Math is Music to My Ears

Caron D. Forman
Richard R. Wright School

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“How is it that for most people music is a powerful part of their personal life and yet when we go to work or school we turn it off?”

Chris Boyd Brewer, Music and Learning, 1995

Overview

In this paper I wish to research the effectiveness of music in the urban classroom and more specifically, the elementary math classroom. While using music in the classroom is not a novel idea, I want to discover the direct impact on my fifth grade math students to see if using music that is relevant to me and my students will indeed improve their retention of content and thus directly improve their grades and performance on standardized tests. This unit will look at the effectiveness of music in the classroom, music and mathematics and the influence of music on the African American student in urban areas.

My elementary school is located in North Philadelphia, which is a high poverty section of the city. It is also a Title I school which means since a high number of our students come from low-income families, the school receives federal funding. My students discover at a very early age that the odds are against them, culturally and economically.

This past school year my principal informed the upper grades, fourth and fifth, that we would be implementing block scheduling. This is very rarely seen at the elementary level. She assigned me the reading and social studies block and my grade partner math and science (we switched because what she assigned was the total opposite of our academic strengths!). Her reasoning for the change was to give our students the “middle school experience” of changing classrooms, changing teachers, becoming more responsible for their belongings, etc. so that they would be better prepared when they begin middle school next year. Another reason she wanted this transition was to prove a
theory of her own that if the students had a dedicated block of content, as opposed to one teacher trying to cover all the curriculum in a school day, scores would improve.

I was very excited to take on this new challenge of teaching only math and science, who doesn’t love math? I wanted to infuse music into my math lessons but with becoming the new math lead and receiving a new math curriculum, I found it very difficult to implement this year.

The concept of using math in the classroom is not new, but when taking elementary education classes during my undergraduate years, and even on the graduate level, I do not recall the use of music in the classroom being suggested as a tool or staple of the classroom. I think it is a concept that most teachers fall into or stumble upon instead of it being a part of their curriculum from the beginning. Gardner includes music as one of his multiple intelligence methods of learning yet it is never mentioned in professional developments as a way to reach some of our students. In short, some students respond to musical sound and educators need to tap more into this as a way of differentiation. I believe this to be even more effective in an urban classroom setting because music is such a strong part of the African American culture. Even earlier than Gardner’s research of 1983 was the work of Dr. Georgi Lozanov and Evelyna Gateva who researched ways to increase memory by using music in the classroom.

**Background**

To prepare for this unit, I will first research the use of music in the classroom. The question is not if it is effective but how effective is it? I will also research the use of music in the mathematics classroom and how the two seemingly different subjects go hand in hand. I will also research music and the African American child in the urban classroom. Usually when one hears about this subject, the use of hip-hop music comes to mind but I want to discover if certain genres of music are more or less effective. My research will also include Gardner’s theory of multiple intelligences, specifically musical-rhythmic.

**Rationale**

For years the School District of Philadelphia has been plagued with underachieving, low performing schools at all grade levels. This was very evident four years ago when 23 public schools were closed with more closings in the next two years. The schools were closed due to low performance and/or low enrollment. Many factors attribute to the closing of schools – socioeconomic status, the mushrooming of charter schools, limited resources, lack of funding, teacher shortage, and the list can go on and on. Yet against these prevailing odds, teachers are expected to deliver grade level lessons to below grade level students and to have these students perform on a proficient level.
I have been teaching fifth grade for a total of ten years, not consecutively, at Richard R. Wright, a low performing Philadelphia public elementary school. Every year I am faced with a classroom where more than half of the students are performing below basic. This year there are two fifth grade classes that were divided homogeneously by reading levels (one group is the high reading class – basic and above and the other group is the low reading class – below basic). Initially, I found the low reading group to be a little more proficient in math than the high reading class. I attributed this to the fact that usually a child is stronger in one content area than the other. As the year has progressed and the math content has become harder, the roles have now switched, the higher reading class is performing better than the lower reading class. I believe this to be because the content is now becoming more literacy based and also the harder the content, the higher the need for critical thinking skills. The most recent published School Progress Report (SPR) reports data from the 2015-2016 Pennsylvania System of School Assessment (PSSA). For the third, fourth and fifth graders that took the PSSA at Richard R. Wright, there were no students who scored advanced and only 7% scored proficient or advanced (this is out of 151 reported students, so approximately 10 students). Evidently and quite glaringly, there is a problem. My question is, will using music in the math class help my students improve their scores and ensure that those numbers don’t remain so somber?

Musical Intelligence

In 1983, Howard Gardner presented his theory of multiple intelligences in the book *Frames of Mind: The Theory of Multiple Intelligences*. He suggested that the traditional way of testing intelligence based on I.Q. testing was too limited and that people learn and solve problems in various ways. He proposed that there were at least eight different intellectual capacities to approach problems and create products. These capacities include linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, interpersonal, intrapersonal, and naturalist intelligences.

Developmental psychologists agree that musical talent is one of the earliest to emerge in the developing child. Gardner states that except for children whose parents create musical opportunities for them, there is no further musical development after the early school years (ex. nursery rhymes, lullabies). What is interesting is that music can be connected to all of the intelligences specified by Gardner. So why isn’t music used in the math classroom to enhance or support the other intelligences? The explanation to this could be that musical abilities are situated in the right hemisphere of the brain and logical/mathematical abilities are situated in the left hemisphere of the brain. On a biological level, the ability to understand mathematical concepts and relations entails right hemispheric activity, the same place where musical abilities lie. However, left-brain function is accessed when processing musical information, especially musical notation. For people who are “musically intelligent”, the brain must learn to negotiate the hemispheric functions with agility. But why not tap into both hemispheres?
Without going into too much detail about the different intelligences, the question I still ask is, if music can be connected with all of Gardner’s intelligences and students learn by utilizing one or more of these intelligences, why is music not incorporated more into the math classroom to tap into students who possess this intelligence? Or why is music not used more in the classroom after the early years of education?

Music in the Classroom

There have been several texts written about how music helps in the classroom in general. In reading Eugenia Papaioannou’s article about music in the classroom, she raves about how using music has enhanced her classroom. She notes that her students were in a better mood and that directly enhanced her mood as the educator. She then began to use music as a background when beginning a lesson. She noticed that this also enhanced the students’ positivity and helped build rapport between the class and her. Since the use of music so had such a positive influence in her class, Papaioannou added background music during tests and midterms. She noticed the soothing effect the music had on the students. Music released tension, facilitated memory, and helped the student concentrate for longer periods of time.


- establish a positive learning state
- create a desired atmosphere
- build a sense of anticipation
- energize learning activities
- change brain wave states
- focus concentration
- increase attention
- improve memory
- facilitate a multisensory learning experience
- release tension
- enhance imagination
- align groups
- develop rapport
- provide inspiration
- add an element of fun
- accentuate theme-oriented units”

He also believes that there are specific ways music can be used in the classroom. First, is learning information. Music can be used to help remember information and experiences. Music can increase interest and activates the information mentally,
physically, or emotionally. When music is coupled with information, these two elements will provide a hook for recall. According to Brewer, there are three ways music can be used in the classroom.

The first way is to use music to help learn information:

- Active learning experiences – music will engage students mentally, physically, and emotionally and create learning states, which enhance understanding of learning material.
- Focus and alpha state learning – music stabilizes mental, physical, and emotional rhythms to attain deep concentration and focus in which large amounts of information can be processed and learned.
- Memorization – songs, chants, poems, and raps will improve memory of facts and details.

The second way music can be used in the classroom is for attention, attitude, and atmosphere.

- Welcoming and attention – background music creates a welcoming atmosphere and helps get students motivated and prepared to learn. Music can refocus students by regaining their attention and can calm students.
- Community builders – music helps create a sense of community and cooperation. Music is very effective in helping in the understanding of other cultures and bonding.

The third way music can be used in the classroom is for personal expression.

- Creativity and reflection – music is used to stimulate internal processing, to facilitate creativity, and encourage personal reflection. It has been found that students will write much more with music than without.
- Personal expression through the musical intelligence – creating music expresses inner thoughts and feelings. Writing songs related to content allows students to express how they feel about the content.

Music and Mathematics

In most children’s lives, music plays an important role in experiences at home and at school. According to Geist & Geist (2008) and Southgate & Roscigno (2009), music activities and materials are excellent for promoting patterning and emergent mathematics. Music keeps children engaged in a mathematical activity for long periods of time. Because of this, positive attitudes are promoted towards math and mathematical concepts.
are constructed in a developmentally appropriate way for infants and toddlers. Edelson and Johnson (2003) found that music enriches the mathematical learning environment because the content is infused with activities that are fun, promote learning and allow the child to actively participate.

Whether students are infants or college age, learning mathematics should be kept natural and comfortable. In a study done at the Ohio University Child Development Center, children were interviewed about their math activities. Most of them commented on the activities that included music. The children also used music in some way to explain math concepts. Many times the children did not recognize the activity as mathematics. Although older students would of course recognize mathematical content, why can’t it still be taught with music in the math classroom with the same ease and flow of the preschool classroom?

Music and the African American Student in the Urban Classroom

Before studying the effects of hip hop in the mathematics classroom, I first need to research the effect of music on African American students. Like any other culture, music makes up a vast part of it but why is there such a huge and direct correlation between hip hop and the African American student and learning?

In the book *Hip-Hop and Mathematics: A Critical Review of Schooling Hip-Hop: Expanding Hip-Hop Based Education Across the Curriculum*, the authors delve into the critical consciousness of African American students in urban areas. It is essential to understand the culture and the consciousness of the student before attempting to relate content to them. When a concept is being implemented into the classroom, it must be relevant to the student or it will have no effect at all on overall learning.

In 2013, Emdin conducted the use of hip-hop in science education, an affiliate to mathematics. Emdin believes that first teachers need to realize that hip-hop is not merely a genre of music but a culture. From his findings he pushes for five main concepts (the 5 C’s) that teachers should use to engage hip hop based education (HHBE). These 5 C’s make up what he calls reality pedagogy. They include 1) cogenerative dialogues, 2) co-teaching, 3) cosmopolitanism, 4) context incorporation, and 5) content development. In short, he believes that students should 1) discuss content in a rap cypher manner, 2) become the teacher and prepare the lesson, 3) be responsible for each other, 4) incorporate context with the community and with hip hop, and 5) teachers admit to students that they do not know everything but share how to acquire new knowledge.

The book goes on to eventually dispute Emlin’s pedagogy stating that he does not address the critical consciousness of the student. “Without addressing critical consciousness, Emlin’s notion of using rap cyphers or rap battles as part of his reality pedagogy is not different from teachers who simply rap or use rap text or rap videos in
the classroom without any critical examination of rap music, the artist lifestyle, or the communities they rap about.” The dispute goes on further to state that sometimes educators are so focused on including rap in the classroom that they do not consider how the students identify with hip hop. In other words, educators, like musicians, must know their audience. Martin states that educators must assume responsibility for helping African American students to develop healthy racial, academic, and mathematics identities. He believes that these identities have played a major role in helping African American students achieve at high levels.

The authors of this review listed some important considerations before using HHBE in mathematics education suggesting that it be approached from five areas of caution. They believe that there is an agenda being pushed in mathematics education to conduct liberatory research. In an edited volume of Martin’s (2009) Mathematics Teaching, Learning and Liberation in the Lives of Black Children, he assembled mathematics teachers of African descent and others to provide African American children with a meaningful mathematics education to “change the direction of research on Black children and mathematics”. (p. vi) The authors believe that using rap in any form in mathematics classrooms without first examining rap music, the artist lifestyle, or the communities they rap about is anything but liberatory. The first consideration is where does providing African American students with a liberatory mathematics education fit into the current research being advanced in HHBE?

Second, the authors stated that the theories for HHBE in K-12 settings are under theorized. In other words, for most mathematics educators, using rap music or videos constitutes hip-hop pedagogy. The educators do not take into account the critical consciousness of their African American students. The second consideration is what are the key tenets of HHBE that should guide teachers in general and mathematics teachers in particular to achieve liberatory outcomes?

Third, according to Berry and McClain (2009), it is important for Black students to determine what it means to be a Black mathematics learner through racial and mathematics identity development. Thompson and Davis (2013) believe that there is a distinct difference between racial and cultural identity development among African American students in mathematics settings. These authors argue that racial identity development pertains to the ways social constructs of race shape African American students’ racial identity as opposed to cultural identity which pertains to African American students’ developing ethnic identities that connect them to their cultural heritage. With this theory in place, it is believed that sometimes African American students are developing hip-hop identities that do not parallel their cultural identity. In some circles of thinking, it is believed that mathematics educators have to determine how to address African American students’ development of hip hop identities because many of these educators are consciously and/or unconsciously fostering these ideas.
Fourth, there has been an advance in trying to understand how social construction of race, racism and other forms of oppression impact African American students’ mathematical experiences and realties. Martin believes that researchers, policymakers, and practitioners should examine how social constructions of race and racism affect the mathematics education landscape. I found this interesting because I thought to myself if mathematics is being delivered to the African American learner in a practical sense or is it being delivered in a way that the educator perceives the African American student would learn? The next consideration is where does HHBE stand on addressing social construction of race, racism and other forms of oppression that are prevalent in the lives, schooling and mathematics education of African American students?

Lastly, there has been a shift to focus on successful African American students. Some factors that contribute to this success are early opportunities, family support, teacher and peer support, extracurricular activities, and spiritual beliefs. There needs to be a focus on collective mathematics achievement opposed to focus on individual mathematics achievement. The last consideration is how does HHBE promote high achievement in African American students that can complement or advance efforts in mathematics education? The underlying verdict that the study of this book suggests is that HHBE should be used to teach African American students mathematics in urban schools.

As stated earlier in my paper, the use of hip-hop in the classroom is not new. In fact, it has sometimes been the topic of controversy asking if hip-hop should be used in the classroom because of its roots.

In an article by Jeffrey Hicks, he addresses the culture of hip-hop music. He cites it as being borne of poor, inner city life that glorifies stereotypes and stigmas of the lower class. He goes on to say that hip-hop promotes the fast life of gaining success and materialism. He sums up his article by stating that the hip-hop culture “deadens the drive toward civility and legitimizes backwardness.” Another article that I read posed the question, “Does Hip-Hop Really Belong in the Classroom?” While this author does not give a definitive answer to his question, he does present the point of hip-hop in the classroom empowering for students but also questions if teachers “keep it real”. By this he means, as stated before, are the teachers keeping the true essence of hip-hop music or merely using it as a fun way to connect with students.

On the other hand, I read some favorable articles regarding the use of hip-hop in the math classroom. There was an online article written several years ago where a math teacher in Los Angeles used hip-hop in his math class. The students responded favorably to the method. The teacher discovered that the students had no problem memorizing the rap and in turn, memorizing the concepts. The raps were even extended into videos.
With the many books and articles written about how the use of music in the classroom has a positive effect on the learner, I do not think one can argue if it is useful or not. It has been scientifically, psychologically, and physiologically proven to be true. The argument lies in the specific use of hip-hop music in the classroom. You have those that will argue that hip-hop should be kept in its true form while being used and you have those who think that hip-hop can be used as a tool that is relevant and relatable to those students in the urban classroom.

Objectives

This unit is intended for students in upper elementary grades but can easily be adapted for lower grades. The students spend approximately 2 hours a day in math and an hour and a half in literacy. The number of days a week may vary depending upon the science curriculum but it usually averages 3-4 days a week.

The objectives of the unit include:

- examining the effects of music in the classroom
- examining the effects of music and mathematics
- examining music and the African American child in the urban classroom
- exploring studies previously done on music in the classroom
- researching Gardner’s multiple intelligence of music
- encouraging educators to use music as differentiation in the classroom

Strategies

This unit will include using books, articles and websites that will provide grade appropriate information about music in the classroom. Music will be used during lessons as backdrop, during active learning and also during reflection of content. Students will ultimately be able to create their own musical method to aid in understanding and applying content. Students will also be able to discuss if and how music has helped them with math and with overall creativity.

- Whole group activity – Students will participate in the activities in whole groups

- Independent activity – Students will be given opportunities to create raps by themselves whether in class or for homework. Individual activities can also include researching songs or raps during technology.

- Presentations – In some cases, students will present their versions of the content in rap or beat form.
- Writing – Students will have opportunities to write original raps or songs for the given content.

Each student will be able to:

- compose an original song, rhyme, rap, etc. about a specific mathematical concept
- use an existing piece of music and apply it to a mathematical concept
- apply the use of music to another area of content
- use a rhythmic beat or clapping to remember specific math content

Standards

The fifth grade math standards of the School District of Philadelphia are developed according to the Common Core State Standards.

“In grade 5, instructional time should focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole numbers and decimal operations; and (3) understanding of volume.”

The overview of the 5th grade math standards are very content specific and the purpose of my research is not to hone in on just one standard (for example, students will improve in their understanding of place value system) but it will be comprehensive effecting the application of all mathematical content for this grade.

- CC.2.1.5.B.1.
  - Apply place-value concepts to show an understanding of operations and rounding as they pertain to whole numbers and decimals.

- CC.2.1.5.B.2.
  - Extend an understanding of operations with whole numbers to perform operations including decimals.

- CC.2.1.5.C.1.
  - Use the understanding of equivalency to add and subtract fractions.
• CC.2.1.5.C.2
  o Apply and extend previous understandings of multiplications and division to multiply and divide fractions.

• CC.2.2.5.A.1
  o Interpret and evaluate numerical expressions using order of operations.

Annotated Bibliography/Works Cited/Resources

Teacher Resources:
Aleskajitani.com/the-rappin-mathematician/.
  This is a website where “the rappin’ mathematician” raps about different math concepts. He has CD’s for purchase; there are also samples of some rap songs.
  School District of Philadelphia website used for data and standards.
  The author suggests activities that can be used in the classroom to teach or reinforce mathematical and/or musical skills.

Reading List:
  The texts talks about how children develop mentally by using their musical intelligence.
  A review of the book of the above title. The authors discuss how the use of hip-hop should be integrated in the science and mathematics classroom.
  Used for citation.
This article suggests seven ways how music can be used in the classroom. It also details some suggestions of some specific songs to play for different types of effects in the classroom, for example, welcoming music, reflection music, memorizing words, etc.


This article poses the question if hip-hop belongs in the classroom.

Activities

1) Lesson - Fractions, Multiples, Beats, and Measures (adapted for a math classroom)

Students are more likely to grasp key math concepts if several concrete examples of different types are given. Music is one area that can provide interesting, explorable, concrete examples of mathematical ideas. There are many strong relationships between math and music.

Goals – students will be able to successfully cite math facts.

Grade level – Grade 3 or students focusing on basic multiplication and fractions concepts.

Student prerequisites – Students should have studied or should be studying the basic concepts underlying fractions, multiplication, and/or division.

Teacher expertise- Teacher training in music education is not necessary to do this activity. The teacher should be familiar and comfortable with the terms and concepts regarding beats and measures and must be able to identify and count beats and measures when listening to music.

Time requirements – One class period (approximately 45 minutes) to do both the regular and extension activity, and 10-30 minutes (depending on the number of musical examples used) to do the basic activity only.

Objective- While listening to music, the students will clap on the beat. As a group, the students will identify the strong and weak beats and use a different clap for each. For a given musical example, students will count the number of beats and the number of strong beats. The students will then construct true multiplication, division, and/or fraction statements. Students will be able to say a multiplication, division or fraction problem to the beat of the music.

Evaluation – Assess students on ability to write or say correct math statements based on the musical examples.

Materials and Preparation – Decide on at least two songs to use, songs with a strong, easy to feel beat and with beats that are obviously stronger or weaker are best. Try to pick songs that have a different rhythmic feel, fast song, slow song.

Procedure –
1. Sing or play a verse or refrain of the song together. Have the students clap along to the beat.
2. Repeat the song. This time ask them to clap louder on the stronger beats and more softly on the other beats.
3. Once students seem to have the beat, they will recite multiplication, division or fraction problems. There are plenty of variations to this method. The teacher can require students say the multiples of 4 or problems that only equal even or odd numbers. Students can say their own problems as long as they are correct.
4. Students can challenge each other if they believe someone has said an incorrect statement.
5. This method can be used as a drill or as a game where students are eliminated if they say an incorrect statement until there is a winner.
Faster songs can be used as a challenge. Also, a student can be chosen (perhaps the winner of a round) to pick the song to play the next round to (of course, the song is already pre-approved by the teacher).

2) Create your own math rap or song – Students will be allowed to pick a beat (either make their own or use a pre-approved recorded song) and write their own rap or song about a math concept. Students will be asked to write original rhymes and present them to the class.

3) Use a rap song to kinesthetically present a math concept – Students will physically present a math concept to either their own rap or to a pre-approved song. Students will have to use bodily motions to reinforce a mathematic concept.

Other suggested activities

- Use music for focus and concentration – any type of calm and soothing music can be used for this activity. I would use this when students are working as a whole group, most likely after teaching a new concept or while doing classwork. Using classical music can help in increasing concentration, focusing, and creating a calm environment.

- Use music for creativity and reflection – classical music can be used when students are problem solving either in groups or independently. Classical music would also be great at the end of the lesson when students are asked to reflect on what they have learned.
• Use music for setting the classroom atmosphere – various kinds of music can be used depending on what tone is to be set. Music can range from classical to rock. Students will most likely respond to the music and prepare themselves for the lesson of the day.

• Use music for transition – music can be used as a “brain break” or to transition to another part of the lesson. Music can be used to inject fun and creativity into a lesson. Students can be asked to rap or dance their way into the next activity or part of the day.