A Study of the Relationship between Sixth Graders' Music Learning Experiences and their Academic Achievement

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Abstract

The purpose of this study was to determine the relationships between children's music learning experiences and their school academic achievement based on the theory of Multiple Intelligences. Some relative studies of the relationship of music instruction and academic achievement provided the supporting information of this study.

A quantitative multiple regression statistics method was used in examining the relationship between independent and dependent variables through the procedures of data collection and statistic analysis. The follow-up interviews were then conducted with a school principal and a music teacher about the music environment of the school and the general music curricula. A review of the literature from the research results of neuroscience, psychology, and music education served as the basis for constructing the discussion on the benefit of music education.

The main finding of this study indicated that more than two years of music learning experience and keyboard instruction enhanced learning standard subjects in reading, language, and mathematics of 6th graders at a local elementary school in northern Idaho, U.S.A.

Keywords: music learning experiences, Multiple Intelligences, music education, academic achievement

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Introduction

The ways of experiencing and knowing music have been discussed during the past three decades. However, at the beginning of the 21st century there is sufficient research to yield a new view of music education, such as the view of a child's ability to appreciate music starts with the parents' lullaby. By hearing the lullabies, a child begins to become attentive to music. It was seen that music may be a starting point for developing certain intelligences (Glausiusz, 2001).

Some researchers indicated that well-developed spatial intelligence is the ability to distinguish the visual world precisely, to form mental images of physical objects, and to recognize variations of objects (Graziano, Peterson, & Shaw, 1999; Rauscher, Shaw, & Ky, 1993). They theorized that spatial reasoning abilities are important for higher brain functions of music, complex mathematics, and chess.

In addition, research (Yun Dai & Schader, 2001) has shown that parents support their child's music training because they want their child to enjoy the benefits of music. Some parents appreciate the aesthetic qualities of music and how it may enrich their child's inner life, while others engage their child in musical training because they would like them to be well rounded. Other parents believe that music training will enhance their child's academic learning and performance, discipline, diligence, intellect and intelligence. However, could music do more than expressing emotions? Would it also be a factor in developing one's intelligence?

Gardner (1983) asserts that each individual has his/her own dominant intelligence:

"An intelligence entails the ability to solve problems or fashion products that are of consequence in a particular cultural setting or community" (p. 47). Later, Gardner (1993b) offered an additional definition of intelligence in his book, *Multiple Intelligences*: "Intelligence is a biopsychological potential" (p. 51). The gesture of precocious biopsychological potential is recognized as involving intelligence.

Owing to general beliefs on the importance of music training for a child, the significant relationship between a child's academic achievement and his/her experience with music training should be explored.

Significance of the Study

Music has played an important role in many persons' lives, especially in early childhood. Generally, music was sought as entertainment or as an emotional outlet.

Actually, music could be another type of language that human beings use to communicate and expressed their spirit and soul. This second human language was performed with the components of the human vocal track and musical instruments. In addition to the function of communication, music may engage a human being's intelligence. Research showed that music did more than work on our emotions; it was also an important factor in developing intelligence (Lang, 1999).

Based on the comments of previous researchers and the theory of multiple intelligences, this study explored and examined the theoretical framework in a general population of elementary students. From a practical standpoint, this study may contribute to the determination of the value of music education.

Purpose of the Study

The purpose of this study was to examine whether or not a relationship between music learning and the academic performance of selected 6th graders. This research focused on the relationship between independent variables (length of music learning, instrumental music learning and the place students took the music lesson) and the dependent variables (academic achievement test scores on reading, language, and math) through the procedures of statistical analysis. The relationship between keyboard learning (independent variable) and academic achievement on math, reading, and language (dependent variables) was analyzed independently.

Research Questions

To facilitate the study, the following research questions were examined.

1. Is there a relationship between the place students have the music lessons and their achievement scores?
2. Is there a significant difference in school achievement for students who have developed finger dexterity through instrument learning experience and those who have non-dexterous instrument learning experience?
3. Is there a relationship between length of music learning experiences and achievement scores?
4. Is there a significant difference in school achievement for students who have keyboard learning experiences and those who do not?

Delimitations of the Study

1. This study was delimited to participants at an elementary school in one northern Idaho city in the United States.
2. This study's participants were delimited to general classroom students.
3. Interpretation of the study was delimited by use of intellectual theories to narrow the focus and aid in structuring and reporting the results.
4. Other interrelated factors of enhancing the development of achievement such as household income, learning attitudes of an encouragement provided by parents, and parents' educational level were delimited in this study.

Limitations of the Study

1. Small sample size limits generalizability.
2. The sample consists of students from elementary schools in a local school district, which may or may not be representative of the entire population of same age children.
3. This study does not establish cause and effect relationships between variables.
4. Students with higher intelligences may not put out effort to achieve at a higher level.
5. Success in many complex activities can probably be achieved in different ways.

Literature Review

Literature review has documented a portion of the information about brain development, the neuronal function of learning, and subject's cognitive processes in the brain. Based on the theory of Multiple Intelligence, the review of literature demonstrated how research has connected different intelligences in the music neuronal science field. The concepts of brain responsiveness to musical stimuli and patches of cerebral cortex committed to language and mathematic functions have all been related to music learning. However, the literature demonstrated that there were limited studies in examining the practical evidence of those connections.

Intelligence Theory

Intelligence

Rogers (2002) said that "a gifted child need not necessarily be gifted across the board or in all areas. A child may be very advanced in reading or mathematics but may be average in some other areas" (p. 4). Howard Gardner (1993b) indicated that "individuals can be gifted in any area that is recognized as involving intelligence"(p. 51). An individual, who advances knowledge quickly in a specific area or domain, is identified as "gifted".

Bouchard (1999) described animal-learning theorist N. J. Mackintosh's interpretation of human intelligence: "Intelligence is an enduring human characteristic that it is causally related to many real life conditions, and is of personal and social importance" (p. 922). From Mackintosh's point of view, Charles Spearman's *g* factor (IQ score) is the hypothetical measurement of human intelligence. He argued that it is only the consideration of scientific importance. "We have no theory of cognitive development that explains how environments shape different children's different IQ scores" (p. 922).

Multiple Intelligences

Howard Gardner (1983), professor of education at Harvard University, describes the characteristics of his Multiple Intelligence (MI) theory in *The Frame of Mind*. He noted that each individual has his/her own dominant intelligence and argued that "nearly anyone who is not brain damaged can achieve quite significant results in that intellectual realm" (p. 47). He believed that there is a biological link to a particular intelligence. For example, an autistic child who can play a musical instrument beautifully but who can not speak (Gardner, 1993b).

From Gardner's (1993b), he defined intelligence as the manifestation of engagements between two competences:

> (a) Individuals, who are capable of using their array of competences in various domains of knowledge; and (b) the societies that foster individual development through the opportunities they promote. (236)

Consequently, he names eight different intelligences to explain a range of human potential in children and adult. These intelligences are

1. Visual/Spatial Intelligence

   The ability to perceive the visual is processed in spatial-temporal reasoning, transforming mental images in space and time.

2. Verbal/Linguistic Intelligence

The ability to use words and language.

3. Logical/Mathematical Intelligence
   The ability to use reason, logic and numbers.
4. Bodily/Kinesthetic Intelligence
   The ability to control body movements and handle objects skillfully.
5. Musical/Rhythmic Intelligence
   The ability to appreciate, perform and create music.
6. Interpersonal Intelligence
   The ability to relate and understand others.
7. Intrapersonal Intelligence
   The ability to self-reflect and be aware of one's inner state of being.
8. Naturalist Intelligence
   The ability of a mastery of taxonomy (classification).

Neuroscience

During the decade of the 1990s, neuroscientists began to study the connection of Multiple Intelligences (MI) and brain function extensively (Weinberger, 1998). The notion of Gardner's (MI) theory has emerged from brain based research. The brain is a complex learning organ. Studies on the tracking of music stimulation in the brain could lead to a more widely drawn view of intelligence, and they may present support for a relationship between music learning and the enhancement of brain function.

Hodges (2002) evaluated the importance of brain development based on several studies. He concluded that the sensory environment is important for neuronal connections because it facilitates the interconnections among brain cells. A study by Olsho, Trehub, Bull, and Thorpe (as cited in Hodges, 2002) found that children raised in a rich sensory environment make more neuronal connections of the brain than those raised in an impoverished sensory environment.

Music and the Brain

Research studies that investigate the relationship between music and brain function have been developed since 1980s. Listening to music and appreciating music is a complex process that involves memory, learning and emotions. Some research has suggested that music is processed by the right cerebral hemisphere and the left hemisphere is also important in music production. It is likely that there are multiple areas of the brain that are important for the musical experience (Weinberger, 1998).

Frances Rauscher and her colleagues studied the effects of music training in 3- and 4-year-old children. They had one group of children in music keyboard training,

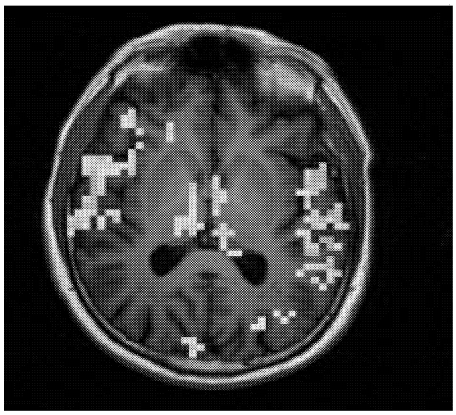
the second group of children received singing training, and another matched group received equally frequent private computer lessons. Students were given a spatial-reasoning test before and after training. Test scores revealed that the keyboard group showed significant improvement, while the computer group and the singing group showed no improvement on the test. The researchers indicated that keyboard training has a specific effect on the spatial-temporal. They also suggested that music keyboard training can enhance learning standard subjects such as mathematics and science, for which spatial-temporal reasoning is particularly important (speakers Cohen, 1997).

Leng and Shaw (1991) proposed that "music may be considered a `pre-language`, early music training may be useful in `exercising` the brain for certain higher cognitive functions."(¶. 1) According to their examination of neural theory, higher brain functions involve the temporal evolution of neural firing activity. Further, they suggested that music stimulation is a useful neuronal model of coding higher brain function in understanding higher creative cognitive processes. Moreover, Bodner et al. (2001) indicated that listening to particular music enhances brain function especially in spatial-temporal reasoning. Furthermore, early musical learning experiences imprint the potential for changing brain organization (Hodges, 2002).

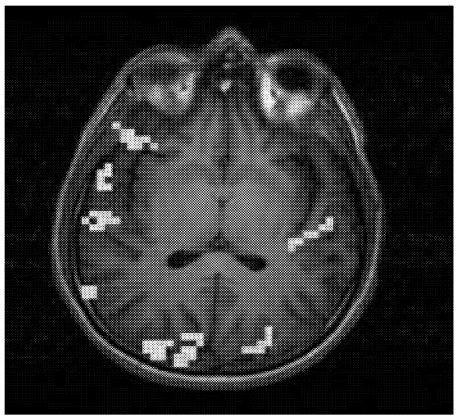
Elbert, Pantev, Wienbruch, Rockstroh and Taub (1995) studied the part of the cerebral cortex which receives sensory input from the fingers. They reported that the amount of cortex response when the left-hand fingers of string players were stimulated was greater than those who are not string players. They suggested that learning to play a string instrument at an early age produces a relative increase in the size of an involved part of the brain.

As McMillan (2003) reported, Michael Thaut and his coworkers conducted a preliminary study in brain mapping of a professional musician and an engineer. They used Functional Magnetic Resonance Imaging (fMRI) to monitor the brain activities of a professional musician and an engineer while the Brahms symphony played. Significant activity resulted in both hemispheres of the musician's brain (see Figure 1). In the engineer's brain, there was activity in the left hemisphere but very little activity in the right hemisphere.

Figure 1. Significant Differences in Brain Activity



Extensive activity in a musician's right and left brain while music is being played.



Less activity is shown in the engineer's right brain while music is being played.

Gaser and Schlaug (2003) found that the gray matter volume of the brains of professional musicians (keyboard players) and non-musicians differs in motor, auditory, and visual-spatial brain regions. They believe that those differences may represent a structural adaptation in response to long-term skill achievement and the repetitive practice of those skills. They also specify that their hypothesis is supported by strong association data of structural differences, musician status and practice intensity, in showing structural changes in response to long-term motor training.

In another study regarding the pianist's brain function of music processing, J. Haueisen and T.R. Knosehe's investigated the dynamics of brain activation in pianists during music perception. They found that there is an activation of the cortical motor areas when listening to music (as cited in Meister et al., 2003). Meister and colleagues used functional magnetic resonance imaging (fMRI) to investigate the cortical network, which mediates music performance compared to music imagery in 12 music academy students playing the right hand part of a Bartok piece. All students had piano as their principal instrument. In their analysis of the fMRI data, the sensorimotor cortex areas in the left hemisphere were activated.

Music and Achievement

Research indicated that music instruction promotes academic achievement. Horn (1983) referred to many studies which have shown that test scores rose when the arts

were added to curricula. One of the studies showed that music students at one Saddleback Valley High School held higher grade point averages (GPA) than non-musicians in the same school in 1981-1982. Music students GPA averaged 3.57. Non-music students GPA averaged 2.91. Further, 5% of non-music students held 4.0 GPA, while 16% of the music students held 4.0 GPA.

Dr. James Catterall (1999) of UCLA analyzed the school records of 25,000 students. He found that students who studied music had higher grades, scored better on standardized tests and reading proficiency exams and had better attendance records. When he factored in economic status he also found that students from poorer families who studied music improved their overall school performance at the same rate or faster than all others.

A more recent experimental study by Ho and colleagues (2003) found that ninety right-handed boys ages 6 to 15 with music training had significantly better verbal memory than children without such training. Forty-five of the participants had musical training. They were members of the Band and Orchestra Program of the school, and they had lessons in playing classical music with Western instruments for at least 1 hour per week provided by professional instructors from the Hong Kong Academy for Performing Arts. The rest of the participants had no such musical training. The results of their study suggested that the beneficial effect of music training on verbal memory can be verified in individuals with less than six years of music training. A positive correlation between the duration of music training and verbal memory was found.

A study of the relationship between music training and adolescents' mathematics achievement was presented by Cheek (1999). Out of a total of 113 students who received music lessons at school, 36 also had private music lessons while 77 did not have private music lessons. They all had taken the Iowa Tests of Basic Skills near the end of eighth grade. The investigation found that 20 of the 36 students who received private music lessons with two or more years had a significantly higher mean mathematics score than the 77 students who had no private music lessons ($t = 5.72$, $p < .001$).

Methodology

The purpose of this study was to investigate whether the length of music learning, type of instrument learning, place of music instruction, and piano instruction were related to 6^{th} graders' academic achievement in reading, language, and mathematics.

Data were collected from the school principal with the permission of the superintendent of the school district, and questionnaire about music learning

experience was developed for 6th grade students (N = 42). A quantitative multiple regression statistics method was used in examining the relationship between independent and dependent variables through the procedures of data collection and statistic analysis. The follow-up interviews were then conducted with the school principal and the music teacher about the music environment of school and the general music curricula.

Instrumentation

Survey Questionnaire

A survey questionnaire was constructed for the participants regarding their music learning experience. Participants were surveyed about their music training in terms of whether or not they had music learning experience, the type of musical instruments they played, the number of years students had received training, whether private lessons were received, whether students joined group music learning, and their amount of practice time.

Idaho Standards Achievement Test (ISAT)

The Idaho Standards Achievement Test (Achievement, 2003) served as the data for the dependent variable. ISAT is a standardized test designed to evaluate student achievement in the areas of math, reading and writing, along with Idaho State Achievement Standards. Those standards are the minimum standards to be used by school districts in the state in order to establish a level of academic achievement necessary to graduate from Idaho's public schools (¶. 1).

Participants

The selected sample are 6th grade students at an elementary school in a town in northern Idaho. A total of 45 students answered the questionnaire, and 42 of them had ISAT achievement scores on record. Thus, there were three participants eliminated due to missing scores from the data analysis. Only those participants with the complete ISAT scores were included.

Interviews

The interviews conducted with the school principal and the music teacher regarding the school music curriculum, the school musical environment, and any music group or band in the school. According to the school principal, all students in first through the sixth grade received choral music lessons twice a week, and fourth

through sixth grades played the recorder during music lessons as well. Moreover, the music teacher also taught students how to play on a keyboard. They had an all-school performance once a year, but did not engage in any music competitions at school. The school formed a band and a string groups and met twice a week. Students did not have individual lessons.

Statistics Analysis

All the data were ranked and tabulated on a PC computer using, Statistical Package for the Social Science (SPSS) for Windows, Version 11.0 for Multivariate Analysis of Variance statistical methods, and Statistical Analysis System (SAS) for observed frequency description.

Level of Significance

The level of significance, type I error, is the probability of rejecting the null hypothesis when it is true. Most social science researchers agree that α equal to 0.05 is a reasonable level for accepting reliability in human subject research. Based on the statistical value which has been generated through SPSS, we have to accept the hypothesis when the alpha level is above 0.05.

Findings and Discussion

By observing the data related to the percentage of students with high and low standard ISAT score averages, it can be seen from the descriptive statistics that students who had either dexterous instruments, keyboard instruction, private music lesson, or more than two years of musical learning experiences had a higher distributed percentage in the high level of standardized reading, mathematics, and language tests within their group.

However, by answering the research question one, there was no significant difference found between the ISAT reading, math, and language scores of students who did and did not receive private music lessons.

For answering question two, no significant difference was found between students with different instrumental learning and the ISAT scores on reading, language, and math.

One of the main findings of this research was on the question three, the relationship between length of music learning experience and ISAT reading and math scores was significant, but language was not. There were significant differences found

between the years of experience and the dependent variables of reading and math. For the measures of reading, the *F* value was 4.406, *p* value was equal to 0.042 < 0.05 of alpha level, and math with a *F* value equal to 5.082, *p* value was equal to 0.030 < 0.05 of alpha level. It was concluded that there were significant relationships between length of learning music and ISAT reading and mathematic scores.

Moreover, the other main finding of this research supports the important role of keyboard learning. Relationships between keyboard learning and ISAT reading, language, and math were found. There were significant differences found in the keyboard variance on the dependent variable of reading, the *F* value equal to 4.378 and the *p* value equal to 0.043 < 0.05 of alpha level, language, the *F* value equal to 8.276 and the *p* value equal to 0.006 < 0.05 of alpha level, and math, the *F* value equal to 8.047 and the *p* value equal to 0.007 < 0.05 of alpha level.

This result supported previous findings by Graziano (1999), who has indicated that taking piano lessons improves specific math skills of elementary school children. Moreover, this finding also supported Rauscher's (1997) suggestion that music keyboard training can enhance learning standard subjects such as mathematics and science, which is based on her researches of music and the spatial-temporal reasoning function of the brain.

Discussion

Music played a role in the development of children from the earliest vibration of the first lullaby. It entered a child's life from experiences in the family, from the media, as part of religious worship, in the school curriculum, and in play. In addition to its vast social value, recent research suggested that music is also important for intellectual development. As Dr. Shaw (n. d.) noted in the internet front page of the M.I.N.D. Institute website, "Music will not only help us understand how we think, reason, and create, but will enable us to learn how to bring each child's potential to its highest level" (¶. 1).

Music education is a lifelong process involving students at all levels. Music is an academic subject with its own special body of knowledge, skills, and unique ways of knowing and thinking. It is also widely believed to have many benefits for children beyond those within the realm of music itself. These benefits are thought to contribute importantly to development by improving intellectual, motor, and social abilities and skills.

As Weinberger (1998) said " since musical competency is part of our biological heritage, part of human nature, we should not continue to treat it as a frill" (p. 38). When school systems make the decision to reduce or eliminate music from the

curriculum, the benefits of music for brain development could be a part of the consideration.

Music teachers who are now struggling to maintain minimal program offerings may be on the edge of a significant change in the attitudes of administrators, school boards, and parents with regard to the importance of studying music. Due to the struggles of the music educator, there has been an increasing amount of neuroscience research, which has indicated a blooming awareness in the areas of brain development and music. Thus, empirical supporting the notion that music is a unique mode of knowing.

Still, the music teacher must be concerned with the effectual basis for convincing people of such a notion. As Dr. Rauscher said in an interview on National Public Radio's program, "Science Friday" (1997), " What we think music is doing is stabilizing the neural connections necessary for this kind of spatial-temporal ability," she also clarified that there is little evidence to suggest that just listening to music produces lasting intellectual benefits. She continued " I think the evidence is solid enough to say, 'Let's improve and expand our music education programs for young children.' One of the things we have to be careful about is jumping to conclusions that we don't have data on at all."

Conclusions

The main theme of this research was to determine the benefits of music education in children's intelligence. Several relationships between music learning and cognitive achievement were found in this study. Biological evidence has suggested that if children develop some kind of mental skill involved in one area of learning, and if they need that skill in some other area of learning, the brain can, at least on occasion, make learning easier through transfer.

Based on the small sample size and the variances among the seven variables, the data analysis and statistical treatment showed the tendency that when one had music instrument instruction more than two years, he/she also had a higher ability in reading, language, and mathematics.

From the results, this study suggested that early music learning benefits children's cognitive growth. The value of music education in a child's academic achievement is important.

Recommendations

By studying the effects of music, neuroscientists may discover additional facts about the brain. Musical insights into the human condition are uniquely powerful experiences that cannot be replaced by any other form of experience. It is important for music educators to keep abreast of new findings in applied fields as the reverberation of the musical neuroscience research progresses.

Music should not only be taught in school music classes but also widely applied in other subjects in a teaching model. Additional study is needed in correlating music with the development and understanding of multiple intelligences.

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小學六年級學童音樂學習經驗與學業成就相關之探討

黃慧娟*

摘要

本文之研究目的是根據多元智慧理論來探討兒童的音樂學習經驗與其在學校的學習成就之關係，音樂學習與學業成就之相關理論與文獻亦作爲本文之論述。

本研究採用量質性混合之研究方法，文獻探討範圍包括神經科學、心理學和音樂教育方面的研究並根據研究結果架構出音樂教育的益處之討論。

根據研究中主要之發現指出，兩年以上的音樂學習經驗與接受鋼琴的教學，加強了美國愛達荷州北部地方小學六年級學生在閱讀、語言及數學主要學科的學習標準。

關鍵字：音樂學習經驗、多元智慧、音樂教育、學業成就

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