean: 89.947

Table 2 shows the results for off-task behavior with and without music. The results show that there was a decrease in off-task behavior on the days that music was playing. On the days without music, students were off task on an average of 33%, 43%, and 41% during the observed class period times. On the days with music, students were off-task on an average of 30%, 22%, and 22% during the observed class period times. The students were observed four times throughout the double math class period. The students were observed a total of six days. Every twenty minutes in the class period the students were observed, resulting in four observed time periods each of the six days. It

was noted how many times they were off-task out of the observed times each day. Observations were made both when music was being played and when there was no music. There were a total of 4 observed times each day, 12 when music was not being played and 12 times when music was being played.

Table 2

Results for Off-Task Behavior

Without Music Off-Task Behavior			With Music Off-Task Behavior		
January 18	January 23	February 8	January 19	January 26	January 31
25/76 33%	33/76 43%	31/76 41%	23/76 30%	17/76 22%	17/76 22%

Table 3 shows the results of the students' survey responses. The students were given a survey focusing on four main topics about when music was played in the classroom. The students completed these surveys individually. In each of the four categories they were asked to check off one option based on how they felt. The first topic was about concentration. The students checked over either: I could concentrate much better, I could concentrate a little better, or my concentration was worse. Six students chose that they could concentrate much better, ten students chose that they could concentrate a little better and three students chose that their concentration was worse. The next topic was about the students' motivation while the music was playing. Seven students chose that

they felt much more motivated to complete assignments, ten students chose that they felt a little more motivated to complete assignments, and two students felt that they felt less motivated to complete assignments. The next topic was about the students' feelings. Thirteen students chose that they felt a lot calmer or more relaxed while the music was playing, three students chose that they felt a little bit calmer or more relaxed when the music was playing, and three students chose that they did not feel calmer or more relaxed while the music was playing. The last topic was about the students' overall thoughts. Ten students chose that overall they really liked having music on during math, seven students chose that overall they kind of liked having music on during math, and two students chose that overall they didn't like having music on during math.

Table 3

Results for Student Survey

Survey on Concentration			
Responses	I could concentrate much better	I could concentrate a little better	My concentration was worse
# of Students	6	10	3
Survey on Motivation			
Responses	I felt much more motivated to complete assignments	I felt a little more motivated to complete assignments	I felt less motivated to complete assignments
# of Students	7	10	2
Survey on Feelings			
Responses	I felt a lot calmer or more relaxed while the music was playing	I felt a little bit calmer or more relaxed while the music was playing	I did not feel calmer or more relaxed while the music was playing
# of Students	13	3	3
Survey on Overall Thoughts			
Responses	Overall, I really liked having music on during math	Overall, I kind of liked having music on during math	Overall, I didn't like having music on during math
# of Students	10	7	2

Chapter V

Discussion

This study examined the effect of playing classical music in a sixth grade mathematics classroom. The students were observed several times throughout this study to determine whether the use of music in the classroom had an effect on their mathematical performance. The participants of this study were 19 middle school students ranging in ages from 11-12 years old from a K-8 public school district. The results showed that music overall had a positive effect in the classroom. The students were observed on their behavior and their performance on skill worksheets when music was being played and when music wasn't being played. Overall, their off-task behavior decreased on days when the music was being played. Their performance on their skill worksheet also showed higher scores on days with music playing than on days when music wasn't playing. Lastly, the students took a survey on four different areas and more than half the class had a positive feedback about the music.

Students reported that they felt differently and more successful in the mathematics classroom when classical music was being played. In the area of concentration, sixteen out of the nineteen students stated that they could concentrate a little better or much better when classical music was being played while only three students stated that their concentration was worse. In the area of motivation, seventeen out of the nineteen students stated that they felt a little more motivated to complete assignments or much more motivated to complete assignments while only two students stated that they felt less motivated to complete assignments. In the category of feelings, sixteen out of the

nineteen students reported that they felt a little bit calmer or more relaxed while the music was playing or felt a lot calmer or more relaxed while the music was playing while only three students reported that they did not feel calmer or more relaxed while the music was playing. In the area of overall thoughts, seventeen out of the nineteen students reported that they overall kind of liked having the music on during math class or overall they really liked having the music on during math class while only two students reported that overall they didn't like having music on during math. Based on the data from the study, most of the students who weren't classified didn't have much of a change in off-task behavior. They tend to have very minimal, if any, off-task behavior without music, which also stayed the same with music being played. However, students who were classified all improved their off-task behavior. Out of the fourteen students who are classified as having a disorder, receiving basic skills, or being assessed for I & RS, thirteen of those students improved their score on their skill worksheets. The classroom teacher who implemented the intervention reported the students continue to use the strategies. They performed best when being reminded that they were taking a skill worksheet and that the music was on. Over a relatively short period of time, students showed improvement in their ability to focus, stay motivated, and feel relaxed while the music was playing. They also showed improvement in their off-task behavior and their scores on their skill worksheets. Based on these results, students in a sixth grade math class can benefit from this strategy. This basic model can be modified to meet the needs of classes within different content areas and at different levels. Providing instruction to students of any age and math level can help to improve concentration, motivation, and feelings of students. These skills can be transferred to helping students in all content

areas and can help students in their every day life. These skills will be valuable for students to obtain as they continue their education.

The results of playing classical musical in a sixth grade math classroom while students completed skill worksheets and independent work suggests that students were positively affected by this intervention. There was improvement shown in the task worksheet scores from when there was no music playing to when the music was playing. The results showed that student performance was greater when music was being played. Out of the nineteen students in the classroom, four of the students scored the same amount with music playing than without music playing, one student scored lower when music was playing than when music wasn't playing and the remaining fourteen students all increased their scores on their skill worksheet when music was playing.

There was also improvement of the off-task times from when there was no music playing to when the music was playing. On the days without music, students were off task on an average of 33%, 43%, and 41% during the observed class period times. On the days with music, students were off-task on an average of 30%, 22%, and 22% during the observed class period times. The survey taken by the students also showed that about 89% of the students in the class overall felt that they liked having the music on during class time.

One method for teaching mathematics is to integrate the arts into instruction (Betts, 2005). Music is an ideal form of art to be integrated in mathematics instruction. The links between music and mathematics are very rich and include melody, rhythm, intervals, scales, harmony, tuning, and temperaments. These musical concepts are related to the mathematical concepts of proportions and numerical relations, integers, logarithms

and arithmetical operations and the content areas of algebra, probability, trigonometry, and geometry (Beer, 1998; Harkleroad, 2006). In the past decade, educators have implemented several different instructional strategies to provide a music-mathematics integrated curriculum, although the levels of integration have varied (An, Ma, & Capraro, 2011).

Mathematics-music integrated instruction has the potential of improving students' attitudes toward learning mathematics and of increasing students' mathematics achievement (An, Kulm, & Ma, 2008; An, Ma, & Capraro, 2011; Benes-Laffety, 1995; Omniewski, 1999). In regard to the first point, music can be used to engage students in learning mathematics in an enjoyable but also relevant way. Secondly, music can be used as a resource by teachers to present and design mathematical problems in non-routine ways. This provides students with the opportunity to apply their mathematical knowledge in meaningful ways and connect new mathematical knowledge to existing knowledge.

In this current study, students were not making any changes to their daily routine in their math classroom. The only change that was occurring was that some days classical music was being played while other days there was no music being played.

In addition to testing, the students completed a classical music reflection at the end of the study that focused on four main categories: concentration, motivation, feelings, and overall thoughts. In the concentration category the students had the option to choose either 'I could concentrate much better', 'I could concentrate a little better', or 'My concentration was worse. Six students chose that they could concentrate much better, 10 students chose that they could concentrate a little better, and 3 students chose that their concentration was worse. In the motivation category the students had the option to

choose either 'I felt much more motivated to complete assignments', 'I felt a little more motivated to complete assignments', or 'I felt less motivated to complete assignments'. Seven students chose that they felt much more motivated to complete assignments, 10 students chose that they felt a little more motivated to complete assignments, and two students chose that they felt less motivated to complete assignments. In the feelings category the students had the option to either choose 'I felt a lot calmer or more relaxed while the music was playing', 'I felt a little bit calmer or more relaxed while the music was playing', or 'I did not feel calmer or more relaxed while the music was playing'. 13 students chose that they felt a lot calmer or more relaxed while the music was playing, three students chose that they felt a little bit calmer or more relaxed while the music was playing, and three students chose that they did not feel calmer or more relaxed while the music was playing. The last section was about the students' overall reaction to the music. In the overall survey, the students had the option to either choose 'Overall, I really liked having music on during math', 'Overall, I kind of liked having music on during math', or 'Overall, I didn't like having music on during math'. 10 students chose that overall they really liked having music on during math, seven students chose that overall they kind of liked having music on during math, and two students chose that overall they didn't like having music on during math. At the end of the survey, the students had the option to make a comment. Some of the comments included, "I like the music! I felt relaxed", "I liked the music, but I wish there was more variety of songs", "I liked having music in the background while we worked. It has never happened and I like the new change", "I really liked when we had the music on", "The music helped me be more focused, but I didn't like the style of music", "It was nice, but I wish the music was more like the music we

listen to. Overall, I really liked the music and we should do it more often. I think more schools should do it”, “Sometimes I had trouble hearing the music, but when I could hear the music it helped me with my work”, “The music helped me a lot in math and I did better with my work with the music”, “May we please do this again?”, “I honestly think most of the kids in my class didn’t give the music a chance at first because it wasn’t what we were used to listening to. I personally like piano better so I would also enjoy that type of classical music”, “It was calming and it helped me when I could hear it”.

In a study conducted by Abikoff, Courtney, Szeibel, and Koplewicz (1996), they evaluated the impact of extra-task stimulation on the academic task performance of children with attention-deficit/ hyperactivity disorder (ADHD). The study participants consisted of two groups of boys in Grades 2 through 6: an outpatient clinic sample of children with ADHD, and nondisabled controls. Twenty boys with ADHD and 20 nondisabled boys worked on an arithmetic task during high stimulation (music), low stimulation (speech), and no stimulation (silence). The music “distractors” were individualized for each child and the arithmetic problems were at each child’s ability level. The nondisabled children performed similarly under all three auditory conditions. In contrast, the children with ADHD did significantly better under the music condition than speech or silence conditions. When music was playing, the children with ADHD increased their number of correct answers by 33% and 23% relative to their performance during speech and silence, respectively. The authors suggested that the extra-task stimulation preferred by children for certain assignments (e.g., stereo music or TV while working on mathematics) “may be beneficial because it helps the students avoid boredom and therefore stay ‘on task’ for a longer time (Abikoff, Courtney, Szeibel, and

Koplewicz, 1996). Music helps to bring out the best in young people. It nourishes self-esteem and keeps them engaged (Whyte & Mould, 2011).

The results of the 1996 study are similar to this current study. The students in both studies increased their number of correct answers in arithmetic problems.

Limitations

Although the results of this study yielded positive effects, the number of participants in the study were small in size. This group of 19 students provided a limited amount of data on the effectiveness of playing classical music in a sixth grade math classroom. Increasing the number of participants could have provided a more thorough evaluation of the intervention.

Another limitation of this study was the implementation time. Other studies looked at the effects of the use of music in the classroom over longer periods of time. During the study, the school was closed two days due to snow and opened two hours late on two other school days. There were also two fire drills during this class and one lock-down drill. This was unavoidable, but disruptive to the educational process. Several of the students in the study expressed disruptive behaviors due to the schedule changes. This could have had a direct effect on the individual student performance.

Another limitation of the study was the many different diagnosis of students in one classroom. About 75% of the students were either diagnosed with ADD, received basic skills math instruction, had a 504 Plan, or were being assessed through I & RS. Along with learning disabilities/struggles, many of the students had behavioral and social/emotional concerns which impacted their daily functioning. This study may have yielded greater results if it was conducted in a classroom with less activity.

Another limitation of the study was the type of music that the students listened to. I received a lot of feedback from the students that they never heard classical music before and that it was ‘weird’ to them. Some of the students didn’t give the classical music a chance. They also talked over the music and had to be reminded that the music was on. Many of the students would’ve preferred to listen to today’s music.

Finally, the teacher who implemented the music presented the intervention in a specific way. However, only having on staff member conduct the intervention has limitations. When observing the off-task behavior, the results could be biased. Another teacher trained in the same manner may view the students differently, and therefore changing the results.

Practical Implications

The students who participated in this study received specific instructions before, during, and after the study. They knew that the skill worksheets would be used in the study and knew to complete each worksheet in its entirety. The results showed this type of intervention has a positive effect on a variety of sixth grade students in a math classroom. They continued to ask to put the music on even after the study was over. In all four categories of the survey after the study was complete, there was positive feedback from at least 84% of the class in every category. Classroom teachers can continue to use this approach in the classroom. Students can do classwork as usual while the teacher puts music on. This approach can be used when students are doing any type of classwork whether it is independent work, dependent work, partner work, or group work.

Future Studies

There is a large body of research that supports the effectiveness of the use of music in math classrooms. There is less research on the ineffectiveness of the use of music in classrooms. Future studies can focus on longer time periods to assess the students and over different content areas. A large number of students should be included in the future studies to gain a better understanding of the effectiveness of the specific strategy instruction. More than one teacher should be trained in the intervention and should be derived from different content areas. This intervention was conducted in a large group format. Would it be as effective when used in smaller group settings?

Conclusion

In this study, three questions were to be answered. First, do sixth grade students improve their mathematics performance (in areas of staying on task, focusing, and completing work) while classical music is being played? After reviewing the nineteen students' data, they improved their scores on their skill worksheets and 100% of the students either had the same off-task behavior or improved their amount of task-behavior while music was playing in the classroom.

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