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Bebop to hiphop: Music creation for science content retention

Christopher Claud MarkerMorse

BEBOP TO HIP-HOP: MUSIC CREATION

FOR SCIENCE CONTENT RETENTION

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education:

Instructional Technology

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Approved by:

[redacted]

Dr. Eun-Ok Baek, First Reader

7/20/10

Date

[redacted]

Dr. Brian Newberry, Second Reader

ABSTRACT

Songs embody our history, values, and cultural identity. Music instruction is required of all students in other nations, including Japan, Hungary, and the Netherlands, and students in these countries boast some of the highest mathematics and science test scores in the world. Be-Bop to Hip-Hop; Kids Creating Music For Content Learning, incorporates music creation into the conclusion of science units, with students summarize their learning through music, which research shows will cause better long-term content retention of scientific knowledge. Students, in groups, wrote lyrics, created their own song using GarageBand (a music-creation, looping software program) and record their voices singing or rapping their lyrics over their newly arranged tune. Data from analyzing pre, post and post/post tests revealed a significant difference in retention rates in the groups of students who used music to solidify their learning.

ACKNOWLEDGMENTS

Nothing of value is every created in a vacuum; I have had so much inspiration and support in creating this project. I would like to thank Dr. Walter Gershon from Kent State for his ground-breaking research that launched me on my way in this study. In addition, I would like to thank Dr. Brian Newberry and Dr. Eun-Ok Baek from California State University, San Bernardino, who both worked patiently with me. Next, I must acknowledge my fellow teachers who teach with me, and made this research design work; Sonya Justice and Longi Burroughs. Finally, I thank and acknowledge my students, past and present, who inspire me daily.

DEDICATION

I dedicated this project to Betty Morse, who taught me how to be a college student, to my amazing and encouraging wife, Deana MarkerMorse, and to my children, Addison, Siena and Avery. All of you continue to create a world where my best ideas and passions can flourish. I love you.

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CHAPTER ONE

BACKGROUND

Introduction

According to Turner (2008), "songs embody our history, values, and cultural identity" (p. 14). He noted that "Walt Whitman, whose poems use more than two hundred different musical terms, could 'hear American singing' in 1855" (p. 14). Turner further stated, "I believe that all of us today, young and old, can hear America singing, except that now we listen to the whole world" (Turner 2008, p. 14). It is with music, with its power and visceral nature, always touching both the intellect as well as the sub-conscious that allows us to share common musical heritage as well as explore and appreciate new musical collaborations, and allows us to "hear America singing" (Turner, 2008, p. 14).

Statement of the Problem

Students push through their learning, and many teachers push through their teaching, with attention to only immediate retention of knowledge. Yet, students are tested, teachers are evaluated, and schools are compared by their annual state-wide testing results, tests that require students to retain knowledge and skills for months, and sometimes years, at a time. Mark Levy (2009) pointed out that research, such as the TIMSS results, already shows that American science students are stretched too thin. State standards push the pace and scope to such an extreme that important, fundamental topics are given only abbreviated attention. Some tests cover years worth of material; science in California is only tested in 5^{th} and 8^{th} grades, a span of three years! Science material covered in 6^{th} grade curriculum will be tested a full 2 years later, with judgments made on teaching, learning and school environment based on these tests. As educators, we must examine and develop ways of extending the retention of content, as well as improving the engagement of students in the use of new content, so that their knowledge can be kept and recovered for longer and longer periods of time.

As curricular demands for more and more reading, writing and math instruction have been forcing out other curricular concerns, the visual and performing arts standards have often been ignored. Integrating and utilizing the power of Visual and Performing Arts (VAPA) content to assist in the delivery of base content becomes clear as educators examine the loss of time and resources to teach VAPA standards. Curricular integration of VAPA standards and regular content instruction, therefore, seems necessary, to meet both state and national expectations for arts instruction, as well as tying together the power of the arts for content instruction.

Purpose of the Project

The purpose of the project is to develop a way of combining VAPA instructional standards and methods, instructional technology, and science instruction to maximize science content retention through song creation.

Research Questions

The following questions will be answered in this study; can retention of science content be extended and enhanced by the use of music creation? Can students hold onto knowledge longer by writing, producing and recording songs about that content?

Significance of the Project

There are many curricular standards that are given short shrift in today's educational atmosphere, which concentrates on reading, writing, and math. The two subjects that seem to get the least curricular time and attention are science and visual and performing arts. This project allowed students to obtain science content, and use visual and performing arts. The project *Bebop to*

Hip-Hop-Music Creation for Science Content Retention was able to complete different educational goals at once;

1. Students using technology to create music that has value to the student, and engages the student in both the activity of creating music, and the reformulation of content into lyrics, musical thought and song.
2. Content knowledge in another discipline other than music (in this case, science) is extended and retained for longer periods as students use computerized music looping and song creation software to create music that expresses that knowledge.
3. Music creation could later be adopted by interested teachers as an adjunct to their instruction, or as a teaching strategy to improve retention of content knowledge.

Limitations

The primary limitation in this project was time- time for the students to learn the technology, use the technology to create their songs, and time for them to complete the lyrics, songs, and their recordings. Time for such things as art, music and, in fact, science instruction, is extremely limited in today's elementary classroom, where curricular time is pressed on one side by dense math standards, and on the other side with literacy and English language demands. According to Frank Smith (2009) the pressure to reduce classroom instructional time in the arts, as well as any other subject that is not math or language arts, is real and quantifiable. Smith (2009) goes on to state that Arts education, in fact, has been in decline for more than 30 years, as mandates from districts and states crowd out the arts, combined with a public perception that the arts are not essential.

The secondary limitation was the teacher's ability to organize the limited computer hardware to meet the needs of the 85+ students who used the equipment to create music, as well as the timing of the lessons in the school year; the last lesson was completed with less than 6 weeks left in the year, and so the distance in time between post and post/post assessment was not as great as it could have been.

Definition of Terms

The following terms are defined as they apply to the project.

Visual and Performing Arts (VAPA) - Dance, music, theatre, and the visual arts as content instruction in K-12 schools.

Content Retention - Student's ability to remember significant learning from subject matter taught.

Looping Software - *Software* that uses pieces of digitally recorded music. These pieces of music, or "loops", can be arranged into different sequences, keys, rhythms, and sounds.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

Be-Bop to Hip-Hop- Kids Creating Music To Solidify Content Learning, the investigation into whether having students write songs at the end of science units to summarize their learning causes better long-term content retention, uses the arts, and music creation specifically, as a pedagogical method to improve instruction. Processes and ideas found in the literature to strengthen and solidify the theoretical underpinnings of the project are many. In examining the literature on content learning and the arts, four distinct forms of investigation immerged: Musical intelligence, utilizing the senses in teaching and learning, using music and the arts in the content areas and models for using music to teach content.

Gardner and Musical Intelligences

Howard Gardner (1983, 1993, 1995, 1996, and 2000) who infused the idea of multiple intelligences into the pedagogical and theoretical underpinnings of education wrote extensively on creativity and children's learning. He identified several types of intelligences, many of which supported and infused creativity and the arts.

Gardner did not see intelligence as either set from birth, nor as a gift from nature. He believed, and demonstrated in his research, that educators could expand and build upon student's "talents" by focusing instruction on improvement of these various intelligences.

To move away from the reoccurring discourse of intelligence as it was described in logical and verbal/linguistic forms, as was the norm of the time, Gardner and his coauthors worked to identify many different types of intelligences that fell into different skills and subsets of skills. Hatch & Gardner (1996, p. 11) included:

- Linguistic Intelligence
- Musical Intelligence
- Logical Intelligence
- Spatial Intelligence
- Bodily-Kinesthetic Intelligence
- Interpersonal Intelligence
- Intrapersonal Intelligence

Gardner (1983) states that "of all the gifts which individuals may be endowed, none emerges earlier than musical talent" (p. 99). Gardner (1983) believed that musical intelligence was not directly linked to either linguistic or verbal intelligence, but is distinct and utterly unique. There is evidence that musical intelligence is linked with certain characteristics of logical-mathematical thinking.

Many in the education world once saw intelligence as static. Gardner remarked that in the past, many researchers, and educators assumed that intelligence was unchanged from birth, and could not be affected by outside forces (1993). Recently, however, this view has changed. Mills (2001) found that the musical intelligence theory gives evidence that learning music has equal cognitive demands when compared with brain activity in learning math, science, and language. With this knowledge, educators can see that musical intelligence can be both the instructional pathway and the purpose in instruction. Gardner (2000) supported the idea that attending to musical intelligence could be useful in the delivery of instruction in various disciplines.

It seems that tapping into student's natural musical intelligence may have the ability to transfer to other content areas such as science, and that to combine science instruction with musical composition, therefore, could lead to better mental retention of knowledge, as students access and utilize different intelligences in the learning of content. This utilization would bridge logical-mathematical, naturalistic and musical intelligences.

Sensuous Scholarship

Stoller (1997) examined the connection between the soul and the mind, working on the assumption that this metaphysical relationship was a vital key to a robust learning that would cause long-term retention, as well as a depth of understanding. Experiencing learning not only through sight, but through taste, scent, strong and vibrant moving visual images, song, or dance, the learner is lead to a rich, profound understanding of the content and context of the learning experience. "Sensuous Scholarship" is the deliberate engagement of the subconscious, through multisensory means, and an open, honest response to learning from both head and heart (Stoller, 1997). He argues that western culture suffers from its demand that there be a separation in mind and body. Only with an undeviating connection through sensuous learning, combining learning and the direct, explicit use of the senses, can we as a culture experience true memory. Stoller (1997) asserts:

> Sensuous scholarship is ultimately a mixing of head and heart. It is an opening of one's being to the world- a true welcoming. Such embodied hospitality is the secret of the great scholars, painters, poets, and filmmakers whose images and words resensualize us. (p. xviii)

The Arts in the Content Areas

In looking at the Arts and learning, Greene (2008) stated "imagination is required to disclose a different state of things, to open the windows of consciousness to what might be, what ought to be" (p. 18). Jacobs, Goldberg and Bennett (1999) remarked that "arts in elementary schools have often been separated from the core curriculum and instead, offered as enrichment activities that are considered beneficial but not essential" (p. 4). In Be-Bop to Hip-Hop- Music Creation for Science Content Retention, the supposition is that students will learn core content better with the use of music creation. This proposition is significantly dissimilar from the overwhelming public conception of how the arts are presented and used in the mainstream elementary classroom. In most, if not all, classrooms, music, if taught or used at all, is an adjunct to the core curriculum, not part of it.

Jacobs, Goldberg and Bennett (1999) made the following observation about Arts in the content areas:

> In addition to introducing students to the arts themselves, using the arts to teach content can demonstrate the power of the arts as a teaching strategy for a variety of scientific content. The arts can help students experience, and therefore more deeply understand concepts in science and other core curriculum areas. Whether used as an introduction or a review technique, the arts have the power to motivate and engage students, even those who are traditionally unable or unwilling to participate fully in school lessons. In short, teachers and students enjoy teaching (and students enjoy learning) through the arts and consequently, this approach can serve as an effective, although often overlooked, teaching strategy. (p. 10)

Goldberg (1997) draws a comparison by differentiating teaching "*about* the arts" (p. ix) with teaching "*through* the arts" (p. xi). In this way, educators utilize the power of the arts to foster interest in, and access to, new content. The power found in using the sensory components of music to teach core content, through the sense of sound, movement, rhythm, visual cues via computer, and tactile motion has been found repeatedly to improve not only content learning, but content retention.

New research and knowledge about how the brain operates suggests that a sensory approach to learning should be given greater emphasis in elementary classrooms. Jensen (2001) argues for greater inclusion of the arts-musical, visual, and kinesthetic-as a valuable teaching aid, noting, "the arts enhance the process of learning. The systems they nourish, which include our integrated sensory, attentional, cognitive, emotional and motor capacities are, in fact, the driving forces behind all other learning" (p. 2). To Jensen, it is not a matter of choosing, say, the musical arts over the kinesthetic. Rather, it is discovering what kind of art makes sense for what purposes, exploring how much time per day is necessary, and finding out what kind of music is best suited for each discipline. In answering these real-world questions, Jensen concludes, "the arts should not be a path only for the alternative learner or those who would otherwise fail..." (p. v) but, he suggests, that the use of the arts for instruction should be wide-spread throughout the curriculum and throughout the school day. This complete integration is supported by not only the most recent research into how our brains take in and retain knowledge, but also research that bolsters the idea that "cognitive systems are enhanced..." and "memory systems are activated through improved listening, attention, concentration and recall" (Jensen, 2001, p. 14).

There has been research to support the idea that having students simply listen to classical music will improve learning. In The Mozart Effect (Campbell, 1997), ties were made between this research and improved cognitive ability. The author suggested that listening to music alone, outside of any music instruction, may have cognitive and other benefits for students. Later researchers questioned whether having children simply listen to music can increase intelligence. Rauscher, Shaw, and Ky (1993) point to evidence that active involvement in music making, instead of passive listening alone, can have some remarkable intellectual effects. These researchers found that elementary students performed better on some math tests after musical training and instruction, married with computerized math puzzles.

<u>Example: Models for Using Music to Teach Content</u>

Rap music is both a boon and a worry for educators, with rap's perceived relationships with gangs, guns, drugs, and violence. Although this assumption about rap and the art forms around rap and hip-hop is obviously erroneous, it often stops educators from embracing this free-form and rhythmic style of poetry. Turner (2008) notes that "rapping can provide a good vehicle for carrying the content of a lesson" (p. 13). He found that that rap lyrics, with an easy to identity rhyming pattern, made it a natural fit for the stories found throughout history. In his writing, Turner commented that students who created raps about various historical subjects were able to have fun, and make a strong memory of the content of the written rap. Turner continued to list various activities that students can do with their raps, including summarization of a unit of study, retelling of a narrative from a historical event, and creating collections of the student's raps and having students practice performing them for the class (Turner, 2008).

<u>Example: Student Generated Lyrics to Known Songs</u>

As part of the Learning About The Solar System Through Music study, Jacobs, Goldberg, and Bennett (1999) had students develop lyrics to express their understandings of the workings of the solar systems, and the various objects found in it. They had their students work in small groups, developing lyrics, which the students would sing or chant to common children's songs.

The teachers allowed students to use their text book as reference material for the lyrics, and the lyrics intent was to demonstrate the student understanding of the content. The teacher would roam around the groups, asking the students to think about what their song would be teaching others about the content. These songs were used instructionally to give a chance for the students to provide analysis of their learning, and encourage higher levels of understanding.

Example: Students Using Music to Learn Fractions

Goral and Wiest (2007) created fraction lessons that were meant to be both developmentally appropriate and engaging. They had their students experience fractions via three different methods; poetry, movement and songs. Students recited "Fractions", a poem by Lee Bennett Hopkins (2001) to help generate vocabulary around fractions, and to engage students in the topic. Students then jumped around on number lines in wholes, halves, and fourths. Given rhythm sticks, students then learned "My Paddle", a Native American song written in 4/4. There were two groups of students. One group was the whole note group, another group were the half-note group, and they beat out rhythms in fractional parts to demonstrate physically and musically the relationship between half and whole. Student assessments shortly after this series of lesson demonstrated mastery of the fractional concepts presented by the entire class. Students interviewed months later still had retention of the main ideas of the lessons.

Example: Using Technology to Create Music

Hardy (2001) found that teachers at Buzz Aldrin Elementary School in Reston, Northern Virginia, were using technology to teach their students the basics of music theory. Teachers used a game with their second grade students, playing sounds on the classroom synthesizer and having the students guess which acoustic instruments from the classroom the synthesizer was mimicking. Then students took turns coming up to the synthesizer, selecting the settings that sounded good to them, while keeping a rhythmic tap to the beat of the machine. Students in the class used Musicshop, a music creation software program that allowed students to create their own sounds. Students had increased satisfaction with their music instruction, verses instruction with acoustic instruments only.

Music and Content Retention: The Next Steps

The data seems clear; the use of the arts to teach content is powerful, engaging, and innovative, and works to improve the retention of content knowledge. The power that music, dance and movement, and other fine and performing arts has on all of us as learners, and the effect it has on our ability to both enjoy and recall our learning, leads to the conclusion that the incorporation of music into instruction is essential. With the advent of technology tools that allow students to compose music, the marriage of music creation and core content knowledge, and the long-term learning effects of combining these educational forces, is now possible. Prior research has examined students as they create original music electronically, looked at teachers' use of music, movement and the arts to help students internalize basic core knowledge, and inspected lessons that had subjects write poetry and rap to express understanding of subject content. A next logical step in this transformative use of music to reinforce standards-based learning is to have students write lyrics and create songs using current and available computerized looping and recording software. Be-Bop to Hip-Hop- Kids Creating Music to Solidify Content Learning looks at the outcome of students designing their own musical expression of content learning in science, and the long-term effect it has on student's ability to remember and access this knowledge weeks after instruction.

CHAPTER THREE

METHODOLOGY

Introduction

Bebop to Hip-Hop- Music Creation for Science Content Retention intended to look at whether students, when given the opportunity and the tools to write music to express their learning, would retain content knowledge longer than students who had an alternative extension experience. Students were taught standards-based science content using the exact same structure, tools, and techniques. Science-based videos and graphics, common to the adopted science program, were used during the instructional phase of the project, and not during the treatment or control phase. Each group of students were then given an opportunity to further explore and refine their learning through Visual and Performing Arts (VAPA) content- Two groups were given a control activity, and the treatment group spent a single, one-hour session, where they were taught how to use looping software, and given the opportunity to write and record songs that expressed their learning. Pre and post tests were given to support changes in long-term retention of the science content.

Community and Site Description

The elementary school chosen for study is located in a school district in southern California. It is part of an Inland Empire school district, the fifteenth largest school district in the state, enrolling approximately 39,725 students K-12 at 43 schools, servicing a 92-square mile area. Located in a storied and historic district, the school is a traditional-calendar school built in 1915 on 8.5 acres. It serves 760 students, from pre-school to 6th grade, with an ethnic breakdown of 39% Caucasian, 44% Hispanic, 11% African-American, 5% Asian-American, and 1% "other". The school houses a Head-Start Preschool program, two Special Day classes, as well as a Resource Specialist program and Speech and Language Arts specialist. Approximately 200 of the students are bused from a largely Hispanic section of the city, 2.5 miles across town. The school is a Title-One school, with a poverty level, as defined by free and reduced lunches made available, of 58%. There are two administrators, a principal and an assistant principal and 34 certificated staff that round out the teaching core.

Student Sample

The sixth grade students, which were the population for this project, were heavily weighted towards boys. There were 88 sixth graders in total, with 49 boys and 39 girls. The sixth grade ethnic makeup mimicked the school at large- 40% Caucasian, 44% Hispanic, 11% African American and 5% Asian. Four of the students were in Special Day classroom, and attended the regular education classrooms for some part of their day. Each day, teachers switched the students so that the English Learners (22) could be given specific and specialized instruction, while the English Only/Fluent English Proficient students learned academic language of either science or social studies. Seven of the students received either a Resource Specialist Program or Speech services. The grade had 6 identified Gifted and Talented(GATE) students distributed in two classrooms. The sixth grade of the school had a higher incidence of poverty than the population as a whole- 69% of the grade were receiving free or reduced lunch.

Research Design and Protocol

Bebop to Hip-Hop- Music Creation for Science Content Retention intended to look at whether students, when given the opportunity and the tools to write music to express their learning, retained content knowledge longer than students who have an alternative extension experience. Students were taught standards-based science content using the exact same structure, tools, and techniques. Science-based videos and graphics, common to the adopted science program, were used during the instructional phase of the project, and not during the treatment or control phase.

Experimental Design

Experimental research is used to answer causal research questions: *Does something cause an effect?* For this project, the question was this: is there a mean difference between students' retention, as measured by differences in post and post/post tests, for students who receive art extension activities around a newly taught science concept and students who participate in song lyric writing and music creation with a focus on the same science content?

As much as possible, as in experimental design in educational research, this project followed some of the classic components of experimental design. The project utilized random assignment to the learning groups, control groups, treatment groups, pre-test, post-test and post-post testing.

Action Research

This project also shared many aspects of Action Research. After looking at many researchers' views on action research, Rock and Levin (2002) have found that "the action research process effectively promotes skills of inquiry, reflection, problem solving, and action" (p. 8). This project incorporates ideas and techniques from Action Research. Proponents of action research claim that it is not just for researchers, but helps to empower research participants to make changes in practice. As an Action Research project, the investigator both wished to bring about change in the school and curriculum delivery at that school and to research the outcomes of the change in the delivery of content, both goals of Action Research. Although Action Research often focuses in education on the "action" portion of the process, this project had research as the main focus of the project.

Research Design

Each group of students were given an opportunity to further explore and refine their learning through VAPA content- Two groups were given a control activity, and the treatment group spent a single, one-hour session, where they were taught how to use looping software, and given the opportunity to write and record songs that express their learning. Pre and post tests were given to support changes in long-term retention of the science content.

Data collected was focused on differences in pre and post test results, as well as post/post test data. Did students score better on the post test by creating music using looping software than students in the control groups who completed some other extension activity? Were the students better able to retain that knowledge when given a post/post test weeks later?

The project design insured that all students had the opportunity to participate in the creation of music to express their learning of science content. There were three rounds of lessons, with each round having all students participate in some form of hands-on learning of 6th grade standards-based science content. When the round of lessons was over, and all students had been given the same instruction in a specific area of content, an extension lesson was given. Students, who had already been randomly assigned to learning groups, were placed in one of three extension activities. Two groups became control groups, and participated in activities that allowed the students to "play" with the science concept taught. A third cadre of students was placed in the treatment group. The treatment was a single, one-hour session where the students had the opportunity to use the computer to create music, including composition and lyrics, related to the previously taught science topic. These students worked in cooperative groups writing song lyrics that expressed their understanding of the concept, and then they created music via computerized music looping software.

Table 1. Research Design- Arrangement of Instructional Groups, Treatment and Control Assignments, and Pre, Post and Post/Post Test

Groups	Topic 1 (Earthquake)			Topic2 (Wave)			Topic3 (Heat)			Post/ Post
R	O_1	I/C	O_2	O_1	I/X	O_2	O_1	I/C	O_2	O_3
R	O_1	I/X	O_2	O_1	I/C	O_2	O_1	I/C	O_2	O_3
R	O_1	I/C	O_2	O_1	I/C	O_2	O_1	I/X	O_2	O_3

R = Random Assignment of 32-35 students to groups.
O_1 = Pretest, O_2 = Posttest, O_3 = Post/Post
I = Instruction
X = Treatment (music creation after the instruction)
C = Control Group (no music creation, art project)

All students were given a post test to determine levels of knowledge retention based on score differences between their pre and post test outcomes. This lesson format repeated in 2 week cycles through three different science topics, insuring all students got to be part of the design group and have the opportunity to write and create music.

Instrument Development and Data Analysis

Students were given a multiple-question instrument, developed by the investigator, using questions developed from the five most reoccurring topics or concepts for each lesson. The simplicity of the instrument was required as time for each lesson was at a premium, and the administration of the instrument could be accomplished with little time taken from instruction. The same instrument was then used as a pre, post, and as the post-post assessment for the project. Although used for simplicity, using the same instrument for pre, post and post/post can effect improvement in scores simply by repeated exposure to the same instrument. A number code was applied in place of names to insure confidentiality of the information. Each instrument was graded, and scores were assigned to each instrument ranging from 0-5. As each assessment was completed, the data was analyzed using a means test.

CHAPTER FOUR

RESULTS AND DISCUSSION

Pre and Post Tests Differences

The pretest/posttest/post-post difference score for each subject in each group was computed to evaluate the research question: is there a mean difference between students' retention, as measured by differences in post and post/post tests, for students who receive art extension activities around a newly taught science concept and students who participate in song lyric writing and music creation with a focus on the same science content?

The pre-test data for the first series of lessons (Earthquakes and Plates) for the three groups was as follows: Group A 2.64/5.0, Group B (treatment group) 2.36/5.0 and Group C 2.39/5.0. This suggests that the students possessed some prior knowledge in the area of earthquakes and earth's plates, but they also had room for new knowledge. The change in scores in the post test was as follows: Group A 3.70/5.0, Group B (treatment group) 3.51/5.0 and Group C 3.35/5.0. Although the treatment group did show more growth and retention of the lesson than the control groups, there was not a very strong difference between the scores.

Table 2. Earthquake Lesson Series - Mean Test Results and Difference from Pre and Post Tests

Pre and Post Tests Earthquake Lesson Series	Pre-test Mean	Post-test Mean	Mean Difference
Group A	2.64	3.70	+1.06
Group B(t)	2.36	3.51	+1.15
Group C	2.39	3.35	+0.97

(t) = Treatment

The next set of lesson (Waves) provided a bigger difference in scores. The pre-test scores for this lesson are Group A (treatment group) 2.03/5.0, Group B 2.21/5.0 and Group C 2.50/5.0. The post-test data results were as follows: Group A (treatment group) 4.28/5.0, Group B 3.73/5.0 and Group C 3.32/5.0. The treatment group improved by an average of 2.25, while the other groups, who also saw growth, had significantly less improvement.

Table 3. Wave Lesson Series- Mean Test Results and Difference Pre and Post Tests

Pre and Post Tests			
Wave Lesson Group	Pre-test Mean	Post-test Mean	Mean Difference
Group A(t)	2.03	4.28	+2.25
Group B	2.21	3.73	+1.52
Group C	2.50	3.32	+0.82

(t) = Treatment

The final lesson series (Heat) also demonstrated more growth in the treatment group than either of the control groups. The issue with Group A and their disparate scores is that once the test was given and then the lesson taught, it was found that the pre-test did not accurately cover the information that was presented. For the following two sessions, a different pre-test that more accurately covered the subject was used. Care was taken to ensure to use the same poorly designed test for Group A in their post-test, which also explains their dramatic difference in scores from the other groups on the post-test. The difference in pre and post test was within the same range as the differences in the other groups, thus, the scores were included in this data set.

The pre-test scores had the following results: Group A .96/5, Group B 2.06/5 and Group C (treatment group) 2.04/5. The change in the treatment group vs. the change in the control groups was also significant in this lesson grouping.

Table 4. Heat Lesson Series - Mean Test Results and Difference from Pre and Post Tests

Pre and Post Tests			
Heat Lesson Groups	Pre-test Mean	Post-test Mean	Mean Difference
Group A	.96	2.21	+1.25
Group B	2.06	3.63	+1.57
Group C(t)	2.04	3.96	+1.92

(t) = Treatment

Although all groups showed improvement in their post-test scores (as would be expected after instruction), the students who wrote songs about the science content had higher post-test outcomes than the control groups. In the Heat lesson series, the control groups had an average growth of +1.41; the treatment group posted an average improvement of +1.92 points, a difference of +.51. The change in the Earthquake lesson series also demonstrated more growth by the treatment group, but not in such dramatic fashion. The control groups average change was +1.01, with the treatment group averaging a +1.15 point increase. This was a difference of +.14, a smaller variation in the changes between the groups. The greatest growth was in the treatment group after the Waves lesson series. The treatment group averaged a +2.25 point increase in their scores, while the control groups posted a combined average change in their scores of only +1.17.

Post Test and Post/Post Differences

As seen in Table 5, the post/post test for the Earthquake series did show loss of retention; however, the smallest decrease in score occurred in the treatment group, and that decrease was rather small.

Table 5. Earthquake Lesson Series - Mean Test Results and Difference from Post and Post/Post Tests

Earthquake Lesson Series	Pre-test Mean	Post-test Mean	Mean Difference
Group A	3.70	3.45	-0.25
Group B(t)	3.50	3.46	-0.04
Group C	3.35	3.25	-0.10

(t) = Treatment

In the Heat Series, for the treatment group, there was no difference at all from the post to the post/post test six weeks later, even though there was drop in scores in the both control groups.

Table 6. Heat Lesson Series - Mean Test Results and Difference from Post and Post/Post Tests

Heat Lesson Series	Pre-test Mean	Post-test Mean	Mean Difference
Group A	2.21	2.10	-0.10
Group B	3.63	3.40	-0.23
Group C(t)	3.96	3.96	+0.00

(t) = Treatment

In the Waves series, the smallest difference between post and post/post test results was in one of the control groups; the treatment group dropped their scores by a substantial margin. There were changes in the make-up of the group between post and post/post testing (students not in attendance, students who had moved away) and this may account for the stark disparity between tests. Also, the treatment group started with the largest post test score of any of the 9 groups.

Table 7. Waves Lesson Series - Mean Test Results and Difference from Post and Post/Post Tests

Waves Lesson Series	Pre-test Mean	Post-test Mean	Mean Difference
Group A(t)	4.28	3.28	-1.00
Group B	3.73	2.07	-1.66
Group C	3.32	3.00	-0.32

(t) = Treatment

Discussion of the Findings

After examining both the differences in Pre and Post, as well as the change within the post and post/post data, students were able to retain their science-content learning better short-term using the music creation vs. the control activities. There was a sharp increase in the number of students who were able to retain their knowledge in the waves group, especially. In the short term, the treatment groups all outpaced the control groups in their ability to recall information from the various science lessons. In long term memory, using the difference between the post/post scores were the best in two of the three treatment groups.

Summary

The data supports the use of music creation as an intervention to prolong content knowledge in children.

Short term post testing clearly showed that students who have created music around a concept retain that concept knowledge better than students who express their content knowledge through art. However, there was data to support the notion that music creation by students also effects longer-term retention of content- it is with these results that further expansion of a program of music creation to solidify content knowledge is justified.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

Introduction

The outcomes discovered in *Bebop to Hip-Hop-Music Creation for Science Content Retention* offer further support for the contention that music creation by students can improve learning in the content areas. As Jacobs, Goldberg, and Bennett (1999) found that music can be an effective teaching tool; this study verified that students who create music can improve their content learning in significant ways. Jensen (2001) noted that arts for instruction should be wide-spread throughout the curriculum, and this study gives further credence to his position. Students working together to create music that reflects their combined learning in a content subject improved their retention of that subject, a conclusion suggested by the research done by Jensen (2001), Campbell (1997), Turner (2008) and Jacobs, Goldberg and Bennett (1999). All of these researchers worked with students, learning and music, and all had positive results. In addition, this project allowed students to create their own lyrics to the songs, a practice found to be effective in Goral and Wiest's (2007) research into allowing students to create lyrics around math concepts. In addition, the results of this study support the belief that using computerized music creation software can be a creative way of combining Music standards and content standards. What was unique about *Bebop to Hip-Hop* was the novel approach of having students create music via looping software, as well as working together in groups to write lyrics and music. This combination seemed to be very powerful indeed.

There was enough differentiation in scores to warrant hope that designing time for students to create music to solidify learning could be a powerful technique for combining technology, VAPA standards, and content instruction. Further research, on a larger scale, would be warranted, and based on these results, would justify a school-wide pilot of such a program.

The main inhibitor to successful integration of music creation into the curricular day would be time. The initial time of one hour for the treatment group was just enough for the groups to write their lyrics, and come up with the basic tracks of their songs. The creative process is very difficult to confine to a specific time frame, and students found the time limit made it impossible to complete their songs. After the post test was given, students were allowed to come in the classroom and continue to work on their songs at lunch and at recess, but to this date, no groups has "finished" their song (although the researcher believes many of the songs are just fine the way they are now). Because the creation of the music portion of the lesson series was relatively unstructured, little control was possible over when, and in fact if, students completed their songs. This frustration with VAPA time is found in many classrooms throughout the nation as teachers struggle to include VAPA lessons into their regular school day.

It is truly exciting to see such reinforcing data to support the expectation that including music creation can improve learning in the content areas. With the literature review also supporting this contention, it is easy to rationalize keeping music creation as part of the instructional day, and the continuation of research into the area of incorporating Visual and Performing Arts into content lessons in support of content standards.

Conclusions

The conclusions extracted from the project follows.

1. *Students who create music and lyrics around an academic content will retain that content BETTER than peers who do not.*
2. *Students who create music and lyrics around an academic content will retain that content LONGER than peers who do not.*
3. *Infusing music creation into the academic instruction of students improves retention, AND successfully allows for integration of VAPA standards into the content areas.*
4. Common, available technology can be used productively to obtain these results- schools will not have to purchase new equipment, just inexpensive and readily-available looping software.

Recommendations

The recommendations resulting from the project are as follows.

1. This program should be expanded and incorporated into an entire school. Teachers would collaborate to pick 3 key content concepts for

music creation for the year, and students, working in collaborative pairs or teams, would create songs for these content concepts throughout the school year.

2. Song creation should be incorporated into existing elementary and middle school band programs.
3. Students could create lyrics and songs at home as extension or homework assignments.
4. Sharing of songs, via CD-pressings, internet-archiving and/or MP3 files, would allow other students to learn from their peers, and give an audience to the musical creation of the budding song stylists.
5. A more thorough data analysis of the differences in pre, post and post/post data sets, using, perhaps, an ANOVA to find statistically significant differences in the 9 groups and 3 tests seems warranted.

Summary

Using music to teach has been part of teaching since our earliest times; it is only in our "modern" educational system that such a powerful and obvious tool would be disused. The outcomes of this project offers tangible and serious support for re-incorporating music into the content instruction of elementary and middle school grades. With the power, flexibility and creative palate afforded by music looping software, teachers at long last can justify using scant curricular time to teach music- such instruction and instructional time can lead to long-term retention of the very content they are mandated to teach. The vision of students writing, discussing and singing songs of their own creation, extolling the knowledge they have obtained, is an empowering and exciting image to behold.

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL, CONSENT, AND ASSENT FORMS

CALIFORNIA STATE UNIVERSITY
SAN BERNARDINO

Academic Affairs
Research and Sponsored Programs • Institutional Review Board

May 15, 2009

CSUSB
INSTITUTIONAL
REVIEW BOARD
Full Board Review
IRB# 08100
Status
APPROVED

Mr. Chris MarkerMorse
c/o: Prof. Brian Newberry
Department of Science, Math and Technology
California State University
5500 University Parkway
San Bernardino, California 92407

Dear Mr. MarkerMorse:

Your application to use human subjects, titled "From Be-bop to Hip-Hop: Does Music Creation Cause Long-Term Retention of Content Knowledge" has been reviewed and approved by the Institutional Review Board (IRB). The attached informed consent document has been stamped and signed by the IRB chairperson. All subsequent copies used must be this officially approved version. A change in your informed consent (no matter how minor the change) requires resubmission of your protocol as amended. **Your application is approved for one year from May 15, 2009 through May 14, 2010. One month prior to the approval end date you need to file for a renewal if you have not completed your research. The protocol renewal form is on the IRB website. See additional requirements of your approval below.**

The CSUSB IRB has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval notice does not replace any departmental or additional approvals which may be required.

Your responsibilities as the researcher/investigator reporting to the IRB Committee include the following requirements. You are required to notify the IRB of the following: 1) **submit a protocol change form if any substantive changes (no matter how minor) are made in your research prospectus/protocol,** 2) **if any unanticipated/adverse events are experienced by subjects during your research,** and 3) **when your project has ended by emailing the IRB Coordinator.** Please note that the protocol change form and renewal form are located on the IRB website under the forms menu. Failure to notify the IRB of the above may result in disciplinary action. You are required to keep copies of the informed consent forms and data for at least three years.

If you have any questions regarding the IRB decision, please contact Michael Gillespie, IRB Compliance Coordinator. Mr. Michael Gillespie can be reached by phone at (909) 537-7588, by fax at (909) 537-7028, or by email at mgillesp@csusb.edu. Please include your application identification number (above) in all correspondence.

Best of luck with your research.

Sincerely,
Sharon Ward, Ph.D.

Sharon Ward, Ph.D., Chair
Institutional Review Board

SW/mg

cc: Prof. Brian Newberry, Department of Science, Math and Technology

909.537.7588 • fax: 909.537.7028 • http://irb.csusb.edu/

APPENDIX B

PRE-TEST, POST TEST AND POST-POST TEST RESULTS

Pretest Results

Earthquakes and Plates Group A	Earthquakes and Plates Group B(t)	Earthquakes and Plates Group C
3	3	3
2	5	4
1	1	3
2	3	4
2	1	2
2	3	1
2	3	3
1	2	4
3	2	2
4	5	3
4	1	2
2	1	2
3	1	3
3	1	2
3	1	3
3	1	2
4	2	3
3	4	1
2	4	0
3	3	1
3	3	3
3	2	4
2		3
2		2
0		1
2		2
4		2
5		2
1		
5		
3		
2.64516129	2.363636364	2.392857143

Waves Group A(t)	Waves Group B	Waves Group C
1	2	1
5	1	5
4	2	2
1	4	0
0	3	1
3	2	1
2	1	2
5	2	3
0	2	3
2	3	2
2	3	2
2	5	1
3	5	2
2	4	5
2	1	4
1	3	3
1	1	5
2	2	2
2	2	2
4	0	1
3	1	4
1	3	4
1	3	3
0	0	2
3	3	
3	1	
0	2	
0	1	
2		
2		
4		
2.032258065	2.214285714	2.5

Heat Group A	Heat Group B	Heat Group C(t)
0	2	1
0	1	3
0	0	1
1	2	2
2	3	4
2	3	0
2	3	1
2	3	2
1	2	2
0	2	3
3	3	2
0	1	4
2	1	3
0	3	2
0	3	1
2	1	2
0	1	1
0	3	0
1	3	4
0	1	4
0	1	1
0	1	2
2	2	2
2	0	
3	5	
0	2	
0	3	
2	2	
1	3	
1	2	
	2	
0.966666667	2.064516129	2.043478261

Post Test Results

Earthquake Lesson Post Test Group A	Earthquake Lesson Post Test Group B	Earthquake Lesson Post Test Group C
4	5	2
5	4	4
3	4	5
3	5	5
0	3	5
4	0	2
5	1	2
4	5	5
5	5	0
3	3	4
3	1	3
4	5	4
4	4	4
3	4	2
4	3	4
3	5	1
4	3	4
4	1	3
3	5	4
5	1	2
3	4	3
5	5	2
3	4	4
4	4	4
2	5	4
5	4	3
5	5	4
4	4	5
5	3	
2	4	
	0	
3.7	3.516129032	3.357142857

Waves Lesson Post Test Group A(t)	Waves Lesson Post Test Group B	Waves Lesson Post Test Group C
4	4	3
4	4	4
5	4	3
4	3	5
3	4	3
2	5	3
4	2	3
4	5	4
5	0	4
5	3	3
5	5	4
3	2	3
5	4	3
5	5	5
3	2	5
5	3	2
5	3	5
4	4	5
5	4	3
4	4	2
4	5	4
4	4	2
5	5	3
5	4	4
5	4	3
5	4	3
5	5	2
3	4	0
3	3	1
5	4	5
5		4
4		
4.28125	3.733333333	3.322580645

Heat Lesson Post Test Group A	Heat Lesson Post Test Group B	Heat Lesson Post Test Group C(t)
0	4	2
2	4	5
3	4	4
2	3	3
3	2	4
0	3	5
1	3	5
1	3	3
3	5	3
4	5	3
2	3	5
1	5	0
2	2	5
2	5	5
3	5	2
2	2	5
4	2	5
2	5	3
2	5	4
3	3	3
2	5	5
3	4	5
3	4	5
4	3	4
2	4	4
4	4	4
0	3	5
2	2	5
	5	
	2	
2.214285714	3.633333333	3.964285714

Post-Post Test Results

Earthquakes and Plates Group A Post/Post	Earthquakes and Plates Group B(t) Post/Post	Earthquakes and Plates Group C Post/Post
4	5	3
5	4	3
2	4	4
3	4	5
2	3	5
4	2	2
4	2	2
4	4	5
4	4	2
3	3	3
3	2	3
4	4	3
3	4	4
3	4	2
4	4	4
3	5	0
4	5	4
4	2	3
4	2	4
3	1	2
3	4	3
4	0	2
3	4	3
3	5	4
2	4	4
4	5	4
5	4	4
4	3	4
4	4	
3	3	
2		
3.451612903	3.466666667	3.25

Waves Group A(t) Post/Post	Waves Group B Post/Post	Waves Group C Post/Post
4	1	2
4	2	4
5	2	3
5	4	4
5	3	3
2	1	2
3	1	3
4	2	3
1	3	4
3	2	3
3	3	4
3	4	3
4	5	3
2	4	5
4	2	5
2	3	2
4	1	5
3	2	4
3	2	3
2	0	2
3	0	3
2	3	4
3	2	3
3	0	2
3	3	2
4	1	0
4	1	0
4	1	5
		3
		1
3.285714286	2.071428571	3

Heat Group A Post/Post	Heat Group B Post/Post	Heat Group C(t) Post/Post
0	4	2
2	4	5
2	3	5
2	3	2
3	2	4
0	3	5
1	3	5
1	4	3
3	5	2
3	4	3
2	3	5
1	4	1
2	2	5
2	5	4
2	5	2
2	2	5
4	2	5
2	5	3
2	5	4
3	3	3
2	4	5
3	4	5
3	3	5
3	3	5
2	4	4
4	3	4
1	3	5
2	2	5
	5	
	2	
	2	
2.107142857	3.419354839	3.964285714

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