Music and the brain

Kimberly D. Madison

University of Northern Iowa
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Abstract
A great deal of literature focuses on the subject of music and the brain and how music can affect learning. Music stimulates brain patterns, and therefore should be considered essential in an academic setting. This review was written to provide an analysis of the published literature and studies in the area of music and cognitive development, to examine how the brain is wired for music, and to determine whether music is an effective tool in enhancing environmental and cognitive learning conditions in classrooms.
MUSIC AND THE BRAIN

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Kimberly D. Madison

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Donna S. Douglas

Date Approved: June 12, 2008
Graduate Faculty Reader

Jean Suchland Schneider

Date Approved: June 12, 2008
Graduate Faculty Reader

Mary Herring

Date Approved: June 12, 2008
Department Head, Department of Curriculum and Instruction
ABSTRACT

A great deal of literature focuses on the subject of music and the brain and how music can affect learning (Mickela, n.d.; Music for All, 2005). Cultures dating back as far as 30,000 years left evidence of humans playing bone instruments and jaw harps (Weinberger, 2006). Studies have been conducted focusing on the effects and benefits of music on the learning of subject matter, music and brain development, and how music enhances cognitive abilities (Gardner, 1993; Lazar, 2004; Mickela, n.d.). The brain physically changes when learning occurs and these changes are most evident when emotion is a part of learning (Zull, 2005). Evidence from cultures throughout history suggests that music is a universal language (Weinberger, 2006). Music can not be thought of as expendable as it stimulates brain patterns, and therefore should be considered essential in an academic setting (Lehr, 1998).

This review was written provide an analysis of the published literature and studies in the area of music and cognitive development, examine how the brain is wired for music, and to determine whether music is an effective tool in enhancing environmental and cognitive learning conditions in classrooms.
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CHAPTER ONE
INTRODUCTION

Classrooms are filled with students, each possessing traits, with the most noticeable being identified as the musical trait (Gardner, 1985). Gardner states, "of all the gifts which individuals may be endowed, none emerges earlier than musical talent" (Gardner, 1985, p. 99). Brewer (1995) asserts that one method of making academics more interesting and interactive is by way of music. Dickenson (1993) suggests there are ways classroom teachers can incorporate music into the curriculum to provide an effective learning environment. Zull (2005) proposes the arts, specifically music, can trigger emotion. Zull further asserts that emotions aid in a person making meaningful connections. The purpose of this literature review was to examine the effects of music on cognitive development and how music can be used creatively and effectively in the middle level classroom.

Teachers realize their classrooms are filled with students of varied abilities and are to be places where students of all abilities can learn; however, there is often the need for educators to seek alternative methods to create an inviting, stimulating, and nurturing environment for all students. Harvard psychology professor and author, Howard Gardner, wrote *Frames of Mind*, (1985) and *Multiple Intelligences*, (1993) making the public aware that there are different forms of intelligences and that of the eight he identified, music was one form of intelligence. Furthermore, as teaching methods evolve, Brewer, (1995a) asserts that one way to create an inviting atmosphere and encourage active learning is
through use of music. Research has indicated that music can be used as a tool to enhance cognitive learning (Campbell, 2000; Clarke, 2006; Dickenson, 1993). According to Brewer (1995a), music can increase student attention in the classroom and help retain information presented. Music touches the senses and reaches emotions, both of which help students learn and recall.

Music can be heard every day of every year; it is a universal language and has been around since the beginning of time (Weinberger, 1999). Music allows the expression of feelings, thoughts, moods, emotions, and behaviors. Music is so much a part of everyday life, that educators should consider the benefits of using music as a major part of the core curriculum (Brewer, 1995a; Dickenson, 1993).

Throughout this paper the effect music has on the brain and student learning will be discussed. This literature review may help educators to better understand the importance of implementing music in the classroom and how music can be incorporated as an educational tool to assist students in the learning process.

**Rationale**

State and government officials are demanding schools become more accountable for student achievement, and educators are constantly seeking ways to increase achievement among students (National Education Association, 2002-2008). As a teacher, I have always enjoyed various types of music very much. I first began to notice how music affects learning when I taught Lynde, my two year old toddler, how to spell her name by singing to the tune of "Bingo" the spelling of her name. Lynde quickly and musically repeated the letters of her name after I sang it to her only three times. Shortly after, we began spelling other simple, one and two syllable words to familiar children's tunes. I was
amazed at how quickly Lynde grasped the spelling of different words such as happy and smile, in addition to her name.

To test my observation even further, I tried the same activity with my three year old niece, who is soft spoken and who spoke very few words. Recognizing her shy demeanor, I calmly sang the numbers 1-5 to her to the tune of "Bingo." I also held up corresponding fingers as I sang the numbers. Several tries later, my niece was speaking the numbers and also holding up the corresponding fingers. Together, through simple songs and activities, she learned the alphabet and simple words such as cat, hat, red, green, and other basic words. These two activities provoked my thought as to how music may be used as an instructional strategy to reach multiple, if not all middle school students in my classroom.

I began to ponder what I had learned through music as a child. I learned all fifty states through a song. "The Golden Rule" was a song children sang every Sunday at church. On Saturday morning cartoons, I learned the function of a conjunction by singing School House Rock (1995a) "Conjunction Junction." I quickly learned that adverbs answer questions like, how, when, where, condition, and reason by memorizing the phrases to the catchy tune, "Lolly, Lolly, Lolly, Get Your Adverbs Here." Along with those catchy tunes came another School House Rock (1995b) favorite, "I'm Just a Bill!" My memory still holds many facts and information from my youth; much of it was learned by way of music.

My personal soundtrack began in the early 1970s, with much exposure to music. My grandparents exposed me to an array of music, but little did I realize the profound impact it would eventually have on both my personal and professional lives.

My grandmother entertained me with the piano throughout my childhood years, and when I became a mother, she exposed her two great-granddaughters to the beauty music
had to offer. One day, as my grandmother played the piano, I began to observe the interactions of my children in a different light. A professional observance came over me, and I noticed that while my grandma was making the keys dance, my own children, within seconds, were laughing, dancing, clapping, and singing.

My seventy-five year old grandmother expressed to me her belief that music helped to heal her as a young child when she was very ill. She further explained that throughout her illness, her mother sat her on the piano bench and played one key at a time. My grandmother learned to play all eighty-eight keys, yet she could not read a single note or piece of music placed in front of her as a child, nor could she do that at age seventy-five.

I wondered how one could play all the ivories, yet not read any notes. I also wondered how music impacted the brain in such a manner. I thought about how music could be used to assist the learning of my middle school students. My grandmother remarked that the music made her feel better and stated that perhaps music is one of life's best medicines, not only for healing illness, but keeping the mind young. Keeping the mind young--that statement was profound for me. I concluded that the mind must respond to music naturally, and I wondered what possibilities that might hold for the learning of my students.

I began to realize that there was much more to music than melody, and that there was much activity in the brain when it was exposed to music; thus, began my desire to better understand how music could help the very young to the elderly. My inner teacher voice began to speak. I knew that because I loved music and had witnessed its effects, I felt compelled to investigate further and seek creative musical ways to promote learning in my middle school classroom. I also felt music could help create an inviting atmosphere where
students looked forward to class and learning new information. I wanted the classroom to be a powerful place where students could grow intellectually and find personal academic success, as well as be exposed to the riches of music.

*Purpose of the Literature Review*

Today students can often be seen listening to iPods and CDs. Music appears to be an essential part of life and an everyday sound. I wanted to learn about the effects music has on the mind, and I also wanted to determine if melody can be used as an instructional resource for teachers. Therefore, the focus of this literature review was to locate, examine, and assemble representative samples of the literature about "music and the brain," which could be valuable to colleagues, professional educators, and school officials as they make decisions about curriculum and instructional methods for schools.

*Importance of Review*

It is important that students enjoy school and attain success by learning how to do their personal best. Each student's personal best is different from the other. It is also important that students are in an educational environment in which they thrive and which is relevant to their young lives. Music may be one way to stay in touch with the times, as well as to create an environment that is appealing to students. Teachers want students to grow and thrive, in addition to learning how to be creative thinkers and learners.

A literature review regarding music and the brain may assist educators in learning how to reach the inner creativity in each student. Whether students have been identified as talented and gifted, average, or in need of assistance, all students have the ability to learn and grow if given opportunities and shown ways to succeed.
Terminology

In order for the reader to fully understand the literature review, the following definitions are provided:

**Melody** - "A pleasing succession of sounds; a series of musical tones arranged to give a pleasing effect; a leading part involving harmony" (Merriam Webster's Dictionary, 1998, p. 467).

**The Mozart Effect** - a term that Campbell (as cited in Kranz, 2000) used to describe "quality music that can be used to improve one's health, intelligence, emotions, and creative abilities" (para. 1).

**Endorphins** - Chemicals released in the brain; which have a calming effect and reduce feelings of stress (Campbell, 1997).

**Mnemonic Devices** - Methods that aid in enhancing the memorization skills of a student (Jetton & Dole, 2004).

**Neurons** - Matter in the brain that serves as the "communicators and the building blocks of the brain" (Shaw, 2000, p. 54).

**Synapse** - "The point at which a nerve impulse passes from one neuron to another" (Merriam Webster’s Collegiate Dictionary, 1998, p. 776).

**Cognitive Development** - the change in the ability to think and reason as a person matures (Comer Children's Hospital, n.d.).

Research Questions

This literature review was guided by two research questions: (1) What is the relationship between music and cognitive functioning? (2) How can music be used to enhance cognitive functioning middle school classrooms?
CHAPTER TWO

METHODOLOGY

In order to understand if there was a relationship between music and cognitive learning, and if music could be a beneficial tool to use in the classroom, a variety of literature about brain functioning, the effects of music on the brain, and the connections between music and cognitive functioning were examined. I read information by experts such as Gardner (1985, 1993), Campbell (1997, 2000), and Weinberger (1994, 1999, 2005, 2006) who have written extensively about the developing brain and the positive impact that the fine arts have on culture and why they should be an integral part of education for all students.

Methods to Locate Sources

My initial search for information about the relationship between music and the brain began with a very well known name in education, Howard Gardner. Gardner (1985) wrote about seven intelligences, with one intelligence being the musical intelligence. In addition, I utilized the public library and the Area Education Agency to access books and articles on the topic: music and the brain. That is when I began to realize that there was a wealth of information on this topic. I looked at the reference pages of articles and from those pages. I looked for other related articles or recognizable authors. I used search engines and borrowed articles from the music instructor at our school.

In my search for additional sources, I repeatedly saw names such as Shaw, Weinberger, Campbell, Gardner, and Brewer in reference lists of books and articles. I was familiar with Campbell because I had read several articles about "The Mozart Effect." It became clear that these names were recognizable names in the field of "music and the
brain." After having checked out and renewing *The Mozart Effect* three times, my mom purchased the book for me. I often speak the words found on the cover of Campbell’s (1997) book when referring to my students' abilities—"Strengthen the mind...unlock the creative spirit." The cover of the book was appealing to me because the words reminded me of the earlier experience I spoke of regarding my daughter, my niece, and my grandmother. I then checked out Campbell’s (2000) book, *Mozart Effect for Children.*

Once I began collecting information, it seemed that I would hear about the effects of music frequently on talk shows, in the newspapers, and I even discovered an article about a non-profit organization, *VH1 Save the Music.* Once again, I concluded that music must be powerful; therefore, I wanted to continue my work on this literature review to better understand music, its impact on learning, and how to effectively implement music in the classroom.

**Methods to Select Sources**

The main tool I used to find literature about my topic, music and cognitive development, was the Internet. I conducted searches using Google and located related material via the electronic data files in multiple libraries by using the EBSCO and *FirstSearch* electronic databases. I was able to locate and find professional education journals, music education journals, and journals from professional education associations through these online searches. I checked out books by leading experts by utilizing the local public library and the Area Education Agency Media Center.

For each book, chapter, or article I read, I would make notes and mentally envision if the content could assist in meeting the district's academic goals through the suggested musical games, strategies, and activities. In addition, I chose reading material based on the
following criteria: (a) was there more than one article or book by the author, (b) how relevant was the information and what research was provided to support the writings, (c) could the information relate or be applied to middle school students, and (d) was the information something I could build on for future instructional purposes?

Procedures to Analyze Sources

In every book or article I read, I first skimmed through chapters or the first few paragraphs. I highlighted important points I deemed relevant to middle school by using sticky notes and a green highlighter.

I placed all of the articles in a three ring binder and using the author's last name, labeled them in alphabetical order. I used sticky notes for chapters of books and stored the books in a sling-back bag. I often carried the notebook with me and made notes in it based on incidents that occurred in my classroom. By jotting down possible musical solutions, I was connecting the literature I had read to my personal thoughts. I was able to draw conclusions and develop a list of recommendations for practice in my classroom and the classrooms of others.

After reviewing each resource many times, I continued to reflect on the connection between music and cognitive development, as well as to develop creative musical methods to be used with students. These repeated reflective writings enabled me to identify, address, and answer the two primary questions of this literature review.

Criteria to Include Literature

I utilized the assistance of librarians at the Area Education Agency and school library to select reputable sources of information. Criteria for selecting any source utilized in this review included selecting authors with credibility and being cited in various
bibliographies. It was also important for me to select sources which included information relevant to the work of teachers, such as lesson planning, instruction, and assessment. The date of publication was also considered. For this review, some of the older citations were needed to verify the longevity of the author’s work and research. In addition, newer publications were used to show that research is ongoing.
CHAPTER THREE
REVIEW OF LITERATURE

Music can be heard daily and is thought of as a universal language (Weinberger, 1999). It is important that students enjoy school and attain success and according to Brewer, (1995a) music may be one way of capturing today's learners. With a little creativity, Lazar implies that music may serve as one method to assist in instruction (2004). Professor of neurobiology and behavior, Norman Weinberger, a recognizable name in the field of music and the brain, wrote, "There is a great deal of excitement over music research these days" (2005, para. 2) and Mickela (n.d.) verifies that much literature is available which examines the subject of "music and the brain" and how music can affect human achievement.

This literature review begins with a section on “Interesting Musical Facts” and then is divided into two major sections that address the main research questions: (a) What is the relationship between music and cognitive functioning? and (b) How can music be used to enhance cognitive functioning, particularly in the middle school classroom?

Interesting Musical Facts

O'Donnell (1999) stated, "Every known culture on earth has music and it is thought to be one of the basic actions of all humans; in fact, the influence of music can even be seen clearly from early modern historical times" (para. 2). Campbell (1997) asserts that even in the earliest of civilization, people worked to the accompaniment of songs. One example O'Donnell gives from past history is that of Thomas Jefferson. When Jefferson struggled trying to find the right wording as he was drafting the Declaration of Independence, he
would pause and then take time to play his violin; he felt the music helped him draft just the right words (O'Donnell, 1999).

Music can be a rhythm of life and can have a physiological effect on individuals (Campbell, 1997). An example of a physiological effect on one is that of an extremely intelligent man, Albert Einstein. O'Donnell (1999) reports that during Einstein's youth, Einstein had his own struggles in school. Einstein's teachers asked his parents to remove him from the classroom because the teachers really did not want to be bothered with him. The teachers felt Einstein was "too stupid to learn." Within time, Einstein's parents purchased a stringed instrument, a violin. Einstein grew to love the music of Bach and Mozart and claimed that the reason he excelled at figuring out problems and equations was by improvising with his violin (O'Donnell, 1999).

Academic performance may improve with music instruction and according to Sancar (1999), areas affected include language development, reading, math and science. In addition, Brewer (1995a; 1995b) expresses that creative and well planned use of music in the classroom can set a tone for a positive learning atmosphere.

Lehr (1998) shares that music helps students and can actually rewire the brain to think more efficiently and should be considered a very important piece of the curriculum. Ironically, famous historical men such as Plato, Socrates, and Einstein knew about the importance of music; however, it was not until the 20th century, along with technological and scientific advances, that the importance and impact of music was demonstrated (Music for All, 2005).

The effects of music are often instant and long lasting. There are new developments that are allowing the insight of cognitive development and how the body and brain
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processes information (Sylwester, 1994). Dickinson (1993) discerns that research is emerging regarding the cognitive sciences that allows useful information to be gained. Technology allows scientists to view the human brain while in the process of thinking. When a person listens to melodies of varied pitch and timbre, the right hemisphere of the brain signals action like a light bulb being switched on. A similar experience takes place with the right hemisphere when an individual plays by ear as Weinberger (2005) implies that music is fun and can aide in brain development. This implication could continue further with Dickinson's claim that when a person learns to read music and follows a sequence of notes, the left hemisphere is very active.

Music and Cognitive Functioning—Early Brain Development

In 1983, Howard Gardner shared with the public, after many years of research, that there are many forms of intelligence (Gardner, 1985). A few years later, books about "The Mozart Effect" gained attention (Campbell, 1997; 2000). In an article titled, "Music on the Brain" by Cromie and Cromie, (2001) it is noted that babies respond to music while in the womb and that babies come into the world with a liking for music. According to Weinberger, (2006) music appears to be innate and infants as young as two months will turn toward soothing sounds. Cromie and Cromie (2001) add that by four months, the notes of a melody may cause a baby to cry or even better, sing a sweet cooing sound.

Campbell (2000), author of The Mozart Effect for Children, informed expectant mothers, parents, and educators how to empower children through the use of music, sounds, and rhythm. Can music really make a child smarter? Campbell (2000) suggests that children who listen to classical music actually increase the number of neuronal connections in their brains. In an article by Begley (2000), it was explained that the neural
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path which connects both the right and left sides of the brain may also explain something rather interesting: the right brain is linked to emotion, while the left is connected to cognition. "The brain seems to be a sponge for music and, like a sponge in water, [the brain] is changed by it" (Begley, 2000, para. 6). According to Begley (2000) and Campbell (1997), the brain's left and right hemispheres are connected by a big trunk line called the corpus callosum. Campbell (1997) shares that the corpus callosum can be compared to a bridge because it is between the hemispheres and allows the hemispheres to respond simultaneously. Campbell (1997) also states, "The corpus callosum of musicians is thicker and more fully developed according to studies on the brain" (p. 192). This information may lead one to believe then that music expands the neural pathways and stimulates learning and creativity.

Hodges (2000a) explains that the mind has a natural ability to react to melody and to participate in music. Music is closely related to language as it is a biological trait of humans. All human beings have music and can respond to and participate in music from their surrounding environment. Hodges (2000a) cites research from Frank Wilson, neurologist, who believes all human beings have musicianship; it is a biological gift. He further states that musicianship does not mean that individuals become expert musicians, but rather they have the ability to respond and engage in the music within the environment; this musical ability starts at birth and carries on for a lifetime. All people in all times and in all places have engaged in musical behaviors. Hodges' writings (2000a; 2000b) have implications for not only music education, but education in the regular classroom as well.

The Resilient Brain

The brain is highly resilient (Hodges, 2000a) and in the early years of life, the
neural connections are made at a rapid rate (Sousa, 2006). Begley (2000) states that music can charm a beast and that those charms work through the human brain. One example, according to Hodges (2000b), involves known examples of disabled individuals, individuals who were profoundly retarded, and those affected by diseases such as blindness or deafness, who were found by researchers to have meaningful musical experiences even when destruction of brain tissues may have eliminated other functions. Hodges (2000b), for example, indicated that cognitively impaired individuals, who have average IQ's of 65-70, are also the same individuals who often display remarkable musical abilities. Another study indicates that listening to music can increase the endorphins in the brain which allows the brain to achieve a natural high and therefore allow a person to be more at ease (Campbell, 1997).

The brain physically changes when learning is taking place (Zull, 2005). According to Weinberger (2006) music appears to have a biological root in the brain which allows the brain to react naturally with music. Sousa (2006) insists that the arts, including music, can be powerful brain food. There are areas of the brain that respond only to music. The brain makes neural connections rapidly, and when children engage in the natural forms of art such as singing and dancing, that allows the senses to assist the wiring of the brain (Sousa, 2006). The neural pathways created by listening to or engaging in music help to enhance the intellectual development of an individual (Lehr, 1998).

According to Campbell (1997), music can assist in giving an individual more stamina, especially when studying. An interesting note, according to Weinberger (2005), is that the right hemisphere of the brain processes melody, and the left hemisphere processes language. The brain adheres to music as it does language, which may help explain why the
brains of children naturally understand music and enjoy musical exposure. Sousa (2006) states that the arts, including music, are fundamental to brain function. Campbell (2000) elaborates that children, when exposed to sounds, rhythms, and melodies, form a synaptic pathway through environmental input of those sounds. The brain depends on synaptic strength for cognitive development (Weinberger, 2005).

The Musical Brain

According to Campbell (2000), brain development at the early stages of life is a process of incorporating patterns into complex systems. "The patterning begins in the womb and after birth continues with the patterning movement, cognition, and the first experiences of social interaction" (Campbell, 2000, p.13). It has been reported that in utero, the fetus hears all sounds as music through the amniotic fluid (Carlton, 2000).

As babies grow and develop into young children, they learn to use words and patterns of language, and like all humans, their speech becomes a communication tool (Campbell, 2000). Campbell further explains that at birth, a child's brain is in an unfinished state. The child's neurons are not yet connected into syntactic networks, so it is crucial during early childhood to use reinforcing methods that will form and assist with those connections within the child's brain. The brain is affected by being surrounded by sounds. Furthermore, junctions known as synapses are being created rapidly in children. By the time a child is 10-years old, the brain will have formed trillions of synapses. Each single neuron in the brain connects to and with thousands of other neurons, ultimately forming a network or pathway that is extremely complex (Campbell 2000). Neurons are the building blocks of one's brain (Shaw, 2000). Neural connections can be made at a rapid rate (Sousa, 2006). Synapses are needed as the brain depends on them (Weinberger, 2005). If synapses
aren't used repeatedly, they have no chance become a part of the neural pathway, because they are either weakened or eliminated (Campbell, 2000; Weinberger, 2005).

Weinberger (2005) reiterates that music helps synchronize the right and left hemispheres of the brain. It is suggested that the left hemisphere analyzes the structure of music, while the right hemisphere focuses on melody. The arts, particularly music, should be considered not just expressive but a form of cognitive expression (Sousa, 2006). The hemispheres of the brain work together when emotions are stimulated, attention is focused, and motivation encouraged. Rhythms, melodies, and high frequencies can also stimulate and change the creative and motivational regions of the brain (Campbell, 1997).

Brewer (1995b) notes that music has the ability to set a scene and aid in enhancing atmosphere. As most human beings know, music makes the foot tap, the fingers snap, and the pulse increase or decrease. The brain can be stimulated to reach high functional levels when exposed to music. Campbell shares that the brain can be stimulated to reach high functional levels when exposed to music. Music can reach the deepest part of the brain; it can do this as, "music has the ability to create multiple patterns simultaneously" (Campbell, 1997, p. 81). The tones of music affect one's brain and body, as well as one's movement (Campbell, 1997). In an article, "Implementing Music in the Classroom," written by Jensen (2002), students learned when listening to or playing music, suggesting that music should be a part of every child's education. Weinberger (2005) supports this by stating that music is not only fun, but it can enhance the skills of children in other disciplines as well. Weinberger (1999) advises that music engages all components of the mind, including the following:
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- Sensory and Perceptual (e.g., auditory, visual, tactile, kinesthetic)
- Cognitive (e.g., symbolic, linguistic, reading)
- Planning/Movement (e.g., organization, sequence of muscle actions)
- Motivational (e.g., determination to study hard)
- Feedback/Evaluation (e.g., hearing correctly)
- Learning (e.g., acquiring new information)
- Memory (e.g., long term storage used and use of new information and skills. (Weinberger, 1999, para. 18)

*The Mozart Effect*

With all of the information available about how music affects the brain, one might wonder whether listening to music can truly make an individual smarter. One of the most well-known studies to bring the topic of music and the brain to the attention of the general public was the work conducted in 1988 at the University of California at Irvine (Rauscher, Shaw & Ky, 1993), popularly referred to as *The Mozart Effect*. Rauscher, et al. studied 36 college students who listened to 10 minutes of a Mozart sonata and found that they scored higher on a spatial temporal task than if they had sat in silence or listened to a relaxing piece instead. There were three groups of students in the research study. One group listened to a sonata, one group listened to relaxation tapes, and one group was subjected to silence. Then, all of the students were given the same spatial IQ test, which was to unfold a piece of paper that had been folded several times. In the end, those who had listened to the sonata performed at least nine points higher than the other two groups. This study sparked more interest in the topic of how the brain responds to music and how can music be used to aid in cognitive and spatial performances of students (Rauscher, et al., 1993; Shinn, n.d.).
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Music, Memory, and Learning

Music and the power it has on memory is another interesting area related to music and cognitive development (Brewer, 1995b; Clarke, 2006). A research study was done at the University of North Texas in 1982 by O'Donnell in which postgraduate students were tested to determine if music could aide them in memorizing vocabulary words.

These students were divided into three groups and each group was given three tests with one being a pretest, then a post test, and finally a test one week after the first two tests. All of the tests given to the students were exactly the same. The first group was read the words with Handel's water music playing in the background, and they were asked to imagine the words. The second group was read the same words and also listened to Handel's water music in the background, but they were not asked to imagine the words like the first group. The third group was read only the words and was not given any background music, nor were they asked to imagine the words. In the end, the results showed that the first two tests from groups one and two proved to have much better scores than the third group. When the results from the third test were given, they showed that group one performed better than the other two groups. The interpretation of the results suggested that background music does play a part in learning information and recalling it.

(O'Donnell, 1999, para.11-12)

Music has important physiological effects on the learner's body (Sousa, 2006). Music can heighten one's awareness, or it can calm one down (such as when background music in the classroom is played) to help students stay focused, thereby allowing them to complete an assigned task (Sousa, 2006). The effects of listening to music are often instant
and long lasting. The spiritual, emotional, and physical elements of the universe are believed to be connected by music. Music is a universal language (Campbell, 1997; Shaw, 2000). Scientists know more today about how the brain functions than ever before.

Campbell (1997) explains that “through the brain stem, auditory nerves join other muscles of the body suggesting that sound influences bodily reactions; the entire body is like an antenna that vibrates in unison with the sound source, whether linguistic or musical” (p. 53). An example of the power music has on the body illustrates that classical music allows the heart and pulse to relax, and when the body relaxes, the mind is more alert (O’Donnell, 1999). Calm, soft music can be used as a relaxation tool in the classroom so students may better concentrate. Again, it is suggested that music can aid in activating the chemicals and neurons that help calm the body and in turn help recollection and thinking.

Music can assist the memory process; sound helps hold attention and one can absorb more information in a highly focused frame of mind (Brewer, 1995a). A student’s brain, when exposed to melodies with a variety of pitch and timbre, will be more activated. When a student tries to read music or play a sequence of notes, the left hemisphere is at a higher alert (Dickinson, 1993). It is in the left hemisphere that analytical thinking occurs. This is important because it can lead into what is called the alpha brain-wave state (Brewer, 1995b), which is a perfect learning state for taking in information through the auditory channels. Also, music encourages emotional responses and stimulates the learner. Music can aid in creating a multi-sensory experience; the more senses involved in the learning phase, the greater the understanding (Brewer, 1995b; Davies, 2000).
Brewer (1995b) and Lazar (2004) demonstrate how memory skills and the retrieval process can be highly stimulated through the use of music. It's the jingle, the song, the rhyme, and repetition of music that makes retaining and recalling information easier in addition to understanding or remembering facts after they have been presented. Music can capture one's attention and balance repetition with ease; this in turn facilitates retention (Davies, 2000). Music affects the brain because of its complex, repetitive patterns. Music connects and develops the motor systems of the brain, improving eyesight and hearing as well as enhancing coordination, concentration, and memory (Davies, 2000). Furthermore, casually listening, singing, or moving to music, in addition to performing or composing music, has been shown to increase reading ability, memorization skills, and the ability to recall vocabulary (Campbell, 1997; Davies, 2000).

Can Music Make One More Intelligent?

According to Weinberger (2005), music has the ability to facilitate cognitive development such as language and reading readiness; it can also aid in the efforts to comprehend and memorize facts. Most adults can relate to this as they recall (a) their youth and the lessons they learned by way of music, or (b) their adult years and the patriotic feelings elicited when singing patriotic songs or religious connections that are strengthened when singing hymns of faith (Campbell, 2000; Carlton, 2000).

Jensen (1998) reinforces the concept of emotional connection to learning. He states in his book, *Teaching with the Brain in Mind*, that learning is strongly influenced by emotion. "The stronger the emotion connected with the experience, the stronger the memory of that experience" (p. 73). Brewer, (1995b) concluded that music can assist in
recalling particular moments and evoke emotions and that using music in the classroom could be an invaluable technique.

The Value of Music

The arts play an integral role in students' development by enhancing cognitive, emotional, and psychomotor skills (Sousa, 1996). In an article written about "Music and the Mind," Dickinson (1993) cites information from Paul MacLean's triune brain theory. MacLean, an advocate for music education, in 1952 first reported that the human brain is really three brains in one. The largest part of the three is the cerebral cortex, which composes about 85% of the brain and is devoted to higher order thinking skills. The relationship to music is clear in instances where students are observed making music together and then noting their improved academic performance. The more senses that are used, the more learning takes place. Auditory, visual, kinesthetic, and tactile modes aid in a learner's experience, and while music is auditory, the other modalities can be used by clapping, tapping, dancing, and humming or playing an instrument (Lazar, 2004).

Dickinson (1993) also referenced Marian Diamond, a neurophysiologist, who believes that the brain changes when making music. "Music can help build neural networks, which are really the hardware of intelligence" (Diamond as cited in Dickinson, 1993, para. 11). Diamond feels that it is essential that music be taught throughout the curriculum and not just in separate areas such as choir. Campbell (2000) reaffirmed the idea that the more stimulation a child receives through music, movement, and the arts, the more intelligent the child will become.

According to Dickinson (1993) and Brewer (1995a), music doesn't just help students in one subject, but rather it encourages development, creativity, and expression in
ways that other traditional learning tools have not been able to. As a learning tool, music is not often applied in the traditional classroom and many educators have been reluctant to integrate it within the curriculum if they do not have a musical background (Lehr, 1998). Sousa (2006) stated that when the arts are implemented in the core curriculum, students have a greater emotional investment in their classes. They learn from each other and are on task more. Even their cooperative learning turns into a more cooperative community. The arts, music, provide a high quality of human experience (Sousa, 2006).

How Does Music Affect the Learner?

Music enters the brain through a person's ears, and the pitch, melody, and notes are processed in areas of the brain, such as the cerebral cortex, the brain stem, and the frontal lobes (Sancar, 1999). The sound is interpreted by the brain's auditory cortex. This happens through both the left and right-brain auditory cortex. The right hemisphere processes melody while the left hemisphere processes language (Weinberger, 2006). The perception of rhythm and the sequencing of sound are determined by the left-brain cortex, according to Sancar (1999). Music and language are naturally distinguished by the brain (Weinberger, 2006).

Music itself is a kind of language that is linked with patterns, and the exposure to music can help a student analyze sounds, such as vowels, along with sequencing words and ideas, as well as reading and memorizing (Campbell, 1995). When listening to or engaging in music, students gain cognitive skills (Campbell, 1995). Mickela (n.d.) discussed the outcomes of research conducted in California:

A study done in one high school on the effect of music on academic development has shown that high school music students have higher grade-point averages than
students who don't participate. At Mission Viejo High School in Southern California in 1981, the overall grade-point average of music students was 3.59, and for non-music students the overall grade-point average was 2.91. This same study also found that 16% of the music students had a 4.0 overall grade-point average and only 5% of the non-music students had a 4.0 overall grade-point average. Music education can assist students in improving their writing, communication skills, and analytical skills. (Mickela, n.d, para. 8)

Understanding information about the musical brain allows one to better understand Howard Gardner's multiple intelligences theory and musical intelligence theory. Hearing musical patterns should aid students in performing better in academics (Gardner, 1993; Weinberger, 1999). As teachers are faced with more and more challenges by the increasing diversity of students (Dickinson, 1993), they need more effective ways to work with varying ability groups.

Campbell (1997) discussed the power music has on students with Attention Deficit Disorder (ADD). One particular study of nineteen children, aged seven to seventeen identified as ADD or Attention Deficit Hyperactivity Disorder (ADHD), listened to Mozart music. The specific music was a CD containing 100 Masterpieces of Wolfgang Amadeus Mozart (as cited in Campbell, 1997). The students who listened to Mozart displayed better focus, mood, control, and social skills.

The Type of Music Makes a Difference

To show that music can help in retaining information, Clarke (2006) reports a test using white mice. The mice were taught to navigate a maze in order to find their food. For eight weeks, the three groups of mice targeted their food with one group listening to no
music, one group listening to rock music, and one group listening to Strauss waltzes. At
the end of the eight weeks, the mice who listened to no music had improved, but the mice
who listened to waltzes made it through the maze much quicker. The mice who had
listened to rock music had gotten worse at finding their food and were becoming
disoriented. The test continued for a few more weeks, and it was discovered that the
Strauss mice retained their memory while the rock music mice had virtually no memory of
anything. This study demonstrates that the type of music used in the classroom could be
helpful or harmful to students in the memorization of class material. Knowing this,
teachers should be selective in the music they use to create and facilitate learning
environments where students develop higher order thinking skills.

The Importance of Music in the Classroom

Weinberger (1999) stated that music is a universal language. Campbell (1995;
2000) suggested that music may be implemented as an effective classroom instructional
tool. Music plays an important role on the physiology of students' bodies (Sousa, 2006).
Dickinson (1993) provided a comprehensive list of eight reasons why music is so
important to the classroom:

1. It is a language that all people speak -- it cuts across racial, cultural, social,
educational, and economic barriers and enhances cultural appreciation and
awareness.

2. It is a symbol system as important as letters and numbers.

3. It integrates mind, body, and spirit.

4. It provides opportunities for students to show self-expression, bringing
the inner world into the outer world of concrete reality.
5. It creates a seamless connection between motivation, instruction, assessment, and practical application -- leading to "deeper understanding."

6. Music merges the learning of process and content.

7. Improved academic achievement -- enhancing test scores, attitudes, social skills, critical and creative thinking.

8. Music provides the means for every student to learn. (para. 7)

Music may be considered an essential instructional tool for the teacher and an essential learning technique for the students, just as textbooks and computers are considered essential in the classroom. Student diversity in the classroom (Dickinson, 1993) may become more unified if music is used, and the uniqueness of all students is brought together using the common interest in and the universal language of music (Weinberger, 1999).
CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this literature review was to examine the effects music has on the brain. There were two initial research questions which guided this review of the literature: (1) What is the relationship between music and cognitive functioning? (2) How can music be used to enhance cognitive functioning in the middle level classroom?

Conclusions

When teachers clearly understand how a child's brain develops and responds to music, it is a clear explanation as to why music may be an integral resource in the classroom (Campbell, 1995; 2000). The first part of the research question asked “What is the relationship between music and cognitive functioning?” This question can be answered by several cited authors starting with the literature provided by Campbell (1997; 2000) and Carlton (2000) who cited research indicating that pre-born babies in the uterus experience musical vibrations through the amniotic fluid. Cromie and Cromie (2001) noted that melodies affect infants to where they will release a pleasing baby sound.

Research dubbed The Mozart Effect by Campbell (1997; 2000) found that student subjects improved on performing spatial-temporal tasks when listening to Mozart music. O’Donnell (1999), in a similar experiment, found that test subjects were able to increase their memorization of vocabulary words while listening to Handel’s water music. Hodges (2000b) reviewed research documenting that cognitively impaired persons often display unusual talent in the music area. Young children, according to Weinberger, (1999) can increase the number of neuronal synapses by listening to music. Brewer (1995b) maintains that music is so powerful that it can help students retain more information and creates
within the brain multiple methods for retrieving information. Dickinson (1993) discussed how both hemispheres of the brain are activated to a higher state when exposed to music.

The second part of the research question asked, "How can music be used to enhance cognitive functioning in the middle level classroom?" Lehr (1998) contended that music organizes the brain so it can function better in all learning situations. Sancar (1999) concurred, noting that the language of music helps students concentrate and to analyze vowel sounds and sentence patterns.

A study reported by Mickela (n.d.) found that students enrolled in music classes and programs at California's Mission Viejo High School maintained much higher grade-point averages than their non-musical peers. Gardner (1993) described music as one of the seven (now eight) major areas of human intelligence. Brewer (1995b) and Lazar (2004) reported that the rhythm of music assists students in retaining and retrieving classroom learning. Brewer (1995a) further reported that music can be used as a device to relieve tension and set the mood in the classroom for increased student performance. Dickinson (1993) cited a number of reasons for including music in the classroom, noting that music can enhance attitudes, social skills, and creative thinking.

Recommendations

The purpose of this literature review was to examine how music affects cognitive functioning and how music can be effectively implemented as a tool in the middle level classroom. Music can promote learning through realistic, powerful, and meaningful experiences. Music can add interest and enjoyment to learning. As this review shows, melodies aid in stimulating the wiring of the brain. (Weinberger, 2006; Campbell, 1997, 2000; Brewer, 1995a).
Implementing music in the classroom is a way to reach today's youth since music is considered a universal language (Weinberger, 1999). Jensen (2002) encourages the use of music for all ages of students. Jensen (1998) suggests background music may not come in the so called "traditional" form of music but can also come in the form of environmental melodies such as waterfalls, oceans, and rain forests. Dickinson (1998) reports that the arts, to include music, provide students creative ways to learn, exercise, and develop higher order thinking skills which also includes skills such as analyzing, synthesizing, evaluating, and even problem solving. Music is viewed as a multi-sensory approach to improve learning (Lazar, 2004).

Music can assist and encourage students in developmental ways as it allows the brain to respond and think effectively. Brewer (1995a) promotes music in the classroom as it can help students learn through a number of creative ways. According to Rauscher, (1995), advocates of the fine arts have become increasingly concerned in recent years about budget cuts and the waning emphasis on music, art, dance, and drama in the nation's public schools. "Music and the other arts are an integral part of every child's development" (Rauscher, 1995, editorial comment as cited on p. 8). Lehr (1998) reports that the fine arts cannot be thought of as expendable, but rather as an essential part of the curriculum. Exposure to music and participation in the arts can provide a higher quality of experiences and can help make connections between new and prior learning (Sousa, 1996). "It's clear that the arts make children both better thinkers and better students" (Rauscher, 1995, para 13).

Today's schools face high expectations of accountability. National and state education officials have placed tremendous pressure on local educators to document
student improvement through high-stakes testing procedures. It is important for local school administrators and school board members to become aware of the research in this study, noting the beneficial effects of implementing music in the classroom.

**Future Research**

Research must continue as it is now known that music has a direct affect on the brain. There is an ongoing number of neuromusical studies (Hodges, 2000a). There is significant reason to continue to stay abreast of current trends, methods, and research regarding music and cognitive functioning. A few reasons are as follows:

1. Research will continue to give educators a better understanding of the human brain and how it develops and responds.

2. Research will continue to assist educators by providing current information so educators can develop innovative methods for learning.

3. Research will help educators better prepare students for a rapidly changing world as it can naturally assist in students' absorbing, recalling, and applying information in order to become highly productive citizens.

4. Researchers such as Weinberger, Rauscher, and Brewer should become familiar names in education just as other highly regarded experts in education.

5. Research in the cognitive sciences helps educators to design methods to increase student achievement and meet the state and federal demands places on schools.

6. Research implies that continued efforts in the field of music and cognitive functioning will have a profound effect on the teaching profession and the future generations.
Administrators and governing boards should be aware of the importance of implementing music in all education classrooms. "Music, like language, is a species-specific trait of humankind" (Hodges, 2000a, para. 10). Since all human beings have the ability to respond and participate in music (Hodges, 2000a), it stands to reason that all students will be engaged by music integrated into classroom instructional practices.

**Teacher Practices**

Given all the research on music and the brain, teachers may consider allowing more music in the classroom, since it has been established as being one beneficial method for improving cognitive functions (Sousa, 2006). Developing and maintaining successful procedures using music will allow students to absorb and express cognitive functions.

Davies (2000) states, "Young people relate to the universal language of music. Different rhythms produce varied reactions in people. Listeners 'feel' the vibrations of music" (Davies, 2000, para. 4). In addition, the effective and well-planned use of music allows students to move into an alpha brain wave state, a learning state for gaining and recalling information (Brewer, 1995a). According to Zull (2005), changing connections in the brain is learning. Music allows emotions and allows us to remember events. Music, as an educational tool, will allow students to retain more information and provide them with a multitude of modes for information processing and retrieval (Brewer, 1995b).

According to Brewer (1995a) there are various ways that music can create a "symphony" (para. 1) for learning. "Music is a powerful tool for our personal expression within our daily lives--it helps 'set the scene' for many important experiences" (Brewer, 1995a, para. 1). Brewer (1995a) also states examples of how music can help students:
1. establish a positive learning environment
2. create a desired atmosphere
3. align groups of students
4. help develop rapport among students
5. enhance imagination and energize learning activities
6. can aide in releasing tension
7. focus concentration
8. improve memory.
9. facilitate a multi sensory learning experiences
10. add fun and also provide inspiration and motivation.

(Brewer, 1995a, para.5).

In an article by Dickinson (1993), she cites research from Dr. Marian Diamond, a neurophysiologist, who states, "The brain changes physiologically in relation to learning and experience--for better or worse" (Diamond as cited in Dickinson, 1993, para. 11). In addition, Dr. Diamond shared that stimulating, upbeat, and nurturing environments allowed students opportunities where interactions and responses provided room for richer neural networking which serves as the hardware of intellect (Dickinson, 1993).

Both Brewer (1995b) and Dickinson (1993) suggest why the arts are important:

1. Integrate mind, body, and soul
2. Offer means for every student to learn
3. Improve academic achievement
4. Help to integrate music across the content
5. Offer collaboration
6. Improve attitudes, social skills, and critical thinking

7. Provide feedback and the chance to reflect

8. Merge learning process and content

9. A language that all people speak

10. Allow for practical application and help build bridges regardless of racial, social, educational, or economic barriers

11. Evoke emotions and provide opportunity for visual images

12. Set the scene and increase focus on content

(Dickinson, 1993, para. 7 and Brewer, 1995b, para. 2-3).

Music will allow emotions to be touched and allow for rich experiences to take place and can empower students to strive to reach their own personal level of success. Zull (2005) encourages the arts in schools. The arts allow the students to become like artists who are the creators and designers. The arts and music allow for self expression and creative success (Weinberger, 1994).

**Student Practices**

The literature presented in this review can allow the professional educator to create a symphony for learning. By implementing musical genres that are appropriately selected, better student rapport among one another and increased academic success for all is possible. Like Brewer (1995a) stated, active learning experiences allow students to become more energized and motivated. In addition, since music making is kinesthetic (Hodges, 2000b), it is important that teachers understand how students' brains can move into a high state of awareness where their brains can process, absorb, and recall important information. Davies (2000) suggests music can engage the listener into the educational setting and
stimulate interest and complex thinking. Lazar (2004), reports that music can be used as a mnemonic device, so with a little creativity, academics can be manipulated through familiar tunes. Various ways to actively integrate music for student use include the following:

1. Using background music while journaling, brainstorming, writing, and problem solving;
2. Use music with an up-beat pace for group activities such as spelling races; vocabulary games, and literature relays;
3. Use music to help with facts and definitions by putting the information to a familiar tune;
4. Use music to stimulate or calm students during a lesson;
5. Use music as a tool for classroom and student management.

Self Practices

I have long felt that music affects feelings, behavior, and mood whether it is to make one happy, excited, mellow, or calm, but not until I did the research for this review was it so apparent to me the impact that music has on the human brain. From the research, I feel I can now better justify the use of music in my classroom, and I can "orchestrate" a more inviting classroom where music can be used as an essential tool that activates students' desire to learn and recall information. Lessons and information presented can be put to rhythm and an active approach can be a daily part of students' lives. And lastly, classrooms can be a place where students can be allowed to express themselves using the universal language--music.
Teachers realize their classrooms are filled with students of varied abilities and are to be places where students of all abilities can learn. Creating a stimulating learning atmosphere through music enhances the cognitive learning of middle school students.
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