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Using Music to Improve Learning in Mathematics

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Using Music to Improve Learning in Mathematics

by

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Chapter I

Introduction

Teaching has become an increasingly difficult challenge for many educators working in urban school districts. Students are frequently taught in ways that do not accommodate varying learning styles. Teachers also feel increased stress and pressure because of emphasis on standardized testing. Many educators spend time doing research on the best way to instruct their students. Research has proven that incorporating the arts is an effective means to improve learning across the academic spectrum (Americans for the Arts, (2007). Studies show that music education is being used as a tool for learning, enjoying and retaining information (Hetland, 2000, Vaughn, 2000, Graziano, Peterson, & Shaw, 1999). Music can be integrated with reading, math, science, and social studies curriculum to enhance skills in each of these academic areas. Using concrete music instruction might be a way for students to enjoy lessons and also apply the skills that are taught.

A recent study suggests that when music is played in the background during a lesson, there is a slight increase in learning, but when students have an opportunity to connect more than one subject; it becomes more meaningful (Giles & Frego, 2004). The integration of music is being used in some classrooms today to help students achieve success. In 1995, Liora Bresler found four styles of arts integration: The Subservient Approach, The Affective Style, The Social Integration Style, and The Co-equal Cognitive Style, which were used in regular classrooms (Irwin, Gouzouassis, Grauer, Leggo &

Springgay, 2006). Each of the styles describes how classroom teachers can use music to enhance their lessons (Giles, & Frego, 2004). There are many reasons why music plays an integral part in learning. Since the publishing of *The Mozart Effect* (a study on classical music on the mind) by Don Campbell, music is becoming a more powerful tool. More recent studies have been conducted to show the importance of music in the classroom (Giles & Frego, 2004, Hetland, 2000, Vaughn, 2000, Graziano, Peterson, & Shaw, 1999). These studies have found the benefits of including music concepts in regular curriculum.

Howard Gardner suggested that there are eight human intelligences, in which he states that musical intelligence is the capacity to perceive, discriminate, transform and express musical forms as found in Rodriguez & Bellanca (2006). Gardner implies that some students learn best through music. So in a regular educational classroom, there are some students who will get a better understanding of their work when music is applied.

Music can be applied to learning the skills needed in mathematics. Early childhood teachers use songs and nursery rhymes to teach reading in their classrooms. Some students are able to remember songs better than spoken words. Using songs and different music components can also help teach mathematics because of the high correlation between music and spatial-temporal reasoning skills (Hetland, 2000).

There is a high correlation between learning music and spatial temporal reasoning, which is primarily used for math skills (Vaughn, 2000). The two subjects (music and math) are closely related when they use identical concepts and skills. For example, patterns are found in music, such as in demonstrations of beat or rhythm. It is also found in math when learning about number systems or considering patterns of

pictures and shapes. Merging the subjects might create a greater connection to help students who are experiencing difficulty in math.

Statement of the Problem

This thesis examined whether first grade students learn math better through music by comparing a traditional method of teaching math versus integrating content and method involving math and music. The focus of the conceptual content was patterns. I was able to find out whether using patterns in the two subjects helped to improve my students' understanding of the math concept and also increase their enjoyment for math.

As a first grade teacher in the Rochester City School District, I am surrounded with assessments for national standards that first graders must meet. A number of the students in my classroom have a difficult time learning math facts and meeting the standards when they are taught in the traditional way. I noticed when music is used collectively with the other subjects, my students were more engaged. Having done research on "*best practices*" in elementary classrooms, I found that music is a great way to enhance math skills (Hetland, 2000). If the arts can help increase students' mathematical learning, perhaps teachers might consider applying these strategies in the classroom.

The purpose of this study was to determine whether music can be used in my classroom to help students understand, enjoy, remember and apply certain mathematical concepts related to patterns. I integrated the Rochester City School District math curriculum with parts of the music curriculum to create New York State Standards based

lessons that teach math concepts. The focus of this investigation was patterns because they can be easily found in both music and math. The integration of the subjects, math and music, helped my students understand math and consequently improve their math test scores.

Significance

Students are able to remember information if they experiment with the subject and teach it to others. Rodriguez and Bellanca propose that students retain information according to their scheme

- 10% from what they read
- 20% from what they hear
- 30% from what they see
- 50% of what they hear and see
- 70% of what they discussed with others
- 80% of what they experience personally
- 95% from teaching to others (Rodriguez & Bellanca, 2006 p. 60).

With that in mind, most curriculums should be student-centered. Allowing more class and personal time, as opposed to lectures, should increase student learning. Using music in the classroom allows students to experiment with the other subjects to enhance retention. Experiential learning is known to have an impact on student learning because students are actively participating in their learning (Rodriguez and Bellanca, 2006).

Numerous elementary schools are cutting out their music programs because of the lack of funding from the state. School administrators often fail to see the importance of best practice on student learning. Rodriguez and Bellanca state,

While it is important for districts to continue their efforts to remake the size of schools, align the curriculum, and strengthen assessment, they cannot forget the quality of instruction. In this, it is important that urban districts pay attention to

that research that makes the most difference in the improvement of test scores for urban students (Rodriguez & Bellanca, 2006 p.7).

The findings of the arts research conducted could benefit best classroom practices.

Students also seem to lack enjoyment in classroom learning and have difficulty retaining information. Therefore, integrating the arts into regular classrooms should be used to help motivate and inspire student learning.

One research study shows that students, who study music especially at an early age, have better spatial-temporal reasoning skills (Hetland, 2000). Making math interesting and accessible to students is an important step in helping them learn the key concepts of a subject. Most students in the public school setting often have a difficult time relating math to their everyday environment. Using music is another way for them to experience how math is used outside of the textbooks. It allows students to put a voice to math so that they do not only see the math but hear math concepts being sung or played on an instrument. They are more actively engaged in the learning as opposed to passively listening. Students can use discovery to solve math problems and figure out the answers.

Rationale

Using music lessons in my classroom helped me make math more meaningful and fun for my students. It also gave me a chance to show my colleagues one way that the arts can be integrated in the classroom. I work in a performing arts magnet elementary school, and therefore, I am surrounded by teachers who know the importance of the arts

but may have a difficult time implementing the arts in their curriculum. I shared the results of my study and the lessons so that other teachers may benefit from this thesis.

After conducting research on the benefits of using the arts in the classroom, I made use of those practices to engage my students in the lessons I teach. My students are exposed to many different styles of music and love to share their music with me. Realizing the important role that music plays in their individual lives, helped me to uncover the arts within them and use that to my advantage when teaching. Children usually memorize the songs they hear repeatedly, which is a sign that students can remember information when it is in a rhythmic form. Various art techniques are used as an aid in the classroom to help teach the curriculum. My project is an additional successful way that the arts can be used in an elementary classroom.

The next chapter will review a series of studies that were conducted in many classrooms to prove the importance of the arts when used in collaboration with other subjects. It will also evaluate brain research and the role that music plays on the brain. The similarities of music and math and math concepts, such as spatial temporal reasoning will also be discussed. Most importantly the literature review will list many ways that music is used to enhance learning in elementary classrooms.

Definition of Terms

The following definitions are based on *Learn NC*, K-12 Teaching and Learning from the University of North Carolina at Chapel Hill School of Education. (2006)

Best Practice – Teachers exploring the latest research on how students learn and applying it to their classrooms in order to enhance learning.

Academic Intervention Plan (AIS plan) - Individual plans that provide specific interventions to meet the child's needs. The AIS plan is written for every student who received a low score on the New York State exams, or is experiencing difficulty in the subject area. This is a step taken before a child can be tested for a learning disability.

Hands-on learning- Instructional activities in which students actively work with and manipulate materials and objects in order to study a concept or solve problems.

Experiential learning - Instructional approach based on the idea that ideal learning occurs through experience. Learning tasks require the active participation of the child in hands-on opportunities and must connect content to the student's life.

Discovery learning - Learning that takes place, not through instruction, but through a student's own examination, analysis, or experimentation.

Chapter II

Literature Review

I. A Research Investigation Into the Importance of Learning Music Brain-based Learning

Brain-based learning involves using approaches to schooling that relies on recent brain research to support and develop improved teaching strategies. Researchers theorize that the human brain is constantly searching for meaning and seeking patterns and connections. Caine summarizes three main techniques associated with brain-based learning:

- **Orchestrated immersion** is “creating learning environments that fully immerse students in an educational experience” (Caine & Caine, 1994). During the teaching of new information, the skill needed should always be the point of focus. Teaching students to concentrate on the subject matter being discussed helps to eliminate any other distractions.
- **Relaxed alertness** is “trying to eliminate fear in learners, while maintaining a highly challenging environment” (Caine & Caine, 1994). Creating a setting where during the learning process a student feels confident about the ability to learn the information. Also allowing students to feel comfortable in order to ask questions to clear up any confusion helps to lay a solid foundation of the material in the early stages of learning.

- **Active processing** is “allowing the learner to consolidate and internalize information by actively processing it” (Caine & Caine, 1994). Actions such as creating memorization games and acknowledging information learned throughout ongoing activities helps the learner to become familiar and comfortable with the material, which increases retention in long term memory.

Authentic learning situations increase the brain's ability to make connections and retain new information. A relaxed, non threatening environment that removes students' fear of failure is considered best for brain-based learning (ASCD Association for Supervision and Curriculum Development, n.d.). Research also documents brain plasticity, which is the notion that the brain grows and adapts in response to external stimuli. In order for the new information to be maintained in the long term memory, there must be changes in the brain representing the new information.

Music and Brain Development

Scientists are conducting studies on how sound travels from the ear to the brain and become music (Burack, 2006). While all of the facts are not known to man, many inquiries have proven that there is a connection with the brain and music (Begley, 2000, Hetland, 2000, Graziano, Peterson & Shaw, 1999). The diagram of the left and right brain (Appendix) illustrates the relationship and aligns with the research that proves music is an aid to raise IQ scores and helps students score higher in achievement tests.

Music education has become very popular in many classrooms today as a tool for learning, enjoying and retaining information. Music, a subject that has often been taught in isolation within the school curriculum, is now being integrated into some regular classrooms because of the recent studies that show the positive aspects of using music. The teaching of concrete music concepts is a way for teachers to incorporate the subject for optimal results (“Americans for the Arts,” n.d.). Many researchers show the high correlation of music and the mind and how it is incorporated in elementary classrooms (Begley, 2000, Hetland, 2000, Graziano, Peterson & Shaw, 1999). Below is an examination of recent research that shows the benefits of music in education.

Music Intelligence Neural Development (M.I.N.D.) – Gordon Shaw

Gordon Shaw is an arts advocate who conducted a number of studies on music and the mind. Dr. Shaw became interested in brain theory in 1973 and has since continued to research the effect of music on the brain. In 1993, he conducted a study using classical music with three year olds. He later retested them as college students and found their IQs had increased by nine points. Later, he conducted another study and discovered that preschoolers who were given piano lessons once a week scored 34 percent higher on math, science, and engineer tests than preschoolers who did not receive music lessons (Burack, 2006). Dr. Shaw went on to establish the Music Intelligence Neural Development (M.I.N.D.) Institute in 1998. The institute developed a curriculum that uses piano keyboard training to help students think mathematically. In an article featuring Gordon Shaw’s legacy, Burack stated, “Shaw’s vision of teaching all kids

regardless of cultural and socio-economic background, how to think, reason and create mathematically is the foundation for the M.I.N.D” (Burack, 2006).

One study that is based on Dr. Shaw’s theory was conducted in 1995, when seventy-nine college students participated in a five day listening experiment. The students were divided into three random groups and had a listening activity for ten minutes. One group listened to Mozart; one listened to a mix of music, while another group listened to silence. After each listening activity, the groups had to perform a task of paper folding and cutting. The group who listened to Mozart improved by the second day and continued to improve each day. There were no improvements with the other two groups. The results of this study helped show a connection with music and how the brain performs tasks. The paper folding and cutting activity is also linked to using spatial-temporal part of the brain.

Importance of Integration Practices in Elementary Classrooms

Integration is a philosophy of teaching in which content is drawn from several subject areas to focus on a particular topic or theme. One of the positive ways to integrate Brain-based learning into curriculum is to have learning designed around interests and to keep the information contextual. It is believed that an interdisciplinary curriculum or integrated teaching reinforces brain-based learning because the brain can better make connections when material is presented in an integrated way, rather than as isolated bits of information (ASCD, n.d.). The use of a thematic approach organizes and combines subjects (reading, writing, math, science, and social studies) to help students

remember the information at a higher rate by creating a connection with real life learning. Students are then able to make important connections in their learning and have a deeper understanding. Instead of studying math or social studies in isolation, a teacher might develop a unit on animals, using math to graph solve problems about animals; social studies to understand habitats, and different geographic homes of the animals; science to study the animals in depth as well as reading different animal books; and writing reports after researching the animals (ASCD, n.d.).

Curriculum integration is also a way for all subject area teachers to connect in order to make learning more meaningful to students. It is a way for special subject teachers such as music, art, physical education, and technology to link to the unit that is being studied in the regular classroom while teaching to the standards. For example, students studying animals can also learn their motor elements by moving like the animals during physical education, learn about famous art work with animals, draw/create animals out of different materials during art, and learn music concepts such as beat and rhythm using animal songs. Incorporating the main theme in all of the subject areas that are taught at school will provide the repetition that most students need in order to increase their retention of the subject.

Benefits of Arts Integration in the Elementary Classroom

There are many ways and levels that the arts can be incorporated into schools around the world. According to Bresler, there are four different arts integration styles found in classrooms. (Giles et al, 2005). Each style is a different level of integration and has

various outcomes when applied in the classroom. Bresler's four styles of arts integration are as follows:

- **The Subservient Approach** is “the type of integration where the arts are used strictly as a vehicle for other academic objectives. It is the most commonly used approach to arts integration” (Giles & Frego, 2005). In this approach, students are enabled to excel academically through proper implementation of artistic expression throughout specific subject areas, while directly correlating it to the standards.
- **The Affective Style** is “found when teachers use the arts as a way of changing the overall mood of the classroom, such as trying to create a calm atmosphere after recess or using the arts to achieve goals such as creative expression or building self-esteem” (Giles et al., 2005). In so doing, they prepare for academic tasks that lie ahead and potentially face each assignment with deeper meaning, seeking a comprehensive outlook, previously anticipated through art.
- **The Social Integration Style** “involves the arts as a vehicle towards participation in school or community events, and is often exemplified in the form of school programs, assemblies, or holidays” (Giles et al., 2005). During performances, students are asked to speak publicly in front of an audience, which will enhance public speaking skills and increase self confidence. Students

understand and develop their creative expression, which can be used in the classroom.

- **The Co-equal, Cognitive Style** “occurs when teachers incorporate objectives that require both cognitive skills as well as aesthetic principles. The style places arts objectives on the same importance level with other subjects” (Giles et al, 2005). In a classroom using this style, the arts curriculum is being taught with reading, math, social studies and science. The arts curriculum is used to enhance teaching.

Giles and Frego conducted research using data from eighteen classroom teachers in an urban school district. The classrooms were of grades one, three and six. The teachers were asked questions such as what types of music activities were included in their day and for how many minutes per week music was taught. They were also allowed to give their thoughts on music in the classroom. They grouped their outcomes into Bresler’s four styles of arts integration to find out which method was most commonly used by classroom teachers. They found that, out of the eighteen classrooms, four teachers had music books in their classroom library accessible to the students, and two classrooms had pianos. The cognitive style was found to be the most effective style used and the least common of the four styles. This study’s results proved the success of implementing music in regular classroom settings and the need for teachers to get training so that they can properly execute arts in their curriculum.

Music Integration in the Elementary Classroom

Based on Bresler's work, it can be concluded that many skills are taught during music class that can be used throughout the curriculum. Musical expression helps children retain instruction in a rhythmical nature. Among song structure in the classroom, certain genres of music have proven to be beneficial to students. "Research on learning transfer between music and other areas of cognition is relevant to educators interested in the contribution of interdisciplinary learning" (Scripp, n.d.).

The Mozart Effect suggests that even when music is played in the background during a lesson, there is a slight increase in learning (Campbell, 1999). Background music is known to have a calming effect on students with behavioral problems (Campbell, 1999). Many teachers use classical music during quiet or independent work to help students focus on their task. According to Hattam, who did a study on the effect of classical music on studying, students are able to focus more with 'calm' music as apposed to 'excited' music (Hattam, n d) Therefore, the teaching of music can have a significant impact on classroom learning.

Music is also used as a form of therapy or relaxation for hospital patients, the emotionally challenged and special needs individuals. According to the Wikipedia encyclopedia, "Music therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a qualified professional who has completed an approved music therapy program. In other words, music therapy is the use of music by a trained professional to achieve therapeutic goals. Goal areas may include, but are not limited to, motor skills, social/interpersonal

development, cognitive development, self-awareness, and spiritual enhancement” (Wikipedia, n.d). Music is commonly used with special needs individuals as a tool for “developmental work” such as communication, and improving fine and gross motor skills. Music therapists encourage cancer patients to passively listen to music as well as play different musical instruments in order to manage stress, express their feelings and promote wellness. They also use music as a form of relaxation for all patients including those who recently had a stroke (Cancerwise, 2005)

In October 1993, Dr. Rauscher and Dr. Shaw found that listening to 10 minutes of Mozart Piano Sonata K 448 increased the spatial IQ scores in college students. Also when students have an opportunity to connect more than one subject, it becomes more meaningful. There is a high correlation with music and spatial temporal reasoning which is primarily used for math skills (Vaughn, 2000). The two subjects are closely related, which will create a great connection to help students who experience difficulty in the subjects.

The integration of music is being used in classrooms today to help students achieve success. It is stated that music helps students achieve success in society, school, developing intelligence, and in life overall (MENC, 2002). There are many reasons why music plays an integral part in learning. Studies show that students who received musical training at a young age perform higher in all academic subjects. According to MENC, the National Association for Music Education, students with music appreciation and music participation scored higher than students with no arts background. MENC also suggests that music helps students develop intelligences (MENC, 2002).

When Howard Gardner described eight human intelligences in 1983, he stated that “musical intelligence is the capacity to perceive, discriminate, transform and express musical forms” (Rodriguez & Bellanca, 2006). He also described it as “the capacity to think in music, to be able to hear patterns, recognize them, and perhaps manipulate them.” He was aware that there are people who actually think musically. Students with this intelligence are known to not only enjoy music but hum, or tap rhythms on their desk or with their feet. They can easily discriminate amongst sounds and recognize sound patterns and also have sensitivity to pitch, timbre, rhythm or sound. Musically intelligent individuals can enjoy, perform or compose a music piece (Educational Broadcasting Corporation, 2004.).

In most classrooms, music is used as a means for student enjoyment. According to society, one of the best things that you can do for your child (student) is to instill in them a joy for learning. Taking pleasure in learning is known to have a positive impact on student achievement. When there is a relationship between music and more abstract subjects such as math and science, students may enjoy learning more and remember the information. Early childhood educators use music to enhance learning. They use nursery rhymes, and different songs to teach many reading skills. Nursery rhymes not only cover the “rhyming” skill, but also phonemic blended sounds, important for emergent readers to grasp. “Little Bo Peep has lost her sheep” is an example of the double ‘e’ sound and includes the ‘sh’ blend as well. Nursery rhymes are also used to teach antonyms, synonyms and other grammatical concepts.

An excellent example of music integrated in learning that has existed for decades is *School House Rock* created by David Mc. Call, George Newell and Tom Yohe. The

series includes forty six short videos designed to help students memorize facts in core subjects like history, science, and math. The videos are short songs that focus on a certain skill such as multiplication, the Constitution, grammar, and others that require memorization (School House Rock, n.d.).

In many music classrooms with young learners, music and movement are often integrated. Movement also supports Gardner's Intelligence theory because it is the kinesthetic aspect of learning. Gardner describes Bodily/Kinesthetic intelligence, (body smart) as "the capacity to use your whole body or parts of your body (your hands, your fingers, your arms), to solve a problem, make something, or put on some kind of production. The most evident examples are people in athletics or the performing arts, particularly when dancing or acting." Gardner recognizes the importance of dance and suggests that educators use activities in the classroom that will benefit the kinesthetic learner. Dance is used in the classroom to aid in the teaching of music skills such as beat and rhythm as well as many social skills.

Music and Math Integration for Improved Learning

Music can be used for learning specific skills needed in mathematics. Using songs and different music components can also be employed to teach mathematics because of the high correlation between music and spatial-temporal reasoning skills (Hetland, 2000). Music has also been shown effective in math fact memorization and the understanding of pattern structures. Because patterns are easily found in both subjects, many classroom lessons can be interchangeable.

Music and Spatial Reasoning

Research shows that music is directly related to the part of the brain that uses spatial reasoning, a skill highly used in math. “Spatial-temporal reasoning is the ability to create, maintains, transform and relate complex mental images, even in the absence of external sensory input or feedback in other words, reasoning through space and time. Math, science, physics, chess, and music all involve this type of reasoning” (Hansen, 2001). The subjects previously mentioned in the quote are all abstract and rely on mental images in order for learning to happen. Music provides another way for students to store the information learned in their mental file.

Researchers Gordon Shaw and Frances Rauscher concluded that college students who listened to the Mozart Sonata for Two Pianos in D Major (K.488) had significant improvements in spatial-temporal reasoning. That study in 1995 proved the importance of music programs and the benefits of music on other subjects.

Kathryn Vaughn, an advocate for music, completed research to determine whether there is a relationship between music and mathematics achievement. She found that “students who take music classes in high school are more likely to score higher on standardized mathematics tests such as the SAT” (Vaughn, 2000). Vaughn goes on to say that “when authentic music instruction is integrated with mathematical instruction based on spatial temporal aspects of learning mathematics, the positive association between music and mathematics learning may increase significantly, to the potential benefit of both subject areas” (Vaughn, 2000).

Music and Math Facts

According to *About Mathematics*, a website created to educate teachers and parents, “success in early math/arithmetic is clearly dependent on children learning the math facts and committing them to memory. Students will certainly benefit from the consistent use of the strategies used in Memory Aids to commit the math facts to memory. Mnemonics creates the rhyming links or associations that give the brain an organizational framework on which to hook new information” (About Math, n.d.). The study and memorization of math facts continues to be an integral part of the elementary school curriculum. Students are expected to learn the facts in order to be successful with operations. Many teachers are looking for different ways to help students learn the facts and while making the process enjoyable.

There are many mnemonic devices that employ music to teach mathematical facts such as addition, subtraction, multiplication, and division. Mnemonic is “a memory aid, and most serve an educational purpose. Mnemonics are often verbal, something such as a very short poem or word (which may be made up), particularly lists. Mnemonics rely not only on repetition to remember facts, but also on associations between easy-to-remember information and to be remembered lists of data, based on the principle that the human mind much more easily remembers data attached to spatial, personal, or otherwise meaningful information than that occurring in meaningless sequences. The sequences must have some connection to a person's existing semantic associations; if a random mnemonic is made up; it is not necessarily a memory aid” (Wikipedia, 2007). This

device is visual and rhythmic which relates to the way the human mind remembers information. Teachers often make up songs and other poetic rhymes to aid in the memorization of mathematical facts.

School House Rock is an excellent teaching tool from the 1970s that addresses math skills and continues to be an asset in the classroom. In math, the specific musical instruction implemented strategies to count by 3s, multiply by 5s and write the number 8, which is “a circle that goes round about itself” (School House Rock, n.d.). Rock’n Learn is also a more recent music and video series that aid in the study of memorizing rote math facts. Rock n’ Learn was created in 1986 and now includes many videos, c.d., and books that teach math facts through the use of more modern music such as rock, rap and country.

Music and Mathematical Patterns

Patterns are “related to repeated shapes or objects. Some patterns (for example, many visual patterns) may be directly observable through the senses. The simplest patterns are based on repetition” (Wikepedia, n.d.). They can be found in most school curricula and in every day life. Students in primary grades study lifecycles of different animals (frogs, butterflies) and examine patterns in life science. M.C. Escher used tessellations (shapes arranged in a repetitive form without overlapping) to show patterns in his art work. Escher’s work is commonly present in art and math classes. Patterns are present in all subjects especially with music and mathematics.

The correlation of patterns in both music and math is apparent especially in the elementary school curriculum. During math class students are required to read, predict,

create and extend patterns using different manipulatives. The first step for the students is to be able to recognize that there is repetition when looking at the shapes, or in some instances, colors. When students are able to recognize there is a pattern, they learn to extend the pattern by predicting what comes next. Then it is time to create a pattern of their own by using the strategies taught.

The process of mathematical patterns is similar to those of musical patterns because students must first learn to identify the pattern or rhythm of a song, in order to create or compose their own rhythm. Wikipedia defines rhythm as "the variation of the length and accentuation of a series of sounds or other events. It involves patterns of duration that are phenomenally present in the music". Therefore, during music class students are required to study rhythm and beat because it is the pattern that distinguishes between different songs.

Musical training in rhythm develops a sense of anticipation and predictability. Good music has some repetition and like math problems, presents irregularity in pattern to actively engage the listener. For example, the pattern in the song "skip to my lou" or any square dance melody has the A A A B pattern that can also be described in colors, shapes, or sizes during math class as "triangle, triangle, triangle, square" or red, red, red, blue."

Musical selection is imperative in bridging student engagement with active participation during instruction. Students respond differently to the chords of the song when using instruments and creating vocal expression throughout curriculum. Major chords are more upbeat and received in the brain as exciting and pleasant, while minor chords create a more dramatic, disheartened melody. Thus, the manner in which

materials are presented while using musical devices has an effect sound tone and is essential in order to have a positive reaction on students.

As a result of the aforementioned studies, researchers have proven that children do indeed advance in educational capacities through use of musical implementation during instruction. Mnemonic devices, rhythmic intonations and cord usage produce a lasting effect on the information students retain when receiving instruction. Moreover, the therapeutic nature of music has been documented as a leading impact in teaching strategies.

Chapter III

Procedure

The purpose of my action research was to find out if using music lessons to teach patterns would help increase my students' understanding of math. I also wanted to find out if using music would enhance their enjoyment of learning during math. The study helped change the way that I teach math because I was able to incorporate the Rochester City School District music curriculum in my first grade classroom. The main objective of my project was to assist my students with patterns and to help them form a deeper understanding for math. I also wanted to encourage the students to see the similarities between music and math and independently begin to relate music to other subjects to help them retain information.

Howard Gardner's multiple intelligences theory impacted my study. After learning about the musical and kinesthetic intelligences, I began to recognize those characteristics in the students in my classroom. I realized that most of my students learn with movement and through experiment, which helped to reaffirm the theory that applying dance is a valuable tool for learning any subject especially math. I observed students tapping their pencils to a beat at their desks and using their musical intelligence. These students needed lessons geared towards their intellect. I also noticed that some of my students with individualized education plans (IEP) enjoyed the music class, and the musical activities in the classroom. After months of reading research on the positive

effect of music used in teaching math, I decided to create a study to investigate whether there is an improvement in learning math when music is used with my students.

Participants

This study was designed in a first grade classroom in an urban performing arts magnet school in Rochester, New York. The school is highly supportive of the integration of the arts in classrooms. During the year, teachers, including myself, work with many visiting artists to implement lessons connecting the arts to the regular subjects. The students are fortunate to have an artist come in every year and share their expertise while teaching them a skill that they need. All of the students in my classroom had the experience of using the arts to learn a subject with an artist.

My classroom composition was as follows: There were twenty students: ten females and ten males. Six of the students were in the first grade for the second time, (four of the six were my students last year), eleven of the students have an Academic Intervention Plan, and three students receive speech services.

The subjects of the study were eight students identified as having difficulty with math and having scored 50% or less on the patterns pretest (Harcourt Brace, 1999). The students were randomly assigned to groups A or B. Group A learned patterns using music, while Group B learned patterns without using music concepts.

Procedures

Patterns are required in both the first grade math and music curriculum. I was able to create an integrated unit on patterns using the Rochester City School District

curriculum guide for music and math. I used the skills needed in patterns and created lessons that incorporated music for Group A, and the same lessons with no music for group B. Before my study, the students were receiving an hour of math instruction daily, and two forty five minute music classes per week. All of the students had been exposed to the integration of music in the classroom prior to my study. I have used music to supplement my reading and writing but never during math. The process of using music during math was a new concept to the students.

The two groups of students received 30 to 45 minutes of instruction at separate times during the day. The groups remained in the classroom to assure their comfort level. The first day, all of students in the classroom were given a pretest to measure their knowledge on patterns (See Appendix A). I encouraged the students to try their best to answer all of the questions on the test. The tests were scored and of the twenty students eight of them received 50% or less on the exam. Those students were placed in either Group A or Group B. On the second day, I proceeded to teach the unit. The skills and topics were the same with both groups; the lesson plan outline is included with this chapter. The only difference was that Group A used musical notes and concepts with the teaching of patterns while group B learned using only mathematical language and concepts.

The first lessons were designed to help students understand what a pattern is and how to recognize a pattern. Then students learned to predict the next steps by studying different patterns. The last steps allowed students to create and experiment with different objects as they produced their own patterns. Students were also given ten minutes after every activity to write in their journal. On the last day, students were given the same

pretest to examine what was learned during the unit. The unit included eight lessons and two tests during a two week period.

Instruments of Study

Students in both group A and group B received the same pre-test and post test so that I could clearly assess their learning. The assessment was created from a collaboration of pattern questions from the Harcourt Brace series used in the Rochester City School District. The comparisons between the pretest and the post test were graphed. The results of the tests will be discussed in the next chapter. The students also completed a survey entitled “What I like about Math” (Harcourt Brace, 1999) before and after the study in order for me to graph any changes in their attitudes toward mathematics. A copy of the survey can be found in Appendix B.

The journal writing pieces also helped me to assess student enjoyment, and understanding of the math concepts during and after the lessons. Students were asked to write a few sentences to keep track of their thoughts, feelings, learning and or any questions that they had during the lessons. A few of the students were not able to write so they were allowed to draw a picture as I scribed their thoughts for them. Students were given the following prompts for their journal writing but were not limited to the following questions.

1. What did you like about the lesson today?
2. What didn't you like about the lesson today?

3. What did you learn from the lesson today?
4. Do you have any questions about something you did today?
5. Do you understand what we talked about?

Both Group A and Group B followed the same guidelines and were given the same criteria in order to add validity to the study. The students were given equal amount of time to process and learn the skills taught. The lesson plans in the unit (Appendix C) taught the same mathematical skills in a familiar setting with me as their teacher. Students were also encouraged to be honest about how they felt in their journal. I reassured them that they would not be graded on their written entry and that their opinion was to help my teaching. The students were separated during writing time and were told not to talk during the ten minutes to encourage entries. After the ten minutes students who wanted to share were given an opportunity to share while others listened and discussed. Students were encouraged to share their thoughts and feelings openly. The results and opinions of the students will be discussed in the following chapter.

Chapter IV

Results

The students in both Group A and B were given a pretest and post test to measure their growth and achievement in mathematical patterns. The test included ten questions about patterns (See Appendix A). The first two questions were assessing pattern identification. According to the lesson plan outline, this was the first lesson taught on day two. Questions three and four asked the students to figure out the next shape in the patterns given. Questions five and six were similar to three and four except the students had to predict the next two shapes of the patterns. For the next two questions, seven and eight, students had to examine patterns and find a different pattern that uses the same shapes. The last two questions demanded the students to find a mistake in the pattern and identify the correct shape that can be used to fix the mistake. The results of the assessment are reported in the following tables.

Table 1: Test Results (Out of 100%)

Group A learned mathematical patterns with music while the students in Group B learned patterns without music.

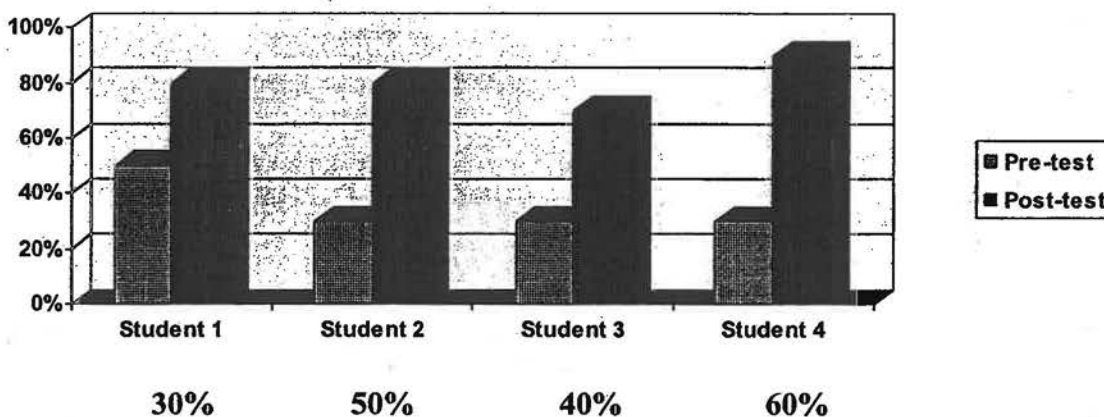
Pre-test

Post-test

Group A		
Student 1	50%	80%
Student 2	30%	80%
Student 3	30%	70%
Student 4	30%	90%
Group B		
Student 5	50%	80%
Student 6	10%	20%
Student 7	30%	60%
Student 8	50%	70%

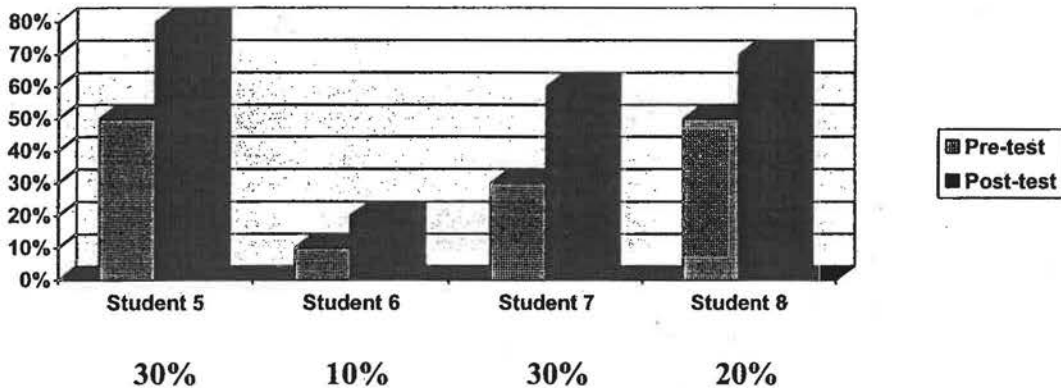
Table 1 shows the increase in all of the students' scores whether or not they were in group A or B. The scores improved after the lessons were taught regardless of the integration of music. The students had a range of increase from 10% to 60%.

Table 2: Percentage of improvement in pattern understanding - Group A



All four students in group A had an increase in their test scores. The average increase for Group A is 45%. Student 4 had the highest increase at 60% and student 1 had the lowest increase at 30%.

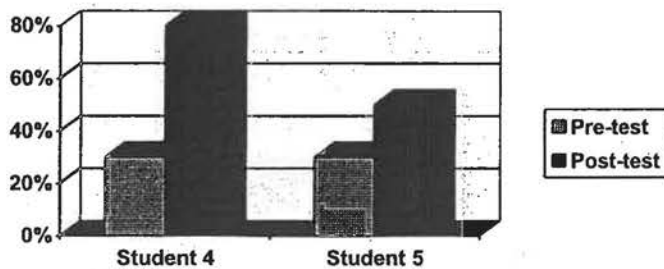
Table 3: Percentage of improvement in pattern understanding - Group B



When you compare Table 2 and 3, the students in Group A had a 30% - 60% increase or higher in their assessment while the students in Group B increase percentage was at 10% - 30%. The lowest increase in Group A was at a 30% which is the highest increase in Group B. The average increase for Group B is 22.5%. When you compare the average, there is a difference of 22.5% which means that students in Group A performed 50% higher in their post assessments than students in Group B. Student 6 had the least growth at 10%, which keeps him at a failing grade. Student 3 received a passing grade but had the least growth in Group A. According to Table 1, 2, and 3, all but one student received a passing grade of 60% or more at the end of the project.

Table 4 shows the comparison between the highest achieving students in both groups.

Table 4: Most significant growth of students in groups A & B



According to Table 4, when the groups are separated, there is a rise in the individual student's achievement level. Student 4 of Group A had the most significant growth while student 5 from Group B showed the most improvement in that group. But when the two students are compared, the one from group A had a more significant growth than the student from Group B.

Survey Results

The students were also given a survey to complete at the beginning of the lessons and after the lessons to track their attitudes about Math. The survey, entitled "How I Feel About Math" consisted of seven questions. (Appendix B). The survey questions were written to find out students' views on math before and after the two week study. The results are as follows.

Table 5 – Students’ attitude towards math

The following numbers stand for the number of students who colored in a smiley face ☺ to show agreement with the questions listed below.

	Before	After
I like solving math problems	6	8
I like telling how I solved a problem	2	4
I like working alone in math	4	2
I like working with others	7	7
I think math is easy	4	4
Math is one of my best subjects	5	6
Math activities are fun	8	8

The survey results in Table 5 show that most of the students enjoyed math and considered math one of their favorite subjects although they did not feel that math was easy. All of the students consider math as fun before and after the study. The attitudes toward math either stayed the same or became more positive during the short time frame.

Table 6: Survey results from Group A and Group B after the lessons

	Group A	Group B
I like solving math problems	4	4
I like telling how I solved a problem	3	1
I like working alone in math	1	1
I like working with others	4	3
I think math is easy	2	2
Math is one of my best subjects	4	2
Math activities are fun	4	4

Table 6 shows that on average the students' feelings in Group A had a more significant change. One student from Group A and one student from Group B stated that they now like to solve math problems. Two students in group A changed their feeling towards telling how they solved the problem. For the question on working alone in math, two of the students felt that working alone is best for them as opposed to most of the students in both groups who preferred working in groups. Some students stated that they like both working together and alone. One of the students in Group A was able to say that math was her favorite subject at the end of the lessons.

Student 4 who had the most significant growth during the study also was able to change her attitude about math. She stated in her survey that she did not enjoy math problems and that she enjoyed working alone. At the end of the two week unit both of those answers changed. She also admitted that math had become one of her favorite

subjects. Student 5, the most improved of group B, was able to change her opinion about liking to solve math problems.

At the bottom of the survey, the students were encouraged to draw a picture of the math activity that they like best. During the pre-survey most of the kids drew a picture of themselves playing card games and working with the manipulatives to solve problems. Group B created pictures of themselves playing cards and using manipulatives as they did during the pretest as opposed to two students from group A, who drew pictures of themselves playing with the instruments that were used to make the rhythm patterns.

The four students from group A stated their excitement about using the instruments and other fun materials during math time. Overall they stated that they "...enjoyed making and clapping a beat because it was like creating a song." The students in Group B expressed their joy of working in a small group although they did not like the worksheets that they had to complete after the fifteen minute lesson. They continued to ask if they could play or use the tiles instead of working on the worksheet on patterns. Overall, all of the students enjoyed the opportunity to work in small groups and learn about patterns.

Chapter V

Conclusions and Recommendations

This project was designed to see if students' math scores would improve if the lessons were integrated with music concepts. I also wanted to assess students' attitudes, and research whether their feelings would change after the two week lessons of patterns with music or without music. After analyzing the data, I was able to draw many conclusions of the benefits of integration practices, especially the arts and regular subjects such as English language arts, math, science and social studies.

All of the students enjoyed the opportunity to work with me in a small group setting. Most of the comments about the lessons were positive because of the privilege of working on a "special project." All of the students' test scores improved after instruction. However, the students in group A, the ones who were given music activities to supplement their math, had a more significant growth on average as opposed to the students in Group B. Most of the students passed with a score of 60% or higher compared to the pretest where all of the students received a 50% score or lower.

This study aligns with the research in chapter two that states the importance of music in primary classrooms when merged with math. In 1995, Bresler stated that the most effective style of arts integration is the "Co-equal, Cognitive Style" which is when the arts curriculum is used to enhance teaching (Giles & Frego, 2005). My study was an example of that style of arts integration because the study of music concepts was used to enhance the learning of patterns. The project suggested the validity of the theory because

when math and music were combined in my classroom, the students exhibited higher achievement. The students in the first group had as much as a 60% growth as opposed to students in Group B whose scores were only 30% higher. The results show that using music was an effective way to teach because of the distinct similarities and uses of patterns in music and math.

The results of the survey, led me to conclude that after the study; most of the students' attitudes became more positive towards mathematics. The students in both groups benefited from the small group setting and expressed an optimistic view towards the lessons. I noticed that all of the students thought math was fun regardless of whether they thought it was easy. It was also interesting to me that both groups enjoyed the lessons although group B did not like working on the worksheets. Group A and Group B were to have the same experiences with the journal. It was difficult for Group B to fill out journal pages because of the lack of time and disinterest in writing after completing worksheets.

The groups were separated and were not aware of what the other group worked on. Towards the fourth lesson the students of Group A became excited with the use of instruments and shared their experience with the class. The students who were not part of the musical group wanted to know when they could use the instruments to learn math. After the post test, the students in Group A got a chance to help me with a whole group lesson using the instruments to make patterns. They were very self-assured in front of the class. All of the students in this study have an academic intervention plan and were not as confident in math. It was reassuring to see the students' progress within a short period of time.

I have always believed in the use of music in the classroom and this study clearly proves to me its benefits. If given more time, I would have liked to continue the research by having a bigger control group. Using only four students in each group limited the results. It would have been interesting to see if the test scores of all of the students in the classroom would improve when music is used. I would also like to teach a different math concept to Group B using music and Group A without using music. The continuation of the study would help me determine if music was the factor or if the students in Group A were more musically intelligent based on Gardner's theory of multiple intelligences.

There were a few challenges when implementing this unit. It was difficult for me to choose which students would receive the math instruction with music because after conducting the research, I believed that using music would be an effective way to teach math. When selecting groups A and B, I had to remain objective and choose according to test scores so that the study could be valid. I was also concerned that all of the students couldn't participate. At the conclusion of this study, I was able to observe many areas of growth in the students who participated. Not only did the students' test scores improve but they were more confident in math especially when presenting their work. It was amazing to see the joy in their (students from Group A) eyes as they became the leaders the day we shared the activity with the whole class.

I strongly believe in the use of the arts to enhance learning in classrooms. I have always limited my use of music to help teach reading, but now I have discovered a new way to incorporate the arts in my classroom. As I continue my teaching career, I look forward to continuing my studies of effective ways to use music to not only make learning enjoyable, but to improve students' test scores.

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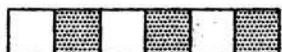
Appendix A

**Pretest
Post-test**

Harcourt Brace, 1999

Write the correct answer.

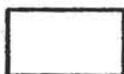
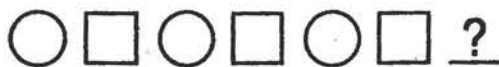
1. Circle the pattern.



2. Circle the pattern.



3. Circle the shape that comes next in the pattern.



4. Circle the shape that comes next in the pattern.



5. Circle the shapes that come next in the pattern.



6. Circle the shapes that come next in the pattern.



7. Circle the different pattern that uses the same shapes as this one.



8. Circle the different pattern that uses the same shapes as this one.



9. Mark an X on the shape that is a mistake in the pattern.



10. Circle the shape that fixes this mistake in the pattern.



Appendix B
Student Survey
Harcourt Brace, 1999

Name _____

Date _____



How I Feel About Math

1. I like solving problems in math.



2. I like telling how I solved a problem.



3. I like working alone in math.



4. I like working with others.



5. I think math is easy.



6. Math is one of my best subjects.



7. Math activities are fun.



This is the activity I like the best.

Appendix C:

Lesson Plans

Harcourt Brace, 1999

Silver Burdett, 2005

Lesson Plans Outline

Group A and Group B

Both groups A and B will have the similar daily goal. They were taught identical skills using different methods. Group A had a music focus while Group B was taught using the Harcourt Brace first grade math curriculum.

Day 1: Pretest and Survey * both groups were given the Harcourt Brace patterns test. The test consists of ten questions testing the skills that were taught in the lessons. The survey titled "How I Feel About Math" will help me document the students' feelings before and after the lessons.

Day 2: Identifying Patterns- What is a pattern? Students learn the definitions of a pattern.

Day 3: Identifying Patterns- Is it a pattern? Students differentiate patterns and non pattern while using their definition of what a pattern is.

Day 4: Reproducing Patterns- Students will look at different patterns and copy them

Day 5: Extending Patterns- Students will study simple patterns and guess what comes next.

Day 6: Extending Patterns- Students will continue more difficult patterns by adding the next pieces.

Day 7: Making/ Creating Patterns- Students will create simple patterns with help.

Day 8: Making/Creating Patterns- Students will individually create and explain their patterns.

Day 9: Analyzing Patterns- Students will look at patterns that have a mistake and predict the mistake and replace it.

Day 10: Post test * the groups were given the pretest again.

Group A

Math with Music

Lesson Plans

Group A

Day 1: Pretest

Objective- The pretest will determine the students' understanding of patterns and provide adequate information about students' knowledge of the subject.

Day 2: Identifying Patterns

Vocabulary

Math: Patterns

Music: Steady beat, pat, clap

Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Music Standard: 2,6,8

Objective: Students will identify the music concept of beat. Students will learn the definition of patterns

Materials: Various pictures of objects that makes sounds (dog, kitchen timer), jump rope

Procedures

1. Tell the students "Steady beat is like your heartbeat. Which of the following things make a steady beat sound? Show them various pictures. Ex. dog barking, wind chime, clock ticking or timer,
2. Have students experiment with beat. Give them a jump rope and allow them to make a steady beat.
3. Ask the students to clap a steady beat using their hands
4. Have students listen to you clap then pat. Repeat your clap and pat pattern then ask the students to tell you what they noticed.
5. Discuss that you can continue to pat and clap. If no one brings up the word "pattern" mention it and explain to students that a pattern keeps repeating. Ask students to describe some patterns that they see at school or at home. Something that keeps repeating. Feel free to give concrete examples like the sun rising and setting, the four seasons, days of the week.

Closure: Explain that the use of the math journal is for the students to write down their thoughts and feelings after the lessons. It is also for them to keep track of what they are learning and questions that they may have about the lesson.

Go over the list of questions they can answer in their journal.

Day 3: Identifying Patterns

Vocabulary

Math Concept: Pattern

Music Concept: steady beat, no steady beat

Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Music Standard: 2,6,8

Objective: Students will listen to various songs and determine whether it has a steady beat or not.
Students will determine what a pattern is by looking at different tiles arrangements.

Materials CD player, CD's with various songs, math tiles

Procedures

1. Review the meaning of steady beat and have students demonstrate what a steady beat is.
2. Inform students that they will listen to many songs. While they listen to the song see if it has a steady beat. After the song they will show a "thumbs up" if the song has a beat and "thumbs down" if the song does not.
3. Play the songs and after every song ask students to show thumbs up and thumbs down.
4. Tell students that they will now show beat using the math tiles. Pass out tiles and have students listen to a short song. (Ex. Rain, rain)*. Every time they hear the beat they should put a tile down.
5. Play the song again. Have students point to the tile as they hear the song.

Closure Have students write in their journal about something they learned today about beat or a question that they have.

Day 4: Reproducing Patterns

Vocabulary

Math Concept: Pattern

Music Concept: steady beat, pattern, rhythm, music notes, call and response

Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Music Standard: 2,5, 6,8

Objective: Students will reproduce simple A-B-A patterns with music notes

Students will clap out patterns by reading music notes.

Materials: Cards with music notes, musical instruments

Procedures

1. Review what a rhythm is. Go over the notes and how they sound. Have students clap the sound and say mango or blue as you point to a series of notes.
2. Clap out a pattern and have students clap the pattern after you. Continue to clap different patterns to see if students are able to repeat the patterns. Use musical instruments to create sounds.
3. Show students the note cards then place them in a repeating order using only the two notes. (Have about 12 of each cards).
4. Have students clap the pattern and continue clapping. Continue making different patterns with the two music notes and have students clap the rhythm.
5. Use the cards and create a pattern and allow students to copy your pattern using similar cards.

Closure: Allow students time to complete journal writing and share their feelings.

Day 5: Extending Patterns

Vocabulary

Math Concept: Pattern

Music Concept: rhythm pattern

ELA Concept: Syllables





Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Music Standard: 2,6,8

Objective: Students will create and experiment with rhythm patterns.
Students will predict what comes next in a musical pattern?

Materials Chart paper, markers, musical instruments, music note cards

Procedures

1. Explain to students that a rhythm is the patterns of a word. It is also the syllables of a word. Give some examples clap out a few words that have two syllables. (apple, berries).
2. Have the students count how many syllables are in the words that you clap. Show them the music sign for the two syllable words.  Tell them when they clap that note to say mango
3. Clap a one syllable word as you say it. Ask the students how many syllables they hear? Show them the music note for the one syllable words.  Tell them when they clap that note to say blue. (If you have instruments, use them to make the sounds)
4. Review the notes on the chart paper and have the students clap them as you point to them. Write a simple A-B-A pattern on the board and have the students clap it as you point to it. Write a variations starting with  and one starting with 
5. Go back and look at the patterns. Have students tell you what will come next.

Closure Have students write in their journal.

Day 6: Extending Patterns

Vocabulary

Math Concept: Pattern

Music Concept: steady beat, no steady beat

Math Standard: 1A1, 1 CM 3, 1 CNI, 1 CN 4, 1 CN 9, 1R2

Music Standard: 2,6,8

Objective: Students will continue more difficult patterns by adding the next pieces.

Materials musical instruments, music note cards

Procedures

1. Create a pattern with the musical cards and have students clap it out as a review.
2. Hand out the instruments and have students copy the pattern that you create. Then have students play the note card patterns with their instruments.
3. Inform students that they will play a game of what comes next by continuing the song that is you play on your instrument. They must first listen to your song and take over where you have left off. (Start with a simple beat and progress to more difficult patterns)
4. Have students take turns playing and continuing each other's beat.

Closure: Students complete a journal page about what they have learned.

Day 7: Making/ Creating Patterns

Vocabulary

Math Concept: Pattern

Music Concept: steady beat, no steady beat

Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Music Standard: 2,5,6,8

Objective: Students will create simple patterns with help.

Materials Pattern strips, markers, musical instruments, tiles, music note cards.

Procedures

1. Play a simple pattern on one of the instruments and have the students describe the pattern.
2. Give the students a piece of the pattern strip paper and allow them to draw the pattern using different color crayon when the beat changes. (For example, blue for ♪ and red for ♪♪). Students can also use the cards to show the pattern.
3. Tell the students now they have to think of a pattern that they would like to make using the instruments. But before they can play it, they have to record it on paper first. They could use the note cards, or pattern strips to show their beat. Help the students get a pattern.
4. Take turns and play each of the students' patterns to see if it repeats. Encourage discussions on why it is a pattern. Also discuss similarities and differences with the other patterns.

Closure: Allow students to write in their journal.

Day 8: Making/Creating Patterns

Vocabulary

Math Concept: Pattern

Music Concept: steady beat, no steady beat

Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Music Standard: 2,5,6,8

Objective: Students will individually create and explain their patterns.

Materials Pattern strips, markers, musical instruments, tiles

Procedures

1. Inform students that they will create a pattern by using the tiles, music instruments, and strips of paper to record their pattern. Review the definition of a pattern and a beat and remind students that patterns repeat and a beat is steady.
2. Pass out the materials and allow students to creatively compose a beat with the instruments, show it with the tiles than record it on the paper.
3. Allow students an opportunity to present their beat to their group members and discuss the similarities in the beats and differences from theirs.

Closure: Allow students an opportunity to write in their journal.

Day 9: Analyzing Patterns

Vocabulary

Math Concept: Pattern

Music Concept: steady beat, no steady beat

Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Music Standard: 2,5,6,8

Objective: Students look at patterns with mistakes and replace the mistake with the correct piece

Materials: Musical instruments, patterns strips (with mistakes), music note cards.

Procedures

1. Tell students that they have to be good listeners and fix the mistakes in the sound that they are about to hear. Play a pattern with one mistake. (For example, red, blue, red, blue, red, blue, blue, blue) and ask the students what is wrong with the beat.
2. After a few more examples with students pointing out the mistakes, Have the students play the beat with the correct sound without telling you the mistake.
3. Use the music note cards and make a few patterns with mistakes and allow the students a chance to fix them.
4. Hand out previously made patterns strips with mistakes and have the students work together to point out the mistakes.

Closure: Allow students to complete their journal page.

Day 10: Post test/ Survey

Objective: Students will fill out the survey about math and complete the same pretest given at the beginning of the study.

Group B
Math Without Music

Lesson Plans

Group B

Day 1: Pretest

Objective- The pretest will determine the students' understanding of patterns and provide adequate information about students' knowledge of the subject.

Day 2: What is a Pattern?

Vocabulary

Math Concept: Pattern

Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Objective: Students will learn the definitions of a pattern by observing different patterns.

Materials: Tiles, worksheet with patterns

Procedures

1. Ask the students if they know what a pattern is. Listen to a few suggestions then tell them that a pattern is anything that repeats. Then give them some examples like the seasons, days of the week.
2. Ask the students if they notice any patterns around the classroom. (They might notice a shirt with stripes, or a bulletin board pattern.)
3. Using the tiles (manipulatives) create a pattern and ask the students to describe the pattern. What is repeating?
4. Continue creating patterns until the students understand. Then give them a worksheet with patterns and have the students circle the ones that repeat and leave out the patterns that don't repeat.
5. Give students time to work on the worksheet then go over the patterns. Allow the students to describe the patterns.

Closure: Explain the journal process to the students and have them write a page about what they learned today.

Day 3: What is a Pattern?

Vocabulary

Math Concept: Pattern

Math Standard: 1A1, 1 CM 3, 1 CN1, 1 CN 4, 1 CN 9, 1R2

Objective: Students will review the definitions of a pattern and differentiate between patterns and non patterns.

Materials: Tiles, worksheet with patterns

Procedures:

1. Ask the students if they remember what a pattern is. Go over the definition then ask for examples of patterns.
2. After hearing the examples, arrange some tiles into a pattern and ask them if it is a pattern and why. Then arrange the tiles into a non-repeating order and ask if that was a pattern and why. Do a few more examples until you feel that the students are able to work on their own.
3. Explain that they will now work on a worksheet to circle the patterns that repeat and cross out the shapes that do not repeat.

Closure: Allow students to write in their journal about what they learned about patterns. They can also draw a pattern.

Day 4: Reproducing Patterns

Vocabulary

Math Concept: Pattern

Math Standard: 1A1, 1 CM 3, 1 CN 9, 1R2

Objective: Students will look at different patterns and replicate them

Materials: Tiles, worksheet with patterns, crayons

Procedures:

1. Inform students that they will play a game with the tiles and making pattern. Let them know that you will create a pattern and they have to make the same pattern as you have made.
2. Start out with a simple A-B-A-B pattern using only two different color tiles. Then continue creating more difficult patterns.
3. Allow the students to work with a partner to create/ copy patterns.
4. When you have observed that students have some understanding of how to replicate the patterns, show the students the worksheet and explain to them that they have to copy the patterns on the worksheet using crayons.

Closure: Allow students to complete a page in their journal.

Day 5: Extending Patterns

Vocabulary

Math Concept: Pattern, repetition, what comes next.

Math Standard:

Objective: Students will study simple patterns and guess what comes next. .

Materials: Tiles for each student, worksheet with patterns, crayons

Procedures:

1. Review with students that patterns always repeat. Remind them of some of the examples such as days of the week, or seasons and ask them if it were Sunday, what day would come next? Continue to ask them questions about those repetitions.
2. Pass out the tiles and tell the students that they will play a game called what comes next just like the examples. Create a pattern using 2 different colored blocks and ask the students to take out the tile that would come next if you were to continue your pattern. Do a few more examples.
3. Explain to students that they will work on a worksheet similar to the game. They will use crayons to complete the pattern.

Closure: Allow students to write or draw in their journal.

Day 6: Extending Patterns

Vocabulary

Math Concept: Pattern

Math Standard: 1A1, 1 CM 3, 1 CN 9, 1R2

Objective: Students will continue more difficult patterns by adding the next pieces.

Materials: Tiles, worksheet with patterns, crayons

Procedures:

1. Pass out the bag of tiles and tell students that they will play the game "what comes next."
2. Start by making patterns and having students predict the next tile. Do a few examples as a review.
3. Let students know that now they have to continue the pattern by adding 3 more pieces to the pattern. Do a few examples. Then have students take turns to add more pieces to continue the pattern.
4. After a few examples, pass out the worksheet and let students know that they have to predict what comes next by coloring the next few tiles

Closure: Allow students to write or draw in their journal.

Day 7: Making/Creating Patterns

Vocabulary

Math Concept: Pattern

Math Standard: 1A1, 1 CM 3, 1 CN 9, 1 R 1, 1 R 2

Objective: Students will create simple patterns with help.

Materials: Tiles, worksheet with patterns, crayons

Procedures

1. Review the definition of a pattern then explain to students that they will have to create a pattern using the tiles. Pass out the bag of tiles and allow them to create different patterns. (Encourage students to use more than two colors.)
2. Allow students about 10 minutes to work with the tiles then pass out the worksheet. Explain that students will use the blank tiles on the worksheet and crayons to create some patterns. Encourage them to use more than two colors
3. When students are done working, allow them time to share their pattern with a partner.

Closure: Students should complete a page in their journal

Day 8: Making/Creating Patterns

Vocabulary

Math Concept: Pattern

Math Standard: 1A1, 1 CM 3, 1 CN 9, 1R2

Objective: Students will individually create and explain their patterns.

Materials: Tiles, worksheet with patterns, crayons

Procedures:

1. Review yesterday's activities and the different patterns that they created. Allow students to share and explain their own patterns. Ask questions like "Did anyone use three colors?" or "Did anyone do the same pattern as someone else?"
2. Give the students the tiles and have them create patterns by giving them different criteria such as "Create a pattern using red, blue, and green" or "create a pattern using a color two times." Allow students some time to work and really understand
3. Have students clean up the tiles and work on the worksheet similar to the previous activity where they have to create a pattern according to the given criteria.

Closure: Allow students to write or draw in their journal.

Day 9: Analyzing Patterns

Vocabulary

Math Concept: Pattern

Math Standard: 1A1, 1 CM 3, 1 CN 9, 1R2

Objective: Students look at patterns with mistakes and replace the mistake with the correct piece.

Materials: Tiles, worksheet with patterns, crayons

Procedures

1. Inform the students that they will investigate different patterns with mistakes, figure out the mistake, and replace it with the correct tile.
2. Create a simple pattern with just one mistake. Ask the students if they can tell you what is wrong. Continue with more examples with each one getting more challenging.
3. Have the students complete the worksheet similar to the activity. Students are to put an X on the mistake and pick out the correct shape to replace it.

Closure: Students fill out a page in their journal

Day 10: Post test/ Survey

Objective: Students will fill out the survey about math and complete the same pretest given at the beginning of the study.

Appendix D:
New York State Standards for Learning Mathematics
NYS Board of Regents, 2005

New York State Standards: Mathematics K-6

Algebra Strand

1A1 Students will determine and discuss patterns in arithmetic (what comes next in a repeating pattern, using numbers or objects)

Communication Strand

1CM 3 Students will share mathematical ideas through the manipulation of objects, drawings, pictures, charts, and symbols in both written and verbal explanations.

Connections Strand

1CN 1 Students will recognize the connections of patterns in their everyday experiences to mathematical ideas.

1 CN 4 Students will understand how models of situations involving objects, pictures, and symbols relate to mathematical ideas.

1CN 9 Students will recognize and apply mathematics to objects, pictures, and symbols.

Representation Strand

1 R 1 Students will use multiple representations including verbal and written language, acting out or modeling a situation, drawings, and/or symbols as representations.

1 R 2 Students will share mental images of mathematical ideas and understandings.

New York State Learning Standard for Mathematics
Revised by NYS Board of Regents March, 2005

Appendix E:

National Standards for the Arts (Music)

MENC, 2007

Silver Burdett, 2005

National Standards for the Arts Education (Music)

Content Standard 1 - Singing, alone or with others, a varied repertoire of music.

Content Standard 2 – Performing on instruments, alone and with others, a varied repertoire of music

Content Standard 3 – Improvising melodies, variations, and accompaniments

Content Standard 4 – Composing and arranging music within specific guidelines

Content Standard 5 – Reading and notating music

Content Standard 6 - Listening to, analyzing, and describing music

Content Standard 7 – Evaluating music and music performances

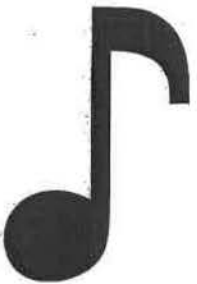
Content Standard 8 – Understanding relationships between music, the other arts, and discipline outside the arts

Content Standard 9 – Understanding music in relation to history and culture

*The National Association for Music Education

<http://www.menc.org/publication/books/standards.htm>

Appendix F
Music note cards



Appendix G

Pattern Strips

