Measure to Measure: Additional Lengths

Using Educative Music Therapy to Increase the Math Aptitude and Social Competency of the Forgotten Middle

by

James D. Heiskell

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Graduate Supervisory Committee:

Barbara Crowe, Chair
Robin Rio, Co-Chair
Michael Mc Beath

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ABSTRACT

Educators and therapists must unify and formulate new strategies to address the academic and social needs of a newly emerging at risk demographic, "the forgotten middle." Currently, a paradigm shift within educative music therapy, human development study, and educational psychology, suggests that curriculums need to integrate alternative methods into their framework, change the definition of at-risk, and recognize math aptitude and social competency as predictors of a student's ability to gain upward mobility and self-sufficiency.

Musical interaction, although considered a secondary measure within educational forums, is a viable means to address the socio-emotional and academic needs of students. In order to substantiate the need for educators to integrate educative music therapy and social competency programs into standard curriculums, the researcher conducted a study using 23 students from a beginning high school guitar class and 4 students from a high school after-school program. These students participated in a ten-week study involving educative music therapy, social competency, and math aptitude.

Participants completed the math fluency and math calculations sections of the Wechsler's Individual Achievement Test version 3, along with a questionnaire examining the participants' beliefs about the influence of music on math aptitude and social competency. Although the pre- and post-test results show no statistically significant difference between educative music therapy and math aptitude, the results from the questionnaires administered suggest that students

perceive that social competency and musical interaction augment academic and social performance.

DEDICATION

This work is in dedication to Dr. Theria Beverly, a leader in education, a Mother, and Grandmother, Chester A. Beverly, a Groundbreaker, Father, and Grandfather, Cecelia Heiskell an educator, Mother, and Grandmother, Aunt Darlene Holloway, Uncle Rick Heiskell, Aunt Elaine and Gilbert Don Lee.

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Chapter 1

INTRODUCTION

Erikson (1968) proposes that identity formation is most important during the first twenty years of life. During these critical stages of development, high school and college students are most vulnerable to the negative affects of environmental stressors. These stressors later influence youth and young adult's emotional stability, academic achievement, and vocational opportunities. To gain further insight into the challenges high school and college students face, Rutter (1981) proposes that when multiple life transitions occur in a relatively short time frame, individuals are placed at an increased risk for social, emotional, and developmental challenges. High school and college age individuals are either transitioning from high school to college or college to the work force and within this transition, multiple environmental stressors place them at risk. In support of Rutter's analysis, Hetherington and Anderson (1987) suggest that additional environmental stressors more negatively affect adolescents and young adults who are already undergoing multiple developmental challenges.

Each one of the above mentioned human development researchers present evidence in support of the conclusion that youth and young adults are naturally predisposed to at- risk factors. From this position of vulnerability, even the slightest changes within social systems, financial markets, and increased environmental stress, greatly minimize the development of youth and young adults. This stymied development results in increased prevalence of mental health issues, downward mobility, and substandard academic achievement. As a result of

the most recent economic downturn, it is important for educators and therapist to recognize that youth and young adults are at an increased risk for down ward mobility and formulate interventions to remediate the negative effects of increased environmental stressors.

In response to rising levels of at-risk individuals, Hawkins, Catalono and Morrison et al. (1992) propose that "approaches that seek to achieve increased resilience, increased social competency, promotion of cognitive and emotional competence, and fostering of pro-social norms are most effective in remediating at risk criteria in youth and young adults" (Hawkins, & Catalono et. al., 1992, p.110). The WT Grant Consortium (1992) presents similar evidence suggesting that the promotion of children's social, emotional, behavioral, and cognitive development is key in minimizing at- risk factors. Wiesberg and Greenberg (1997) present additional research suggesting that "changes in socialization forces that historically nurtured the development of children, especially the family, necessitate the re-conceptualization of school and community practices to support the family in its mission to increase the success rate of youth" (Wiesberg & Greenberg, 1997, p. 99).

In order to understand Weisberg and Greenberg's (1997) proposition it is important to examine the methodology and ideology behind previous efforts to address rising levels of at-risk individuals. For example, Catalono, Berglund, Ryan, Lonczak and Hawkins (2004) explain that early prevention programs from 1950 to 1980 were single dimensional in focus and not based on research. As time progressed researchers took note of the uni-dimensional framework of youth

intervention efforts in the “mid 1980’s, and from this shift in focus a general consensus formed that successful transition into adult hood requires more than avoiding violence, drugs, school failure, and precocious sexual activity” (Catalono, Berglund, Ryan, Lonczak, & Hawkins, 2004, p. 100). From their historical analysis of the evolution of positive youth support programs, Catalono, Berglund, Ryan, Lonczak, and Hawkins (2004) propose that researchers must utilize new frameworks and isolate new variables in order to increase the effectiveness of positive youth support programs. Catalano (2004) and colleagues propose that resilience, social competency, cognitive, and emotional competence are each involved in positive youth support. From this analysis and shift in focus within human development study, it is more important than ever to build upon previous knowledge and apply new techniques to examine the consequences of current environmental shifts on the development of students.

Shelly (1992) proposes that changes in economic systems, family dynamics, financial stability, and social stratification are each factors that influence youth and young adults. From her research, she presents supportive evidence showing that students are currently at an increased risk for downward mobility, because their home environments are less financially supportive. In agreement with the sentiments of Shelly (2002) Marsh and Kleitman (2005) suggest that social class and financial means are limiting factors that separate individuals in regards to upward mobility. They further explain that low-income students are forced to choose between school and work at younger ages, which makes them less prepared to compete in a competitive job market. Utilizing a

similar premise, Bozik (2007) proposes that "parental financial support and better access to quality education, later enhances affluent youth's ability to gain acceptance into universities; thus, placing them closer to self sufficiency" (Bozik, 2007, p. 262). Bozik's research suggests that wealthy families have means to provide private school education, tutoring, and extracurricular activities, which increases one's likelihood of achieving academic success. Unfortunately, individuals from middle or lower class backgrounds are less fortunate.

Due to financial constraints, public school education is often the only option for educating youth from less fortunate backgrounds. This occurrence creates a system wherein middle class and lower class students have less access to higher educational forums, which increases their vulnerability to environmental stressors. Due to financial constraints affluent, middle class, and low-income individuals have unequal access to education and advancement. Schoenhals, Tienda and Schnieder (1998) explain this occurrence through the decision to work hypothesis, which suggests that poor performing students who are disengaged from the learning process and have few socioeconomic resources come to see education as less important to their future. Verik (2009) explains that as a result of disengagement from the learning process more people are placed on the fringes of society, which causes crime rates, mental health issues, drug usage, and social unrest to increase.

The analysis of Verik (2009) supports the conjecture that regardless of race and social position anyone who becomes disengaged from the learning process is at- risk. From this conclusion educational forums must recognize that

minorities and low-income individuals represent a small portion of the vast amount of people who disengage from the learning process. If this concept is not understood, more middle class students will suffer negative consequences of mental health issues and poor academic achievement because, focus is placed primarily on minimizing the complications of minority and under privileged individuals. Minority and low income individuals are important. However, from this outdated view point strategies to assist new at- risk demographics, specifically “the forgotten middle,” are not in place. Le Compte and Goebel (1987) and Franklin and Streeter (1995) suggest that middle class families and students do not receive the mental health support and educational opportunities they need to buffer the effects of increased social stressors.

During the late 1980’s and mid 1990’s Le Compte and Goebel (1987) and Frankiln and Streeter (1995) proposed that middle class students were dropping out and were not being recognized as at-risk students, because they did not meet the current at- risk criteria. Since this finding, Sulivan (2000) further explains that middle class students still are not recognized as at-risk even though they are subject to similar social and economic stressors as those who are traditionally considered at- risk. Through her research, she proposes that divorce, job loss of parents, and increased middle class debt are more current at-risk factors. Le Compte and Goebel (1987), Franklin and Streeter (1995), and Sulivan (2000), each present evidence that at-risk criteria need to be redefined in order to account for current changes in family dynamics, financial markets, and social systems.

In order to build a more comprehensive understanding of the connection between current environmental changes and at-risk factors, Franklin (1994) explains the historical implications involved in defining the term at- risk. She states that in the 1800's, American educators referred to children who did not adjust to academic and social demands of public schools as "backwards" or "mentally deficient." Franklin's research highlights that due to limited research methods and misguided analysis, the specific environmental factors and cognitive deficiencies involved in "backwardness" were not accurately accounted for by previous educators. Franklin (1994) further explains that term "backwardness" lost appeal and medical professionals and educators began to use the label "character impulse disorder" instead to describe the behavior of children who did not meet the same standards as well adjusted children. Due to less sophisticated research paradigms during the 1800's, educators and therapists operated under a limited scope of practice. Unfortunately, the remnants of outdated methods and misguided analysis within education are still seen in the current usage of the term at- risk. For example, the term at-risk is frequently used by educators and therapists, but the end of the thought is often unfinished. If the statement is left at "at risk" and the "for what" section is not defined, the term loses specificity. What is it that youth are at risk for?

Frymier and Gansneder (1989) present data from *The Phi Delta Kappa Study of Students At- Risk* and express that academic success is only one portion of at- risk criteria. "If a student fails a course, is retained a grade, or drops out of school, they are at- risk, likewise, if a student uses drugs or suffers from

emotional issues, they are at- risk" (Frymier & Gandsneder, 1989, p 143). The *The Phi Delta Kappa Study of Students At-Risk* illustrates that children are not the only at- risk demographic, finance is only one portion of at- risk criteria, and racial implications do not always denote at- risk factors. The research of Frymier and Gansdneder (1989) along with various other researchers proposes that the old definition of at-risk is limited and should be expanded past racial and financial parameters.

In accordance with this sentiment, Levin (1988), Swanson (1991), and Bracey (1997) state that the term at-risk is most frequently used to explain risk for school failure. They propose that deficiencies in basic academic skills often interfere with further academic success, eventually creating a cycle of failure that usually results in school dropout. Robinson (2004) is in agreement with the belief that academic success is an at-risk criteria. However, she explains that although academic success is important, "we must not generalize at-risk students inaccurately or inappropriately based on preconceived notions (Robinson, 2004, p. 11). Robinson's (2004) conjecture supports the need for a more comprehensive view of at- risk factors. Her work represents a shift in focus wherein researchers move away from traditional explanations and investigate additional at-risk criteria. For example, the increasing technological demands of the work force accompanied by the steadily declining rates of math aptitude among American high school students creates an environment wherein those who lack numeracy skill are predisposed to developmental complications. This conclusion is supported by examining the chain linkage of events involved in academic

achievement and human development. Through this analysis the increasing importance of standardized test scores in math is apparent.

More recently standardized testing gained greater influence in a student's ability to move forward. This idea is further supported by Heubert and Hauser (1999) who present evidence that a student's performance on standardized tests is currently the most influential variable predicting their movement towards self-sufficiency. Piere, Moran and Lutkus (2005) use evidence from the National Assessment of Educational Programs to highlight the increasing importance of math aptitude for American students. The NAEP reports that The National Mathematics Panel was created in 2006 with the purpose of promoting the furtherance of math and scientific reasoning in young Americans. This intervention by a government appointed initiative suggests that math aptitude is recognized as an additional at- risk factor for American students. Outside of the consequences students receive from substandard math aptitude, on the larger scale, the research presented by the National Mathematics panel suggests that math aptitude is a crucial component involved in the economic growth of our nation. Less math literate citizens translates into less opportunity for our economy to flourish, do to less technological advancement, less scientific research, minimized ability to conserve resources, and minimized generation of revenue.

To further explain the importance of math aptitude for students, Reyna and Brainerd (2007) analyzed national surveys and concluded that Americans are not proficient in math and lack the numeracy skills needed for tasks in everyday life. They report that "inadequate numeracy skill is correlated with poorer health

outcomes, less accurate perceptions of health risks, and compromised ability to make moral decisions" (Reyna & Brainerd, 2007, p. 147). Through examining academic curriculums, Sciara (2010) explains that math aptitude is a predictor of later college success for high school students. He proposes that individuals who surpass Algebra 2 in high school are placed on an academic track that provides them better outcomes in college years. Sciara (2010) proposes that students are twice as likely to finish their bachelor's degree if they complete Algebra 2. Sciara's analysis of the relationship between Algebra 2 and college success suggests that further investigation into the structure of standard curriculums, and increased examination of the long term outcomes of current educational approaches are in need.

To address this issue, research suggests that along with math aptitude, social competency is an additional predictor of at- risk factors for students. Weisberg, Caplan, and Sivo (1989) and Caplan et al. (1992) explain that social competency is an individual's ability to successfully combine various interpersonal skills in order to facilitate positive social interaction and regulate emotional and environmental stressors. Archer (1989) and Elias (1997), give a more detailed explanation of social competency wherein social competency and achieved identity are correlated with autonomy, self esteem, mature intimacy, and internal locus of control. They further explain that socio-emotional competencies have a broad impact on social functioning, because they are predictive of an individuals' ability to handle conflict non-violently. From this analysis it is plausible to determine that outside of academic achievement, positive personality

traits such as autonomy, internal locus of control, and achieved identity are factors that increase one's ability to minimize developmental complications. To further explain the importance of social competency, Cohen (2002) expresses "the current overemphasis on test scores is inadvertently retarding academic achievement and preventing future generations of young people from developing the ability to be active engaged members of democracy" (Cohen, 2006, p. 233). He even goes as far to say "if federal and state policy makers and schools continue to ignore social emotional competencies this amounts to a human right violation" (Cohen, 2006, p. 228).

To further support this conclusion, Nowki and Duke (2004) in their article *Reducing the Drop-out Rates of At-Risk High School Students: The Effective Learning Program (ELP*), "utilized an effective learning program to teach students how to build better social interaction skills and gain increased forms of internal locus of control" (Nowiki & Duke, 2004, p.225). As a result of their efforts, Nowiki and Duke present evidence that the students who received the effective learning intervention were more likely to graduate and attained higher forms of internal locus of control, as shown by standardized tests. Unfortunately, not all educators believe in the importance of social competency within standard curriculums. Social competency is seen as less important within standard curriculums because, "social competency cannot be accurately assessed through norm referenced tests" (Watterhouse, 2006, p. 249). Due to this sentiment, educational forums do not emphasize the importance of social competency to students, causing more individuals to be in jeopardy of limited success due to

being left without skills to overcome emotional, academic, and developmental complications. From this conclusion, in order to decrease the vulnerability of students to at-risk factors, re-evaluation of at-risk criteria along with utilization of alternative approaches is in need.

Mason and Chuang (2001) explain that alternative approaches such as after school programs are effective, because they evolve and continue to incorporate contemporary strategies into their framework. Mason and Chuang (2001) further explain that although afterschool programs, educative music therapy, and social competency training interventions are primarily viewed as secondary measures, these efforts are often equally effective as primary measures, because they are more forward thinking and more inclusive in their orientation. Alternative measures tend to examine a broader spectrum of the students experience in and outside of the classroom. Due to the success of after school programs and various other forms of alternative measures, research suggests that educators and therapist may be more successful in remediating at- risk factors for youth if they incorporate secondary measures into primary education efforts. This will give youth more opportunity to succeed through utilizing intervention that is both academic and therapeutic. To support this conjecture, Chong (2010) suggests that the beneficial effects of after school programs are augmented when educative music therapy is used.

Chong (2010) explains that music therapy is the usage of musical interaction to support the academic achievement of students. Chong explains that students who present behavioral issues within academic settings are often isolated

by teachers as being sub standard students and a nuisance to the class. Educative music therapy addresses this occurrence by giving students opportunity to engage in goal directed activities that are engaging yet educational. From this point of reference students are given secondary forms of education that help reformat previous mal adaptive behavior patterns. Chong utilized educative music therapy techniques with students who were seen to be at-risk due to behavioral issues in the classroom. Her research suggests that at the end of the sixteen week study, the participants scored higher on the *Social Skills Rating System* and presented less problem behaviors while in the classroom. To support this conclusion, Henderson (1983), Montello and Coons (1998), and Rickson and Watkins (2003) present evidence in accordance with the sentiment "educative music therapy benefits students who underachieve and present behavioral problems, because music is an auxiliary strategy that enhances learning skills" (Chong, 2010, p.191).

The educational benefits of music are further examined by Catterall, Chapleau and Iwanga (1999) who present data suggesting that students who report high levels of involvement in instrumental music over middle and high school years show significantly higher levels of mathematic proficiency by grade twelve. This data suggests that students who show increased involvement in the arts display higher levels of academic achievement. For example, "by twelfth grade, youth who have no experience with music are at a greater disadvantage than youth who have intensive musical interaction" (Catterall, 1999, p. 6). McLelland (2005) presents additional evidence showing that music is able to help youth score better on language and math sections of standardized tests.

Administrators should take heed to the research findings of Catterall, Chapleau and Iwanga (1999), McLelland (2005) and Chong (2010), who provide evidence that interventions that increase the social and cognitive skills of students are beneficial, whether used as primary or secondary measures.

A classic example of educators realizing the importance of secondary measures within education is the storied history of the "Mozart Effect." In 1993 educators in Georgia created special initiatives to give students access to music in order to provide them with additional academic support. In 1993, Shaw et al. (1993) witnessed a ten point increase in college student's spatial temporal reasoning ability after listening to Mozart. After much publicity, this effect was then labeled the "Mozart Effect." Shaw (2000) explains that the Mozart Effect is a result of tapping into spatial temporal firing action potentials and manipulating them through music, to cause them to organize in a fashion conducive for higher learning. Shaw proposes that due to the time ordered nature of rhythm and symmetric relationship of music intervals, Mozart's music primes the neural firing patterns of the brain to organize into symmetric patterns; thus, increasing the brain's ability to learn and remember data. Rausher and Shaw (1997) conducted additional musical interaction studies with third graders who participated in ten minutes of keyboard instruction over a six month period. The results suggested that keyboard training improved the spatial temporal reasoning abilities of participants by thirty percent. After examining the data of both of the Mozart effect studies Rausher and Shaw concluded that neural pathways are

organized by musical interaction in such a fashion as to increase spatial and math reasoning.

As stated previously, the research of Shaw (1993) sparked the interest of academic forums and created opportunity for musical interaction to be seen as a valid way to address the academic needs of students. Unfortunately, more recently academic forums show decreasing interest in incorporating musical interaction into curriculums to supplement primary educational efforts. Even though the work of Shaw and colleagues is somewhat controversial, due to recent economic down turn, reexamination of previous efforts to increase the academic success of students is in need. The "Mozart Effect" trials were criticized for being loosely based on scientific findings; however Shaw's proposal that music increases cognitive function is currently being investigated by neural scientists. For example, Schlaug, Steinmetz, and colleagues (1995) at the University of Dusseldorf compared magnetic resonance images (MRI) of the brains of twenty seven classically trained right-handed male piano and string players with those of twenty seven right-handed male non-musicians. The MRI results displayed that musicians showed a larger planum temporal, which is associated with auditory processing of complex sounds.

Janata (2002), Janata and Grafton (2003), and Patel (2003) propose similar evidence showing that the discovery of differing neuro-anatomical structures between musician's brains and non-musician's brains offers evidence that music has the ability to reshape neural structures and increase cognitive abilities.

The findings of various neuroscientists supports the conjecture that interventions that utilize music to address social and academic needs of students are effective, because musical interaction influences motor areas of the brain, the ear and the, auditory cortex which are all implicated in the learning process. For example, Thompson and Andrews (2001) explain that Alfred Tomatis proposes that the ear is a vital organ for learning and can be systematically manipulated to increase brain functioning. Tomatis explains through his "three integrators model that the ear is neurologically aligned with the optic, oculomotor, trochlear, abducens, spinal accessory and, cranial nerves by coming under the control of the acoustic nerve, which is a major mechanism of reception and integration of perception" (Thompson & Andrews, p.184, 2001).

In sum, examination of research that surveys the developmental challenges students face and the distinct areas in which educators and therapist express similar concepts about the usage of alternative strategies within education is needed. This effort will facilitate increased professional dialogue and increase the effectiveness of alternative education interventions. Stepping outside of the traditional educational framework is necessary, because old methods are not yielding desired results. Academic skills in math are still wavering and students are more susceptible to mental health concerns due to lack of unity between mental health professionals and educators. Regardless of the differences between therapeutic and academic professional paradigms, therapists and educators must recognize that as environmental factors change causing new demographics to become at greater risk, there is an increased need to identify new at- risk factors,

and find agreement on the most effective way to integrate alternative measures into curriculums. This unification of efforts creates opportunity to form a common ground, which will inform further investigation into the full spectrum of youth development and education. From this premise, to examine if musical interaction increases cognitive performance and remediates at-risk factors for middle class students the following research questions are as follows:

1. Does educative music therapy influence scores on the math fluency section of the Wechsler Individual Aptitude test 3rd edition?
2. Does educative music therapy influence scores on the math calculations section of the Wechsler Individual Aptitude test 3rd edition?
3. Do students perceive that musical interaction increases math aptitude?
4. Do students perceive that music increases social competency?

Chapter 2 reports on literature examining: human development factors involved in successful transition into adulthood, social class factors and their relationship to upward mobility, forgotten at-risk demographics, the need to redefine the definition of at risk, and the No Child Left Behind initiative. In addition, the chapter reports on the implications of standardized testing in education, math aptitude, social competency, the usage of alternative approaches in education, educative music therapy, the "Mozart Effect" and neurological findings in music.

Chapter 2

LITTERATURE REVIEW

Because literature related to this research is complex, this chapter is divided into the following sections:

- Human Development
- Social Class Factors and Upward Mobility
- Current Definition of At-risk Youth
- Forgotten Demographics
- Need for New At-risk Criteria
- Current Educational Focus and No Child Left Behind
- Importance of Math
- Social Competency
- Alternative Approaches Within Education
- After School Programs
- Educative Music Therapy
- Mozart Effect and Instrumental Learning Studies
- Biological Differences in Musicians Brains
- Genetic Factors in Neural Plasticity
- Neuroscience finding and Music
- Transfer

Human Development

According to Brofenbrenner's (1979) ecological model of human development, development is seen as unfolding within a nested and interactive system involving the child, family, community, and beyond. This model suggests that examining the developmental challenges students' experience, along with the societal pressures that lessen their ability to properly develop, creates opportunity for effective interventions to be formed. Chikering and Reisser (1993) agree and propose that research examining human development and stage salient task formation is needed in order to create successful interventions for those at-risk. In regards to stage salient task formation, Muss, in his text *Theories of Adolescence*, (1996) proposes that "the late adolescent years, eighteen to twenty two are regarded as a crucial time for identity formation" (Muss, 1996, p. 25). Along with the importance of identity formation, Aber and Jones (1997) posit that when youth know how to solve problems with others they are more able to engage in school work, which lessens the negative effect of environmental stressors and increases student's ability to successfully transition into adulthood. From this conclusion they present additional evidence suggesting that something as simple as increasing identity formation can ameliorate dropout, lessen the achievement gap between races, and produce more productive citizens.

The major focus of traditional education is to produce more productive citizens. This effort is increasingly important, because human development research suggests that individuals between the ages of sixteen to twenty-five will represent a large portion of the population in twenty years. As a result of the increased number of individuals within this age group, if more focus is placed on

this demographic, educators and therapists have the opportunity to engage in early prevention, which will remediate at-risk factors of a quickly growing and highly influential demographic. The previously mentioned human development research supports the conclusion that high school and college age individuals are vulnerable to at-risk factors, due to multiple environmental stressors occurring in a short time frame. In sum, research supports the conjecture that interventions which promote identity formation, conflict resolution and interpersonal problem solving are needed within educational forums, in order to remediate the negative effects of high school and college dropout, mental health issues, and wasted opportunity within youth and young adult demographics.

Social Class Factors and Upward Mobility

In order to lessen the effects of underachievement and drop-out, it is vital that teachers and therapists first examine the interactive systems that influence one's ability to develop self sufficiency. For example Bozik (2007) proposes that individuals who start from a position of privilege are afforded better academic and vocational options in comparison to middle class and low income demographics. Bozik presents evidence that affluent individuals have means to attend better high schools, which then translates into entrance into better collegiate forums. Goldschieder and DaVanzo (1989) present similar evidence stating that due to ideal economic factors, high income youth are more likely to achieve semi-autonomy than their low income peers. High income youth achieve semi-autonomy, because they are sheltered from having to choose between education

and work during high school and college years. Greenberger and Stienberg (1986) provide research that suggests low income high school students who work longer hours, receive lower grades than affluent peers who work more in adolescence and less in early adulthood. This research suggests that financial means is able to help affluent youth circumvent environmental stressors and gain greater access to education and opportunity.

On the other end of the spectrum research suggests that lower class individuals have an increased need to bear the brunt of personal expenses without help from parents. “In affluent families who report earning 100,000 dollars a year, 42.1 percent of these individuals offered financial support to their children attending a two year college in comparison to families who made 30,000 dollars a year, where only 18.5 percent of these individuals gave financial assistance to their children” (Bozick, 2007, p.262). Lack of financial support from families increases the personal financial responsibility middle class and low income students must bear. This then translates into “greater chances of being at- risk, more obstacles impeding progress forward, increased propensity for dropout, and minimization of opportunities for personal advancement” (Bozik, 2007, p. 275). In sum, those who do not have access to higher education due to financial constraints are less prepared to compete in a highly technological work force.

Nowiki (2004) presents evidence supporting the conclusion those who lack education are placed at increased risk through his statement “the current state of affairs is that more than seventy percent of jobs require four years of high school mathematics” (Nowiki, 2004, p. 224). The research of Nowiki (2004) and

(Bozik, 2007) supports the idea that due to job criteria becoming more selective, low income individuals are placed further away from self sufficiency and educational opportunities; thus, causing this demographic to fall further behind in needed skills to complete their education and compete in a more difficult job market.

Current Definition of At Risk Youth

Freeberg (1987) states that the term at-risk and minority are often considered to be synonymous. Rossi (1994) supports this conjecture with her assessment that the current definition of at risk is mainly used to explain the deficiencies of Blacks and Hispanics. This limited scope contributes to the misdiagnosis of at-risk factors in middle class youth. Frymier and Gansneder (1989) further explain that there are various degrees of "at-riskness." They propose that "at-riskness" is a factor of "what bad things happen to an individual, how severe they are, how often they happen, and what else happened in the individual's immediate environment" (Frymier & Gansneder, 1989, p. 142). Understanding at-risk factors along a continuum of low to high susceptibility is more accurate, because regardless of one's race or financial position, negative environmental and social changes cause all demographics to be vulnerable to at-risk factors.

Pianta and Walsh (1996) support the assessment of Frymier and Gansneder and propose that the term at-risk is only accurate when used to explain the relationship between cause and effect events; thus, supporting the idea that

there are varying degrees of at- riskiness. Sell and Shepard (1998) support the view of Pianta and Walsh with their statement that family problems, drug usage, physical and mental harm, negative social climate, and community disorganization serve as environmental stressors that are not bound by racial and financial constraints. The research of Pianta and Walsh (1996) and Sell and Shepard (1998) represents a push within educational forums to redefine the definition of at-risk. Their sentiments show that current teachers and educational psychologists realize the need for new methods to address at-risk factors and explanations of cause and effect relationships involved in downward mobility. Although there is evidence of a paradigm shift, the needs of middle class students still are not given appropriate attention. Middle class students are overlooked, because the definition of at-risk does not take into account that individuals who come from moderate income have a different set of challenges than affluent and underprivileged individuals.

Research suggests that individuals who do not meet the current at-risk criteria involving being an ethnic minority, developmentally delayed, or financially disadvantaged are overlooked. Hahn (1987) supports this belief through the statement “dropping out of school is not just an issue for a few minorities and poor people it is a much larger issue” (Hahn, 1987, p.10). Le Compte and Goebel (1987) propose that high achieving youth, with achievement scores above the seventy fifth percentile, from middle to higher middle economic standing, are being neglected from intervention programs pertaining to dropping out. This occurs, because educators and therapists place great emphasize on the

disparity between affluent and low income individuals and racial division, but they forget that the average person is being left without support.

Franklin (1991) posits that middle class students may not be as poor or have a history of racism and discrimination, but they are at-risk due to their dropout status. Franklin and Streeter (1995) suggest that middle class students experience stress, drug abuse, and mental health concerns in a similar fashion to minority and underprivileged individuals; however, they are not considered at-risk. To test their hypothesis, Franklin and Streeter (1995) examined the social and psychological factors that contribute to middle class youth dropping out and express that dysfunctional family networks and socio emotional issues are the main reasons why middle class youth fail to finish their education. This analysis supports the conjecture that regardless of socio economic factors, "middle class dropouts experience downward mobility in an increasingly competitive technology based work force" (Franklin, 1995, p. 434). Along with these findings, Franklin and Streeter 1995 further expresses that fifty five percent of the participants in their middle class drop-out study scored sixty percent or higher on the *Hilson Adolescent Profile*. Scores such as these denote that these individuals meet the criteria for having clinically defined substance abuse disorders and high risk for antisocial behavior.

In sum, the misdiagnosis of the vulnerability of middle class students is expressed through the quote "in fact many middle class youth, because of their seemingly lack of social disadvantage and abilities to perform academically are viewed as individuals more likely to succeed when compared to other high risk

groups" (Franklin & Streeter, 1995, p. 434). Through analyzing changes in human development study and examining educational psychology literature, additional factors that influence student's academic and social development are illuminated.

Forgotten Demographic

According to Brofenbrenner's (1979) ecological model of human development, it is necessary to examine interconnected webs of human development and use developmental stages as the frame work to understand at-risk parameters. In accordance with ecological models of development, students are a product of their home environment. Through examining where students come from, more information is given about where they are going. For example, currently, the economic downturn has caused the homes of middle class students to be less stable. Sullivan (2000) states that more people in the middle class are living at greater risk. To support this claim, she presents evidence from financial records showing that " beginning in 1990 large scale economic challenges effected white collar workers, which was a change from the 80's where volatile markets mainly affected blue collar workers" (Sullivan, 2000, p. 31). She highlights the fact that job stratification has limited mid-level employment; thus, increasing the financial debt of middle class citizens. Sullivan's research supports the conjecture that those who were previously safe from at-risk criteria are no longer risk free, each social class is interlinked, and what happens in the middle class greatly influences all other demographics

Sullivan (2000) suggests that two elements, increased debt and uncertainty of income, contribute to middle class distress. Sullivan proposes that middle class citizens are a major contributor to debt systems, which lowers middle class families' threshold for financial collapse. She proposes that one out of seven middle class families goes into bankruptcy in a single decade. The most interesting portion of her research is that ninety percent of these individuals are educated and have children. This means that those who were previously considered to be risk free, are not. Data also suggests that a mere six weeks off from work can drastically change ones social class standing. Economic down turn has not only affected adults, but youth as well. Youth unemployment rates are on the rise and Verik (2009) expresses that governments are rightly concerned about these rising levels of youth unemployment, because of not only the direct economic costs, but also the social impact of joblessness as manifested by increased crime, mental health problems, violence, drug taking, and social exclusion. Bell and Blanchflower (2009) show their support of Verik's (2009) assesments, through their statement "that spells of unemployment, particularly long-term durations, can lead to scarring effects in terms of a higher likelihood of being unemployed later in life and a wage penalty" (Verik, 2009, p. 3).

When examining the work of previous researchers, West and Prinz (1987) state that middle class youth have similar psychological and family issues when compared to under privileged at-risk youth. This conclusion is currently supported by Cohen (2006) who presents data from a 2003 Center for Disease Control study showing that twenty eight percent of youth reported feeling so sad that they

stopped their normal activities. Kesler, Berglund, Demler, Jin and Walters (2005) further supporte this conclusion through evidence from a recent epidemiological study that half of Americans experience a psychiatric disorder throughout the course of their life. They further explain that most of which begin during youth and adolescence. Educators and therapists must take notice of these findings and offer youth appropriate socio-emotional support during early stages development in order to positively influence the success rate of youth transitioning into adulthood.

To further explain the developmental challenges faced by youth and young adults, examination of the environmental factors that influence college age students is necessary. Johada (1982) suggests that "employment is influential to an individual's sense of self worth and employment provides latent functions that promote increased mental health as a function of social interaction and increased sense of identity" (Feldman, 1995 p. 693). Unfortunately, due to economic instability, more youth and young adults are being removed from the beneficial effects of employment. Winefield and Tiggeman (1989) and Obrian and Feather (1990) argue that "young underemployed workers are just as bad of mentally as the unemployed" (Winefield et al., 1989, p. 425). This statement accurately depicts the plight of many college students. Through job loss and underutilization, young underemployed individuals show a high prevalence of mental health concerns and low levels of resilience.

Seargent and Pfleedger (1990) use information from the Bureau of Labor statistics explaining that there are more college graduates seeking jobs than jobs

needing college graduates. They propose that in 1990, 5.8 million college graduates were educationally underutilized meaning they worked jobs that did not require a graduate degree. Shelly (1992) provides evidence in agreement with Seargent and Pfleedger stating that college graduates in the late 1990's and 2000's can expect to face a more competitive job market than that encountered by graduates of the 1980's. As therapists and educators examine the middle class dropout work of Franklin and Streeter (1995) and synthesize the findings with Sullivan's (2000) economic analysis of middle class families, it is clear that middle class high school and college students are at increased risk for downward mobility due to the effects of drug usage, mental health concerns, family dysfunction, debt, job loss, underutilization, major illness, and divorce.

Need for New At Risk Criteria

In his 2009 State of the Union address, President Obama stated "In a global economy where the most valuable skill you can sell is your knowledge, a good education is no longer just a pathway to opportunity, it is a prerequisite and yet, we have one of the highest high school dropout rates of any industrialized nation. Half of the students who begin college never finish. This is a prescription for economic decline" (State of the Union address, 2009 accessed Sept., 23, 2009, from www.ontheissues.org/sotu-2009.htm). In order to address this issue, the President and other government officials suggest that reformatting No Child Left Behind and implementing changes in the Pell grant system will help college students "persist and graduate," (State of the Union address ,2009 accessed Sept.,

23,2009, from www.ontheissues.org/sotu-2009.htm) but, due to bureaucracy, powerful ideas of change are either forgotten, argued to be ineffective, or belabored in their implementation.

Regardless of what happens on Capitol Hill, teachers and therapists can make a difference in and out of the classroom immediately. This change will occur through utilization of programs that emphasize new teaching styles, cutting edge research, and alternative interventions. Easterly (2001) present supportive economic analysis showing that higher education is correlated to increased economic growth. For example, Easterly (2001) examined the relationship of a strong middle class to health and educational outcomes and found that "the ideal growth and development society is comprised of a large middle class, and that countries with a middle class consensus have more economic growth, more human capital, better national economic policies, more democracy and more urbanization" (Landes, 1998, p. 217). The research of Easterly (2001) supports the conclusion that middle class students are important to the economic stability of the nation, because if more people gain higher education and move into the middle and upper class, there is a greater the chance for economic turnaround.

To further support this conclusion, Miller (1995) states, "The continued existence of minority-majority education gap is prohibitively costly, not only for minorities, but for the nation as a whole" (Miller, 1995, p.4).Miller further explains that "the achievement of significantly higher minority education levels is essential to the long term productivity and competitiveness of the U.S. economy" (Miller, 1995, p.4)." Current human development research suggests that the same

can be said about other at-risk demographics, because when middle class individuals fall into lower ends of the economic and educational spectrum the amount of people who are at-risk doubles. If there are already underprivileged individuals in need, why allow new people to move backwards into this demographic, thus, limiting the chances for the original at-risk demographic to receive needed help? Educators and therapists are forgetting about our strongest assets-middle class students. In conclusion, middle class students represent the largest number of individuals in educational settings and assisting these individuals creates opportunity to make a difference in the economic and social development our nation.

Current Educational Focus and No Child Left Behind

Our current educational focus is a direct result of the publication, *A Nation At Risk,* written by the National Commission on Excellence in Education (1983), which informed the U.S. public that America's schools are currently lagging behind those of other developed nations due to failing reading and math scores. This information alarmed the public and created an academic environment, wherein math aptitude and standardized test scores are currently the most important factors involved in education. Further analysis of this occurrence is offered by Heubert and Hauser (1999) and Adelman (2006) who state that the implementation of No Child Left Behind increased the importance of math scores and performance on standardized test; thus, making standardized testing the exclusive way to determine the academic success of students. In response to this

occurrence, Cohen (2002) suggests that "it is well known that current intelligence tests tend to emphasize linguistic and mathematical abilities, a single minded focus that continues to drive federal educational policy such as No Child Left Behind " (Cohen, 2002, p. 207) .

In agreement with Cohen (2006), Hunter (2003) explains the short comings of No Child Left Behind through the statement, "No Child Left Behind, is a standard initiative that inaccurately suggests that homogeneous educational methods effectively teach all children" (Hunter, 2003, p.156). Hunter presents additional explanation of this occurrence through his examination of the historical implications that influence our current educational focus. He posits that policy makers have long felt that standardized testing is the most accurate way to create uniformity in curriculums and govern policy decisions. Hunter (2003) explains that James B. Connant is responsible for establishing the Educational Testing Service "as a mechanism of sorting and classifying students for colleges and universities as measured by aptitude tests" (Hunter, 2003, p. 154). Hunter (2003) explains that the text, *American High School Today*, documents Connant's (1959), belief that "schools operate as control and regulatory agencies, designed to determine a student's flow into societal rank" (Hunter, 2003, p.154). Currently this statement is interpreted to mean that children who pass standardized tests gain upward mobility and the ones who do not are placed into lower socio economic standing.

Prior to Hunter's (2003) analysis of the historical underpinnings of standardized testing, Stedman and Jordan (1986) proposed that emphasis on math

and science scores negatively affects minority demographics. Jenks and Phillips (1998) further report that African Americans who do not perform well on standardized tests are essentially limited in their educational attainment, which in effect influences their economic standing. Jacobson (2001) in his text, *Educational Achievement and Black-White Inequality* agrees with Stedman and Jordan (1986) and posits that the current educational focus limits the opportunity of minority demographic. For example, Jacobson and colleagues (2001), report that even across socio economic factors Blacks achieve lower math scores then Whites. Meaning middle class and affluent blacks score worse than their white cohorts. This occurrence is further supported by evidence from The National Center for Education Statistics (2005), which reports that by age seventeen, the average black student is performing at around the twentieth percentile of the white distribution. This substandard performance directly influences future academic pursuits and limits vocational opportunities for minority demographic.

Information explaining the minority majority education gap is needed, but what about the middle? Teachers and therapists are well aware of the racial and financial implications that separate low income and affluent students; however, current research suggests that a person's race and lack of resources is not the only criteria for being labeled at risk. Through examining the historical factors involved in the creation of No Child Left Behind, The Educational Testing Service, and the current focus of high school education, it can be argued that these systems operate on outdated at-risk criteria thus, perpetuating the belief that minorities and underprivileged individuals are the only ones at-risk. This then

transfers into higher rates of high school and college dropout, further separation in academic achievement between social classes, and higher instances of mental health issues among students.

In order to offer a more comprehensive view of the challenges all students face, Attwell and Domina (2008) explain that more so than race, socio economic status and standardized testing create academic pathways that allow those from higher socioeconomic strata entrance into higher levels of education, while excluding those from lower strata. This analysis is more current and more accurately depicts the full spectrum of challenges students face within the educational system. A new viewpoint must be adopted, wherein any student who does not perform well on standardized tests is viewed as at-risk. If Blacks and other ethnic minorities are limited in vocational opportunities due to sub-standard standardized test scores, why would the same not hold true for other demographics?

Importance of Math

Outside of the traditional framework for at-risk criteria, math aptitude is a less recognized at-risk criteria in need of greater attention. For example, norm referenced tests are heavily weighted with math sections. In accordance with the analysis of Jenks and Philips (1998) explaining that minorities who do not pass standardized tests are vulnerable to downward mobility, examining the importance of the math sections of SAT, GRE, ACT or AIMS test, further supports that conjecture that the score a student receives on these standard assessments, later influences their socioeconomic standing. To substantiate this

claim, Adelman (2006) gives evidence that math scores are a well-tested predictor of college success and those who do not take a class past Algebra 2 are twice as likely not to earn a bachelors degree. For example, the research of Sciarra (2010) shows that Native Americans, Blacks, and Latinos are more likely than Whites to not complete a math course beyond Algebra 2; thus setting them into an increased at-risk criteria.

Jones, Mulis, Raizen, Weiss and Weston (1992) explain that Blacks and Latino high school students take fewer advanced level math courses than their peers. This has been attributed to minorities attending schools that have fewer resources. It is believed that "due to lack of financial support low income schools do not offer the same math and science intensive curriculums that more affluent schools provide; therefore, low income and middle class students are set on an educational track that does not take them to where they need to be" (Sciara, 2010, p. 203). Rielge (2006) presents additional supportive evidence that twenty percent of Blacks and Latinos fail their freshman year math class, which takes them off course to get into higher levels of math. Rielege suggests that if more students pass freshman math there will be more people on track to gain higher levels of math by the end of high school; thus, increasing their chances to earn a four year degree. Glasser (2005) proposes that since minority students often stop taking math classes when the curriculum no longer mandates it, it is the job of educators and therapists to inform students that acquiring higher level math skills is a well documented predictor of college success.

The research of Glaser (2005), Riedge (2006), and Sciara (2010) supports the conclusion that if substandard math aptitude is a predictor of later developmental complications for low income and minority students, the same negative results can be inferred to other demographics. Why do we still believe that minorities and low income individuals are the only individuals who suffer from substandard math achievement? If a White or Asian middle class student fails freshman math they are in the same predicament as Blacks and Latinos. Therefore, a paradigm shift must occur wherein all students are viewed as equally important. Increasing the math aptitude of a Hispanic middle class students is equally as important as increasing the math aptitude of an underprivileged Asian student. We must adopt this view, because any student who does not perform well in math is less likely to move into higher forms of education. If substandard math scores predict minority and low income at-risk factors it is now time to believe that middle class individuals are equally susceptible to the negative outcomes of substandard math aptitude.

Social Competency

Along with math aptitude, social competency is an additional predictor of at-risk factors. John Dewey (1922), posits that "if the family and school do not work in concert with agreement over important values, then by default the peer group and mass media fill this gap by providing an alternate set of values for youth to adopt" (Dewey, 1922, p. 130). Dewey proposes that school serves a unitary role in a student's life. He states that "there are many other factors that influence a student's ability to maintain civic responsibility, mental well being,

and success" (Dewey, 1922, p. 130). He promotes the idea that secondary measures such as social competency training are able to decrease the polarity between what youth learn in school and what is transferable into day to day reality. Dewey's analysis supports the conjecture that if external sources control a youth's ability to succeed, they are more likely to succumb to environmental stressors. In agreement with this conclusion Coleman (1966) states that external locus of control is related to lower academic achievement and higher rates of dropping out. Even though previous educational theorist emphasized the importance of social competency these interventions are not being integrated into standard curriculums.

Le Compte (1987) supports Dewey's analysis and states that "public school is alienating many middle class youth, because it is too authoritarian and archaic in it's orientation to build an effective culture of learning" (Franklin & Streeter, 1995, p. 445). The Office of the Surgeon General (1999) presents data suggesting that there is a growing awareness that " students with social, emotional, and behavioral needs create additional challenges for educators and without effective interventions these two million students will struggle with problems that will predispose them to long term negative outcomes" (Cohen, 2006, p. 208). In order to address the needs of these individuals longitudinal research conducted by Archer (1989) and Elias (1997) further suggests that interventions that foster socio-emotional competencies are able to remediate at-risk factors of students in need. For example, they explain that social skills are predictive of children's ability to handle conflict nonviolently and achieved

identity is correlated with autonomy, self esteem, mature intimacy, and internal locus of control. Muss (1996) presents additional evidence stating that sense of identity is negatively correlated with dropping out and underachievement. He further explains that students who achieve an increased sense of self-identity are seen to have positive psychological traits that help them transition and adapt.To express the importance of identity formation Hammerick (2002) provides evidence that students with low sense of identity are more apt to be distracted by substance abuse, social distraction, and are less likely to engage in goal directed behaviors.

In order to provide empirical evidence that the using social competency training is a viable means to address the needs of the rising levels of students at-risk, Nowiki and Duke (2004) identified a group of thirty eight students who were at-risk for high school dropout. The participants were considered at-risk, because they missed more than two weeks of school and had less than a 2.0 grade point average. The researchers used a research design wherein the students solved social equations and were presented appropriate ways to use language, in order to clearly express different forms of emotional states. For example, the researcher presented the participants with phrases such as "I am responsible for the reinforcements I receive and the failures I experience" (Nowiki & Duke, 2004, p. 227). The most significant result of this research endeavor was that "the effective learning program intervention was associated with desired changes in school attendance and retention" (Nowiki & Duke, 2004, p.236). Nowiki and Duke further explain that after social competency training the participants showed

"fewer non verbal errors when answering the social equations and the participant's interpersonal interaction styles changed from aggressive and dominant to compliant and cohesive, as measured by standardized tests" (Nowiki & Duke, 2004, p.236). This evidence supports the conclusion that social competency training is a viable means to increase interpersonal awareness and communication skills in students.

In a agreement with Nowiki and Duke (2004), Lounsbury, et. al (2005) further support the usage of social competency training through their research examining the relationship between sense of identity and grade point average. Lounsbury and colleagues explain that self identity is a personality construct that denotes a person's understanding of who one is, purpose in life, set of values, and where one is headed. From this definition they formulated a hypothesis that individuals who have a strong sense of self identity are better able to better perform in academic pursuits. After testing their hypothesis data suggested that there hypothesis was substantiated. They found evidence that students who self report high levels of self identity engaged in higher amounts of hours spent studying than students who reported low sense of identity. From this result, the conclusion was drawn that sense of identity is positively correlated with G.P.A. This finding is significant because, in regards to special populations, Lounsburry and team found that sense of identity is a major factor in academic achievement for Black students. Data such as this supports the conclusion that increasing sense the sense of identity within minority populations may result in minimized achievement gap between races. Gains within any portion of the even distribution

curve are needed, because if the achievement gap is minimized between races, more individuals will have opportunity to succeed, which will in turn alleviate stress from middle class student and improve the educational attainment of all demographics.

Although many educational psychologists believe in the importance of social competency training for students, not all individuals believe social skill training has a place within standard curriculums. For example, Watterhouse (2006) proposes that the psycho metric tests used to substantiate the improvement of youth in social interaction are faulty. Waterhouse attacks the evolutionary theories proposed to support the integration of social competency programs into curriculums and she proposes that there is no evidence showing there are multiple intelligences. She also proposes that through social competency programs, youth may just be learning how to answer questions pertaining to social skills better. Therefore, she feels it is inaccurate to state social competency interventions are successful in increasing the emotional intelligence of students. Watterhouse (2006) further explains that the main problem with emotional intelligence applications in the classrooms is that there are many confounding factors that may influence the student's performance. "Multiple intelligence and social competency training are new methods, wherein teacher enthusiasm and novelty may be the basis for increased scores, not the framework of application" (Waterhouse, 2006, p. 209). In conclusion, even though there is disagreement about the function of social competency training within academic forums, it is

difficult to state that individuals do not profit from learning pro-social norms and being exposed to additional ways to regulate stress and communicate needs.

Alternative Approaches

In order to create a general understanding of the ideologies and practices used within educational psychology and the frameworks through which alternative educational practices operate, comparing literature from educational psychologists to ideologies expressed in alternative therapeutic practices is necessary. Hunter (2005) points out that school based mental health work is needed, because it provides additional opportunity for schools to creating safe, caring, and inclusive environments for students. This sentiment is supported by Mc Reynolds (1997) who states that mental health and school partnerships have a historic relationship that needs to be rekindled. Mc Reynolds (1997) examines the historical factors involved in the relationship between educators and therapists and presents evidence explaining that Sigmund Freud and his colleagues expressed interest in applying psychoanalytic theory to help children develop and learn, Lightner Whitmer opened up the first psychological clinic in 1896 to examine psychological issues within educational, and Anna Freud created forums wherein parents, teachers, and mental health professionals met to examine how social emotional life interacts with cognitive development and child learning. Each one of these individuals operated under a paradigm that challenged the standard approach to education.

William James (1899) in his book, *Talks to Teachers on Psychology: and to Students on Some of Life's Ideals*, shows additional support for the usage of

alternative therapeutic practices in education. James (1899) proposes that teachers should emphasize to students the benefits of ten minutes a day of poetry, meditation, and music. Davis (1984) and Levinthal (1998) more recently offer physiological evidence to back James's claim, through their explanation that poetry and music are believed to increase endorphin levels, which influences cognitive and emotional functions in humans. Dewey (1922) shows his support for alternative educational practices in the text *Moral Principals in Education.* He suggests that students must balance internal motivations prior to engaging in academic pursuits. From this conclusion he proposes that teachers and therapists need to utilize alternative methods that promote alignment of internal motivations with academic pursuits.

Dewey steps outside of the traditional beliefs of his day and used evidence from relaxation therapy to show that self regulatory techniques such as meditation help promote pro-social conduct by making morality intrinsically rewarding. Dewey shows his understanding of the need for students to engage in activities that aligning their internal motivations with academic demands and facilitate better emotional awareness. With a similar premise to Dewey, Benson (1996) further examined the beneficial effects of meditation on student performance. He posits that when cognitive functions become suspended, the mind and body settle into a wakeful yet relaxed alertness that offers opportunity for internal motivations to align with cognitive functions, through altering physiological states. James (1899), Dewey (1922) and Benson (1996) each propose that

interventions that are able to align internal motivation and alter physiological states are effective in augmenting primary educational efforts.

After School Programs

In accordance with the belief that alternative methods are beneficial for youth, examining what methods are most effective to help youth minimize at-risk factors is necessary. For example, Halpern (2002) explains that after school programs were first implemented in the 1980's with the purpose of servicing as additional ways for youth to sharpen interpersonal and academic skills. The After-School Alliance Poll (2003) reports that after school programs give youth and young adults additional support and help them handle school stress, peer pressure, and increased expectations from adults. Gottfredson, Gerstenblith, Soule, Wormer and Lu (2004) express that participation in after school programs is related to reduced negative behavior, reduced delinquency, drop-out, and interaction with police. This conclusion is further supported by research from the YMCA (2001), which shows that teens who do not participate in after school programs are three times more likely to skip classes, use marijuana, alcohol, smoke cigarettes, and engage in sexual activity.

Unfortunately, due to the current economic down turn, after school programs are closing. From this occurrence youth are left without needed additional support to increase their movement forward. Research shows that alternative methods such as after school programs augment primary educational concerns, keep youth physically safe, and mentally well adjusted. Therefore, if youth are not given opportunity after school to engage in supplemental forms of

social and academic development, social competency and positive youth support programs should be integrated into standard curriculums to insure students have every chance to learn and develop.

Educative Music Therapy

In line with research from the YMCA (2001) and various educational psychologists who highlight the need for alternative methods that combine therapy and education, Chong (2010) presents research showing that the beneficial effects of after school programs are augmented when a focus on musical interaction is in place. For example, Chong conducted research with an after school program wherein educational music therapy was used to minimize the negative effects of underperformance and at-risk criteria for youth. She first explains that "educational music therapy is an approach that uses musical experiences to reinforce skills that transfer into academic learning (Chong, 2010, p. 191). Chong (2010) explains that educative music therapy involves "using music to act as a stimulus to release repressed energy through sound sublimation in music; thus, bringing repressed emotions and cognitions to the forefront of one's awareness where they can review sub conscious material and then begin to reshape cognitions and formulate more appropriate behavioral patterns" (Chong, 2010, p. 194).

Chong, along with many other music therapists operates under a psychodynamic paradigm, wherein musical responses represent internal cognitive and emotional material. Through this psychodynamic paradigm, the concept of musical sound sublimation is considered to operate under similar psychic

parameters as the standard Freudian explanation of catharsis. From this framework, Chong explains that the usage of educative music therapy arouses repressed emotions through vibratory force, which in turn allows individuals the opportunity to access unexamined areas of cognition and reformat undesired behavior patterns through structured musical interaction. Chong (2010) utilized educative music therapy techniques to "address the student's socio-emotional needs and reinforce learning skills inherent in musical tasks, in order to transfer such skills into non musical activities; thus, resulting in enhanced academic and emotional skills in the participants" (Chong, 2010, p.193). Her research design involved taking participants through structured musical interaction sessions that were organized to target specific non academic skills. The task complexity was accounted for according to the age and cognitive development level of the participant involved. Chong conducted research for sixteen weeks, and in her discussion section, she notes that due to a limited sample size the researchers did not find that musical skills increased academic performance, but the results did show that the participants score higher on *The Social Skills Rating System*.

In sum, the result of Chong's (2010) educative music therapy study, suggests that music interaction is able to increase the social competency skill and academic success rates of students. Chong (2003), Lemiux, Fisher and Pratto (2008), and Clark and Breman (2009), provide further evidence that musical interaction is effective in and out of school. They provide evidence that musical interaction is a versatile intervention that is useful for behavior modification, therapeutic intervention, and increasing academic skills. To give further support

to the conclusion that musical interaction is a viable method to decrease at-risk factors for youth and young adults, in the article *Positive Youth Development in the United States: Research findings on Evaluations of Positive Youth Development Programs*, Costa-Giomi (2004) conducted a longitudinal study examining the interaction between self esteem and musical interaction. Costa-Giomi and colleagues identified underprivileged and middle class youth and gave them three years of individual piano instruction and a free acoustic piano.

After the three year period the researchers examined the participant's responses on the CAT two math and language sub tests, along with their scores on the Coopersmith self esteem inventory. The most significant result of this research is that piano instruction greatly increased the self esteem scores of the youth involved. The research team found a significant statistical interaction between musical interaction and self esteem. Costa-Giomi concluded that the reason why the self esteem scores of the youth increased was due to "the youth being given a free piano, individualized attention from professional musicians, the opportunity to play in recitals for peers, and the means to develop their musical interests" (Costa-Giomi, 2004, p.148). This explanation suggests that musical interaction that involves skill building and social interaction with mentors is beneficial for the self esteems of youth and young adults. Costa-Giomi further explains that "when the statistics were analyzed the improvements in self esteem were seen to be independent of sex and family income" (Costa-Giomi, 2004, p.148).

This evidence supports the conclusion that musical interaction is able to cross racial, sex, and financial barriers. It is also important to note that the

children who received instrumental music training for three years or more outperformed their control counterparts in areas closely related to music. The piano students showed increased fine motor skills and heightened ability to discriminate between melodies both on the Gordon's Intermediate Measure of Musical Aptitude and the melodic discrimination tasks. In regards to academic skills, the children receiving two years of piano instruction outperformed the control group in language scores and improved more than controls in visual-spatial skills over the first two years of instruction. However, by the end of the third year of the study, the control group displayed similar visuo-spatial skills as the experimental group. In order to explain this occurrence, the researchers suggested that "it is therefore possible that instrumental music training may accelerate the natural development of spatial abilities rather than confer a permanent advantage to musicians" (Costa-Giomi, 2004, p. 148).

This finding is supported by Harding (1990) who proposes that youth who have a music rich environment during early childhood show higher language achievement scores in later educational pursuits. Cutietta (1995) presents additional supportive evidence from a summary of a large body of work examining the relationship between music instruction, language skill, and math, wherein he concludes that musical interaction does in fact increase specific cognitive skills. Hetland's (2000) meta analysis proposes that there is considerable evidence that music instruction improves specific cognitive spatial skill in children. This claim is further supported the statement "even though the results of music study and academic scores can be questionable, there are no

studies showing that music diminishes academic pursuits" (Costa-Giomi, et. al., 1999, p.141).

In the *Involvement in the Arts and Human Development: General Involvement and Intensive Involvement in Music and Theater Arts*, Catterall, Chapleau and Iwanga (1999) conducted a longitudinal study examining involvement in the arts and academic success. Their research presents data suggesting that students who report high levels of involvement in instrumental music over middle and high school years show significantly higher levels of mathematic proficiency by grade twelfth. The data shows that the longer youth stay in the arts, the greater the benefit they receive as shown through increased academic standing. For example, by twelfth grade youth who have no experience with music are at a greater disadvantage than youth who have intensive musical interaction (Catterall, 1999, p. 6).

Leading educational psychologists proposes that music, although portrayed as a fun activity that is unneeded for scientific reasoning, is highly educational and has the power to reach individuals who are less persuaded by traditional educational methods. This claim is further supported by Scott (1970) who presents research showing that rock and roll music improved math performance in four hyperactive children, when compared to normal classroom performance. The ability to generalize these results is weak due to the limited sample size, but Pehlam (1994) reports that youth with ADHD, displayed a thirty percent increase in assigned seat work when rock and roll music was played. Pehlam explains this occurrence through the under arousal optimal stimulation

theory which states that the distractibility of children with ADHD is a functional attempt to modulate their under arousal by increased levels of stimulation (Zental & Zental, 1983). From this conclusion Pehlam concluded that listening to music was not a distracter, instead, music was able to facilitate academic performance by increasing the arousal levels of the youth. The research of Catterall, Chapleau and Iwanga (1999), Hetland (2000), Costa-Giomi (2004), and Chong (2010) supports the conjecture that educational music therapy is beneficial for promoting skill building, behavior modification, and increased sense of self worth.

Mozart Effect and Instrumental Learning Studies

Various music therapists and educational psychologists propose that musical interaction is able to give students additional academic and social support, however their claims are denied due to lack of empirical evidence. Most educators feel musical interaction is strictly for entertainment, but the research of Shaw (1993) gives insight into the scientific rationale behind the effect of music on cognition. Shaw uses evidence from Hebb's (1949) analysis of neural plasticity, Mountcastle's (1978) columnar organization principle, and the Trion model of brain functioning to explain the mechanisms through which musical interaction increases cognition. Hebb (1949) proposed that learning is a function of changes made at the synaptic level due to reverberating neural circuits. Hebb further explains that adjacent neurons interact and over numerous interactions, changes in anatomical structures take place, thus, altering the initial system causing learning due to experience to occur.

Mountcastle (1978) proposes that the cortex is functionally organized into columns consisting of 1000 to 10,000 heavily interconnected neurons. The larger columns of the cortex are composed of mini columns, which produce the irreducible processing units of neurons. These "irreducible processing units of neurons create a basic internal neural language, which is activated in spatial temporal firing patterns at the mini column scale, through time ordered and symmetric properties" (Shaw, 2000, pp.75, 329). Shaw uses Mountcastle's explanation of neural assembly to explain how musical stimuli influences cognitive function. For example, Shaw proposes that "since music utilizes rhythm and symmetric relationships, a stimulus such as music primes the brain for higher functioning through music's ability to influence the brain's internal language, by organizing firing patterns within mini columns, which unifies various cognitive systems" (Shaw, 2000, p. 75).

Shaw, Silverman, and Pearson's (1984) explain that 20 years of data was synthesized in order to create a mental map outlining specific locations in the brain where music is processed. Shaw (2000) explains in his book, *Keeping Mozart in Mind*, that "the Trion model allows for a completely new framework for information processing and associative memory storage, by challenging the idea that individual neurons fire" (Shaw, 2000, p. 236). Shaw uses evidence from Hebb's (1949) learning principle and Fishers' (1980) explanation of spins to support his belief that the Trion model more accurately demonstrates how neural firing patterns interact than previous models. He proposes that neural firing patterns operate through regular units. As these regular units are manipulated, sub

groups of the original pattern create permutations. These permutations then act as a separate representation of the initial encoded stimuli. To further explain this process Shaw and colleagues propose that underlining mathematical principles govern the way permutations are created.

Shaw and colleagues studied the "probability to which the sub groups of the original stimuli organize, through utilizing mathematical formulas, to explain the processes involved in information processing within the brain" (Shaw, Silverman, Pearson, 1984, p. 2365). After rigorous examination of thousands of mathematical representations used to model the processes involved in learning, Shaw and Collegues concluded that music is able to manipulate the fashion in which the brain encodes information, which causes increased cognitive capacity. In order to further test this hypothesis Rausher (1997) examined the influence of keyboard instruction on cognitive ability by giving three to five year old children ten minutes of keyboard lessons for six months. At the end of the research endeavor data suggested that the children who received piano keyboard training showed a thirty percent increase on an object assembly task from the WPPSI in comparison to other testing groups.

Rausher (1997) and colleagues concluded that as the participants engaged in musical behavior on the keyboard the brain was given additional ways to encode and process spatial relationships, due to the keyboard's symmetric structure. For example, the keys on the keyboard are related to each other through simple ratios that outline intervallic distances. Rausher and colleagues further explain that melodic and rhythmic dictations are also built upon principles of

periodicity and symmetry. From this analysis the act of reading music is proposed to prime the brain to recognize symmetric relationship and coordinate cognitive functions in relation to specific timing sequences. To further substantiate the effect of music interaction on cognitive function, Rausher, Robins and Jens, (1998) conducted studies wherein rats displayed improved spatial skills during completion of mazes. These findings suggest that musical stimuli caused neuro-anatomical change to occur within the rats, which resulted in increased spatial relationship ability.

Through analyzing the results of various "Mozart Effect" trials Shaw (2000) uses the research to explain the difficulties students face in regards to math aptitude. He explains that students in the United States are behind in math, because they are not taught both types of mathematical reasoning methods. He explains that mathematical reasoning is a function of spatial- temporal reasoning and language- analytic reasoning. Spatial-temporal mathematic reasoning involves visualizing the answer to a problem, while language analytic involves choosing the right formula and completing the problem. He further explains that research suggests that music interaction facilitates usage of spatial-temporal reasoning methods that are not taught in schools. This evidence supports the claim that music interaction acts as a secondary form of education that increases spatial temporal reasoning skills that are not taught in schools.

Although highly controversial the work of Shaw (2000) demonstrated that music interaction is not just a form of entertainment, but is also highly correlated with enhanced spatial-temporal reasoning skills and computational skills. School

boards in Florida in the mid 1990's heard the original "Mozart Effect" findings and concluded that musical interaction should be integrated into curriculums to assist students in their academic pursuits; however, more recently many educational psychologists show disinterest in alternative measures that utilize music within educational forums. Many disbelievers in the ability of music to increase cognitive function feel that the Mozart Effect is unsubstantiated and based on faulty research. For example, Waterhouse (2006) propose that the evidence from various Mozart Effect studies is not strong enough to support the usage of musical interaction as a secondary measure within traditional educational methods. This claim is further supported by Stough, Kerkin, Bates, and Mangan (1994) who retested the Mozart Effect and found no statistical improvement from participants. The researchers used three conditions in their study, which were Mozart, dance music, or silence. The researchers were not able to replicate the research of Shaw (1993). From this occurence, the researchers concluded that there was no substantiation for the Mozart Effect, because the participants did not show increases on the Raven Advanced Progressive Matrices for spatial performance during the Mozart listening trials.

Other researchers state that the Mozart Effect is only significant with young children ages one to five, because babies and preschoolers benefit from music interaction due to the presence of less cognition that can interfere with new learning. Greenoung (1987) explains this occurrence as readiness for experience. He states "children are born with a basic genetic blue print for development that guides the over production of synapses in expectation of normal environmental

stimuli" (Jones, 2002, p. 360). Huttelocher (1994) further investigates neurological development in children by explaining that sophisticated cognitive reasoning ability is seen in children at five months. He explains "that the first years of life are characterized by dramatic growth in synapse formation and dendric density" (Huttelocher, 1994, p. 30). In addition, Huttelocher explains that "growth rates peak between ages two and three subsequent decrease, finally leveling off at adult levels" (Huttelocher, 1994, p. 30).

Gunnar and Barr (1998) offer a different assessment of neurological development showing that even adults can benefit from music interaction. They explain that the brain continues to develop throughout adulthood and is able to be altered through experience. They propose that "even though synaptic connections are reduced at a faster rate after age three, there is still opportunity for growth due to experience. "The over production of synapses occurs when the brain expects a particular sensory stimulus to occur "(Gunnar & Barr, 1998, p. 5). For example, stimuli that are expected to be seen in the child's average environment are accounted for through the creation of additional synapses to process the information. Gunnar and Barr's (1998) analysis provides evidence that adults who learn instruments have the ability to reshape neural connections as a function of overproduction of neuronal assemblies due to the increased environmental demands of practicing an instrument.

The debate between Waterhouse (2006) and Rausher and Hinton (2006) gives further insight into conflicting ideologies between educators and therapists about the usage of musical interaction as an alternative method in schools.

Waterhouse feels speculation without empirical evidence should not be accepted in educational forums. She supports the idea that scientific myths tend to perpetuate because they service a need for the lay person. Often time's mere speculation can be considered to be scientific, because people use scientific findings to limit personal stress and choose not to fully investigate how the findings were tested. Waterhouse emphasizes that there is too little evidence for music instruction to be placed into curriculums. Rausher and Hinton (2006) express their agreement with her statement and respond that "listening to Mozart studies have too many negative findings to warrant being applied to the class room," (Watterhouse, 2006 p.250). "Merely listening to music may not have the power to persuade educators that a simple song can make children more intelligent, but learning an instrument can" (Watterhouse, 2006, p. 250). Waterhouse responded by saying that the original findings that occurred during the Mozart listening trials were not validated; therefore, Rausher and Hinton's explanation of instrumental music study transferring into increased cognitive abilities cannot be used to account for higher learning capabilities.

Biological differences in Musician's Brains

Outside of the application of musical interaction in the classroom, neurological evidence suggests there are clear differences between musician's brains and non musician's brains. Some believe musicians are born with structural differences that predispose them to engage in music, while others feel the structural differences are a result of musical training. Although this debate may

never be settled, the brains of musicians are structurally different than non musicians. Various neural scientists believe that this evidence of structural difference supports the conjecture that musical training increases cognitive abilities. For example, Discover magazine published an article which discussed research by Schlaug, Steinmetz, and colleagues (1994) at the University of Dusseldorf. The group compared magnetic resonance images of the brains of twenty seven classically trained right-handed male piano and string players with those of twenty seven right-handed male non musicians. The researcher team found that the musicians presented a larger planum temporal, which is associated with auditory processing of complex sounds. The researchers were also interested to find that the planum temporal was bigger in the left hemisphere and smaller in the right hemisphere in comparison to the non-musicians. This research is further substantiated by Pantev and colleagues (1998) who also found that musicians have a structural enlargement of the planum temporal.

Schlaug (2005) presents additional data suggesting that the musicians in his study presented a thicker nerve-fiber tract, the corpus callosum, between the left and right hemisphere, along with the presence of increased grey matter in the sensori-motor regions. Neural scans showed that the differences were especially striking among musicians who began training before the age of seven. Schlaug explains that these individuals were seen to have a ten to fifteen percent increase in corpus callosum density. Livonen (2006) later interpreted this conclusion to mean that musicians show increased neural growth of cerebral grey matter in response to intensive environmental demands of learning an instrument. Livonen

(2006) further explains that music study promotes growth of the bridge between the two hemispheres of the brain, the corpus collosum. Livonen expresses that structural enlargement of the corpus collosum denotes improved motor control, by speeding up communication between the hemispheres.

In agreement with Livonen, Janata (2002) proposes that musical interaction not only increases the functioning of the corpus collosum, but it also creates a higher volume of connections in the auditory cortex and increased grey matter concentration in motor cortices. Janata (2002) presents additional evidence that musicians, who begin their musical studies in early childhood, possess a corpus callosum that is up to fifteen percent larger than non musicians. He also suggests that the auditory cortex of professional musicians is one hundred and thirty percent denser in comparison to non-musicians. Through this evidence, Janata concluded that more so than almost any other stimulus, music prompts greater connectivity between the brains left and right hemisphere and between the areas responsible for emotion and memory. He further substantiates his conclusion by highlighting the fact that the brain processes music in both the left and right hemisphere. From this conclusion, he proposes that listening and attending to music involves the auditory system at its highest level, the auditory cortex.

The neural imaging data of Schnieder (2002) is in agreement with Janata. Schnieder (2002) presents evidence that musicians have a larger Helsch Gyrus than non musicians, due to restructuring of neural anatomy as a function of musical training. Schnieder presents evidence that string players have larger

representations of the digits of the left hand than non musicians. This evidence shows that neural restructuring is not instrument specific. For example, Schulz, et al. (2003) present data suggesting that professional trumpet players show enhanced interactions between auditory input and somato-sensory input to the lip, as a result of years of practicing their instrument. Alfred Tomatis, M.D, (1996) proposes that the ear is a vital organ for learning and can be systematically manipulated to increase brain functioning. Tomatis explained through his three integrators model that the "ear is neurologically aligned with the optic, oculomotor, trochlear, abducens, spinal accessory, and, cranial nerves, which are under the control of the acoustic nerve, which is a major mechanism of reception and integration of perception" (Thompson & Andrews, p.184, 2001). In sum, Tomatis feels that the ear influences every level of the nervous system; therefore, the ear is the gateway to higher learning due to the rich interconnections between the ear, brain stem, cerebellum and higher cortical regions.

Wang, Saffroni, Reid, Stienschnieder, and Sussman (2009) propose that the environmental demands of playing an instrument cause musicians to have better ability than non musicians on listening and discrimination tasks related to manipulating and remembering three tone sequences. This finding may be interpreted to mean that rehearsal increases the musical abilities of musicians, but biological evidence suggests that changes in neural anatomy cause the increased musical skills in musicians. For example, Pantev and colleagues (1998) found similar evidence that musicians present enhanced cortical representations for tones of the musical scale when examined under FMRI.

In conclusion, the work of Tomatis (1991), Janata (2002) and various other neural scientists, presents evidence that the auditory cortex is influential in learning and musician's brains are structurally different than non musician's brains. The explanation of why this occurrence takes place is still somewhat inconclusive. However, a large body of research suggests that due to the increased environmental demands of playing an instrument, musician's brains undergo neural restructuring. This evidence of neuro-plastic effects caused by music suggests that musical interaction is able to influence neural systems, which may result in increased cognitive ability.

Genetic Factors in Neural Plasticity

Scientists propose that the neural connections of the brain are malleable. Due to this malleability, rehearsal and continued experience are believed to alter the original formation of neural connections, which may indicate altered cognitive functioning. This phenomenon is explained as neural plasticity. Through this explanation of neural plasticity, the steroid secretion hypothesis for music interaction and neuro-genesis proposed by Fukui and Toyoshima (2008) offers evidence that "music interaction influences the flow of steroids, which then influence and restructure neural patterns; thus, increasing spatial temporal reasoning skills" (Fukui & Toyoshima, 2008, p. 766). For example, "listening to music facilitates neuro-genesis, the regeneration and repair of cerebral nerves by adjusting the secretion of steroid hormones" (Fukui & Toyoshima, 2008, p. 766). Fukui and Toyoshima use an evolutionary and genetic framework to explain the

mechanisms through which music increases cognition. For example, they propose that "music appears to be involved with steroid production via the pathway from the auditory system to the auditory area particularly the neural pathway mediated by the cerebral limbic system" (Fukui& Toyoshima, 2008, p.769).

Fukui and Toyoshima also hypothesize that "music interaction influences neural plasticity through stimulating the flow of cortisol, testosterone, and estrogen, which causes restructuring in the brain and increase cognitive functions through steroid secretion and re-organization of neural firing patterns" (Fukui & Toyoshima, 2008, p.769). Their hypothesis is supported by Forlano (2006), who states that in humans, primates, and birds, cortisol, testosterone, and estrogen are believed to increase spatial perception and cognition. For example, "the signing of birds is speculated to be influenced by testosterone and estrogen which are involved in neuron organization, neuron survival and neural song system formation" (Nottebohm, 1981, p.1369). Abbot (2002) present similar supportive evidence in his proposal that "music effects neuronal readjustment response to brain cells in relationship to sound and music stimuli and causes change in cell counts" (Abbot, 2002, p.13). Although many educators and scientists feel that musical interaction is unrelated to increased math aptitude, the steroid secretion model proposed by Fukui and Toyoshima (2008) supports the conjecture that music influences specific regions of the brain involved with math aptitude through steroid secretion, which may in turn increase cognitive performance.

Neuroscience Findings and Music

Janata and Grafton (2003) tested memory according to the Hebb (1949) learning principle and present evidence that neural regions implicated in the perception- action cycle, memory storage, musical perception, production of abstract sequences, language, and syntax overlap. Janata and Grafton propose that their finding of neural overlap is in agreement with Shaw's (1997) Trion model. From this conclusion, they propose that musical interaction is able to cause a coupling effect that organizes various cognitive system, which may result in increased cognitive performance. Overy (2003) is in agreement with this conclusion and states that music interaction enhances cortical firing patterns causing increased mathematical and spatial temporal skills through music's influence on both the priming and consolidation stages of learning. During the priming stage of learning the degree to which on attends to incoming stimuli influences the level to which the information is encoded and stored. According to Dykes (1997) highly intelligent individuals reduce neural network activity in regions not relevant for task performance. From this conclusion, he proposes that a musical stimulus is able to guide ones attention and increase their capacity to attend to relevant information. Dykes (1997), proposes that additional cortical neurons are likely to become tuned to task specific stimuli during training and contribute to better performance.

In regards to increased performance, Jausovec (1998) and Anokhin, et al, (1999) posit that less complex EEG patterns are observed in more intelligent individuals. Bhattacharaya and colleagues (2001) present further supportive evidence that neural scans of musicians display greater phase coherence than the

ones of non musicians, during mental rotation tasks. Doppelmayr and colleagues (2005) explain this occurrence through their proposal that increased spatial temporal reasoning is a result of musical stimuli activating specific task relevant brain areas and inhibiting task irrelevant areas. The work of Jausovec (1998), Anokhin, et al, (1999), and Doppelmayr and colleagues (2005) supports the conclusion that music not only increases attention capacity, it coordinates various cognitive functions. For example, in the article *When The Brain Plays Music: Auditory-motor Interactions In Music Perception and Production,* Zatorre, et al. (2007) present evidence indicating strong bidirectional connections between auditory and movement related areas. Zatorre and colleagues used a design wherein non musicians were trained to play simple melodies on the key board. After the participants learned the simple melodies they were then presented either the same melody or an incorrect version of the melody through ear phones.

The researchers found that co-activation occurred during the listening trials between the Brocas, ventral pre-motor cortex, and parietal areas. Along with this occurrence, when the non musicians heard the melody they were trained to play, motor areas were also activated. The conclusion from this occurrence was that after musical training neural activation was enhanced when the familiar melody was played in comparison to the non familiar melody. Zatorre further explains that when the non musicians heard simple melodies comprised of the same notes, but in a different order, slight activation was seen. These results were interpreted to mean that there is a connection between the ear and motor systems that can be a new avenue for learning (Zatorre, 2007, p. 547).

Hund and Georgiadis (1999) explain that familiar musical stimuli increase co-activation processes, because musicians show lower levels of activity in motor regions than non musicians for simple musical tasks. This suggests that musicians use a more efficient pattern of neural recruitment due to increased environmental demands of learning and instrument. To play a piece in time it requires feed forward predictions of timing and the use of sensory information to modify and correct movement sequences. Lahav et al., (2007) presents similar evidence in the article *Action Representation of Sound: Audio-Motor Recognition Network While Listening to Newly Acquired Actions*. The research of Zatorre,et al. (2007) and Lahav et al. (2007) supports the conclusion that trained musicians have tighter auditory and motor connections than non musicians due to musical training. Petacchi et al. (2005), Pfordresher and Palmer (2006) and Brown and Martinez (2007), present additional supportive evidence backing the research of Zatorre (2007), through their hypothesis that the cerebellum and the pre-motor cortex show co-activation during auditory discrimination tasks along with disruption of auditory feedback influencing motor execution. Musical stimuli causing co activation of motor regions is further explained through the proposal that executing rhythmic motor movements involves a network of brain areas including basal ganglia, cerebellum, pre-motor cortex, and supplementary motor cortex in the auditory and motor portion of the brain.

In support of the belief that the auditory cortex and movement areas co activate, Haslinger, et al. (2005), Baumann, et al. (2005), and Bangert et al. (2006) present evidence that the auditory cortex is activated when musicians

observe someone else play a keyboard. Zatorre and Kohler (2002) state that mirror neurons are not only activated by the observation of goal directed activities, but they also associate sounds produced during the actions indicating that the auditory modality can access the motor system. This occurrence is believed to suggest that similar auditory and motor areas are activated when pianists play a piece without being able to hear it and when they listen to it without playing it. The research of Zatorre and Kohler (2002), Petacchi, et al., (2005), Brown and Martinez (2007), and Pfordresher and Palmer (2006) suggest that learning an instrument co activates sensori-motor and auditory modalities within the brain, which results in increased cognitive function in musicians.

As a result of the co activation between motor and auditory regions of the brain, musical stimuli are believed to cause neural restructuring within the auditory cortex. Ediline (1999) proposes that the secondary auditory cortex shows the most change in regards to neural plasticity induced by sound stimuli. Tomita (1999) supports this claim through his hypothesis that modulation by the NBM has onset latency similar to the auditory n1 and p1 domain, which is related to top down processing. Tomita presents evidence that similar onset latency between the n1, p1 and NMB services as an additional teaching role, which increases cognitive functioning. The above mentioned research examining the effects of co activation, neural frequencies involved in perceptual processing, and broader implications of plastic effects caused by musical interaction, supports the hypothesis that musical interaction has the ability to promote increased cognitive functioning.

Lappe and colleagues (2008) conducted additional research examining the impact of short term uni-modal and multimodal musical training on neural plasticity. The researcher team expressed that few previous studies have examined cross-modal plasticity; therefore, they used MEG to examine the effects of different forms of musical training on non musicians. They propose that learning to play a musical instrument requires complex multimodal skills involving simultaneous perception of several sensory modalities. In order to test their hypothesis, the research team examined the difference in mismatch negativity between participants who either received musical training or no musical training. The participants were divided into two groups. Participants in the uni-modal group listened to melody sequences and made decisions about pitch content, while participants in the multimodal testing trials were trained to play basic keyboard melodies and then were presented similar and dissimilar auditory stimuli through headphones. The most significant finding of Lappe (2008) was that when nonmusicians were trained to play a melody on the keyboard, motor areas were seen to be activated in when the familiar melody was played, but not when unfamiliar melodies were played.

Lappe (2008) also found that “during the longer testing stimulus, there was more activation in the right side of the brain, which was seen to explain sensori-motor and auditory multimodal interaction creating a greater generalizeability in the participants” (Lappe, 2008, p. 9637). This conclusion is further supported by Zatorre and Samson (1991) who explain that the right side of the brain is preferential in encoding spatial information (Zatorre & Samson 1991,

p. 9639). In sum, the researchers found that " multi modal sensori-motor training is more demanding and motivating than merely listening to music, which causes more attentional resources to be spent on the perception of tones" (Lappe, 2008, p.9637). From this conclusion, the researchers proposed that "the multimodal musical training group reflected greater enhancement of musical representations in the auditory cortex after sensori-motor auditory training" (Lappe, 2008, p.9637). This evidence supports the conclusion that not only are "sensorimotor and auditory systems connected, but, sensorimotor-auditory training causes plastic effects in the auditory cortex over and above changes introduced by auditory training alone" (Lappe, 2008, p. 9638).

In the article, *Understanding the Benefits of Musical Training*, Trainor, Shahin, and Roberts (2009) found evidence that the induced gamma band response to musical stimuli is larger in musicians than non musicians. From this hypothesis Trainor and colleagues propose that induced gamma band response is related to processes involved in executive function. This sentiment is expressed through their statement, "musical training involves top down and bottom up processes and this form of integrated training may be the reason individuals show better attentional and memory processing" (Trainor, 2009, p. 136) From this conclusion Trainor explains that "this superior executive function is believed to enhance learning and performance" (Trainor, 2009, p. 133). The research of Trainor and colleagues is further supported by Fujoika (2008) who proposes that children who take music lessons present stronger beta band activity along with increased gamma band reposes.

To explain how enhanced beta and gamma band activity translates into increased academic performance, Flohr (1981) uses the quote “music makes you smarter” to show that the SAT board recognized the relationship between musical interaction and increased cognitive functioning more than twenty years ago. In agreement with Flohr (1981), Schellenberg (2004) conducted a thirty six week small group keyboard and singing study, wherein as a result of musical training six year olds showed increases in IQ and standardized test scores. Schellenberg explains his finding through stating “music lessons act as an additional form of education that promote memorization focused attention and progressive mastery of skills” (Foregard, 2008, p. 2). Shahin, et al. (2004) presents additional supportive evidence that four and five year olds who receive musical instruction present increased cognitive ability in comparison to non musical counter parts. Foregard (2008) in the article, *Practicing a Musical Instrument in Childhood is Associated with Enhanced Verbal Ability and Non verbal Reasoning,* also explains that music is associated with enhanced fine motor skills in children and adults. She found that children who received instrumental music training for three years or more outperformed the control group in areas closely related to music, fine motor skills, and discrimination between melodies (Foregard, 2008, p. 5). She also suggests that children who engage in music lessons present an increased verbal ability in comparison to those who do not, as measured by the Ravens Advanced Progressive Matrices.

In the article, *Distributed Auditory Cortical Representations are Modified When non musicians are Trained at Pitch Discrimination with 40 Hz Amplitude*

Modulated Tones, Bosnyak, et al. (2004) trained nonmusicians to decipher different sound frequencies for half an hour per day for two weeks. He found that during the sound discrimination trials the amplitude of the auditory cortex, specifically the N1c enhancement was larger, over the right hemisphere in comparison to the left hemisphere. Bosnyak (2009) also found that "modification of distributed auditory cortical representations suggests that more pyramidal neurons depolarize synchronously in the A2 after training on the discrimination task" (Bosynyak, 2004, p. 1097). From this information he posits that "the neocortical mantle serves as an attention like function that gates plastic changes at the synapse and facilitates improved performance after remodeling has occurred" (Bosynyak, 2004, p. 1097). In his conclusion, Bosnyak states that "although it remains difficult to establish a direct correspondence between ERP components in children and adults, the most important point may be that, in both adults and children, short-term musical training seems to produce effects that are similar to those observed with long-term musical training" (Bosnyak, 2004, p. 1088). This conclusion is further supported by Menning, et al. (2000) and Bangert, et al. (2001). Buonomano and Merzenich (1998) offer additional supportive evidence stating that it is well established that frequency tuning in the human cortex is not hardwired after early development, but can be altered with experience.

In the article, *Musical Training Influences Linguistic Abilities in 8- Year Old Children: More Evidence for Brain Plasticity,* Moreno et,al. (2009) found that "six months of musical training significantly improves behavior and influences the development of neural processes as reflected in specific pattern of

brain waves" (Moreno, 2009, p.712). The research design involved examining the magneto-encephalography patterns of the N250m and the N300 response levels of participants during pitch discrimination tasks. Moreno, et al (2009) explains that "these two response levels reflect functionally different processes, because the N250m is larger over the left hemisphere while, in line with adult data on pitch processing, the N300 is larger over the right hemisphere" (Moreno, 2009, p.712). "The N300 response level reflects the difficulty of stimulus categorization and the extra attention required to discriminate small changes in pitch" (Moreno, 2009, p.721.) Moreno's research shows that examination of various brain wave patterns presents evidence that the effect of musical expertise can be seen throughout the course of development from early childhood to adulthood. This conclusion is supported by Bangert, et al. (2001) and Haueisein and Knoshe (2001) who present data suggesting that in both children and adults short term musical training produces effects that are similar to those observed with long term musical training. This analysis is further supported by Schlaug et al. (2005) who reports that children with four years of musical training present a higher volume of grey matter volume in several brain regions including the sensori-motor cortex and larger activation in the superior temporal gyrus than control children. Koelsch, et al. (2005) present additional evidence showing that musical expertise is correlated with increased activation in the right inferior fronto-lateral cortex and anterior part of the superior temporal gyrus involved in spatial reasoning.

Jausevec (2006) in his article, *The Influence of Mozart on Brain Activity in the Process of Learning,* utilized event related synchronicity to examine the

different levels of electrical activity in the brain during learning stages. He found that individuals who listened to Mozart's music displayed EEG patterns that were less complex with less degree of randomness. He interpreted this to mean that "Mozart's music was able to decrease the relative number of concurrently activated and competitively interacting neuronal assemblies, which primed the brain for increased cognitive function" (Jausovec & Gerlic, 2006, p. 2711). The testing trials involved listening to music and completing spatial rotation tasks. The participants either verbally answered or imagined the answer while researchers examined their electrical activity on EEG scans. During testing trials Jausevec and Gerlic noticed that in the beginning three seconds of the spatial temporal reasoning task the activity was located in the parieto- occipital brain region involved with spatial perception and imagery.

When participants were prompted to answer verbally the area of the brain involved moved from the parieto- occipital brain region giving evidence that musical stimuli influenced the spatial temporal reasoning areas of the brain. Jausovec and Gerlic's ability to use event related synchronicity to track the timing and location of mental events related to musical processing and spatial temporal reasoning skills, supports Raushers' (1997) priming theory that music does have priming effects that organize and increase cognitive functions involved with spatial temporal reasoning. The belief is further examined in the article *The Effect of Musical Training on the Neural Correlates of Math Processing: a Functional Magnetic Resonance Imaging Study in Humans*, wherein Schmithorst and Holland (2002) examined participant's verbal responses and performance on subtraction,

addition, multiplication, division, and comparison of ratio tasks. Schmidhorst and Holland suggest that multiplication is processed by language areas in the brain, while addition and subtraction are processed in the visuo-spatial areas of the brain

From this framework, Schmidhorst and Holland hypothesize that that musicians and nonmusicians use different neural processes to calculate math problems. For example, they found that for non musicians greater activation was seen in the and left prefrontal cortex, the occipital gyrus, and the inferior parietal lobe, while in musicians greater activation was seen in the left fusiform gyrus. These results suggest that musicians utilize areas of the brain that are better suited for mathematical and spatial processing. Schmidhorts and Holland (2002) propose that "increased activation in the left fusiform gyrus seen in musicians is likely associated with increased proficiency in the processing of shape information, generated by years of reading music, interpreting musical notation, and practicing an instrument" (Schmidhorts & Holland, 2008 p .194). Schmidhorst and Holland explain that through musical training, musicians learn how to detect wrong notes simultaneously and know when motor movements aren't coordinated. From this conclusion they propose that "the ability to detect wrong notes and improper timing of motor movements allows musicians to use better coordinated cognitive functions during mathematic calculations" (Schmidhorst & Holland, 2008 p. 194). In sum, Schmidhorst and Holland present evidence that musicians encode more abstract forms of mathematical content; thus, improving their cognitive abilities.

Menon, et al. (2002) present further supportive evidence in a recent FMRI study showing that during math testing when participants compare correct

answers to wrong answers, activation is seen in the pre frontal cortex. This occurrence was interpreted to mean that the pre frontal cortex is implicated in the processing of comparing correct information to false information. Menon further explains that the prefrontal cortex is involved in interpreting and maintaining results while resolving the conflict between external wrong answer and internal right answer. This process is similar to the task of musicians who must judge the intervallic relationship between notes and utilize sequenced movements to complete rhythm patterns. Burband (2000) proposes an alternate explanation, wherein decreased activation of the left inferior lobule accounts for the difference between musicians and non musicians in regards to math mathematical processing.

Burband supports his hypothesis by citing research suggesting that subjects who use a visual strategy involving lining up of numbers display an increase in the left inferior parietal cortex relative to those who use a verbal strategy of approximation. From this conclusion, he proposes that it is in accurate to state that musicians use a more abstract form of math processing. Along this line of reasoning Munte (2002) suggests that that the effects of musical training are not domain specific to math, but to general intelligence abilities. Munte proposes that increased general intelligence function accounts for the decreased activation in the visual areas of musicians, while Gabrielli (1998) suggests that improved performance may also be related to improved semantic working memory. From the findings of Munte (2002), Gabrielli (1998) and Schmidhorst and Holland (2008), the conclusion is somewhat inconclusive about the difference

in mathematical processing between musicians and nonmusicians; however, the general consensus is that musical training is associated with decreased activation in the visual association areas, which supports the hypothesis that" increased math aptitude in musicians is a function of improved working memory performance and increased abstract representations of numerical quantities" (Schmithorst & Holland, 2004, p.193).

Transfer

Although there is a wide array of evidence supporting the idea that musical interaction transfers into increased cognitive function, transfer has been one of the most actively studied phenomena in psychology. It is difficult to understand the processes involved in transfer, because "researchers are almost in total agreement that little transfer occurs between various learning trials and application to alternate tasks" (Determan, 1993, p. 5). Ceci (1996) expresses the difficulty in defining transfer, through her proposal that encoding, retrieving, mapping, and extending knowledge are inherent in a wide range of cognitive tasks; therefore it is difficult to accurately explain the process of transfer. Woodworth and Schlosberg (1954) propose "transfer is the carrying over of any act or way of acting from one performance to another" (Woodworth & Schlosberg, 1954, p. 734). In order to accurately assess the fashion in which musical interaction carries over to other cognitive pursuits some researchers suggest that a more clear definition of what constitutes carry over is needed.

Bransford and Cocking (1999) highlight the lack of a sound operational definition of transfer through their statement there is no clear agreement on what

constitutes carrying over or a new context. Halford (1999) further reports that transfer should be explained in a more comprehensive definition to help researchers clearly define the parameters through which transfer is examined. Halford further suggests that as long as the definition is not agreed upon little advancement will take place in the understanding of the processes involved in transfer. Although there is little consensus on the definition of transfer, the most general understanding of the term involves acquiring appropriate educative skills, which are then cognitively organized and applied to various environmental settings. Within this effort, to more clearly define the processes involved in skill acquisition and application of concepts to new environmental demands, researchers place a distinction between near and far transfer.

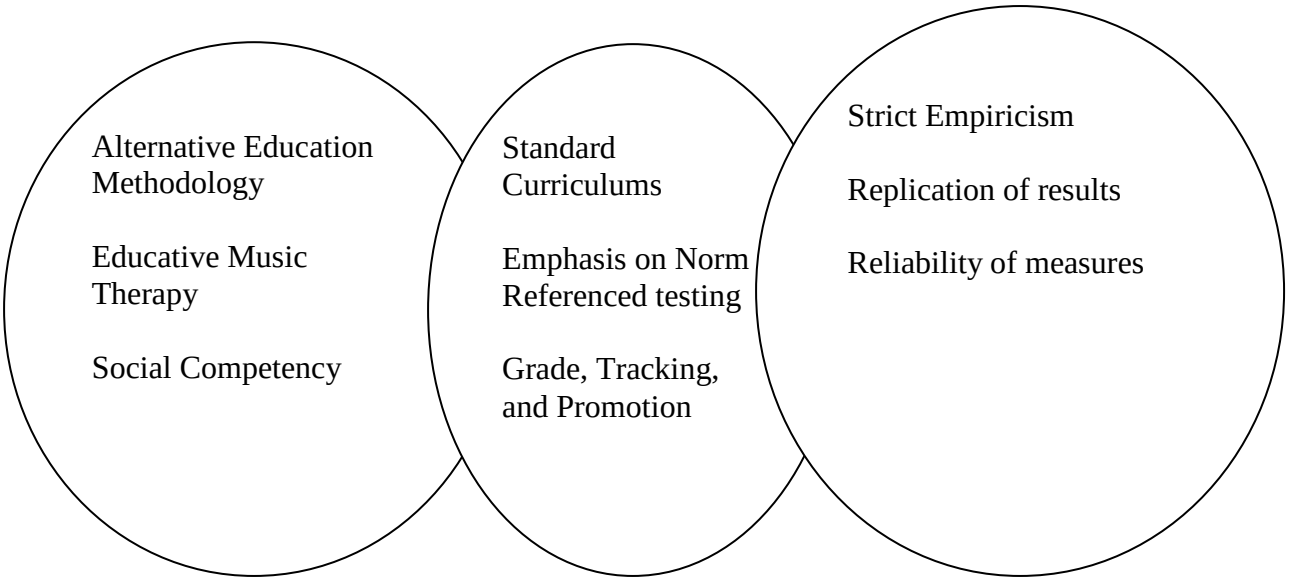
Grotzer (1997) explains that the relationship between musical interaction and increased spatial temporal reasoning skill is a function of near transfer, because both mathematics and rhythm utilize proportions and logic based formulas, while Klausimer (1961) explains that far transfer is defined as the goal of gaining skills that transfer from school to contexts outside the academic environment. For example, he states the main reason for formal education is to facilitate learning in situations outside school. Van de Vuvjer and Hutschemaeker (1990) agree with Klausimer and explain that through repeated exposure to logically equivalent problems, individuals interpret the underlying reasoning schemes and develop meta-cognitive insights into their inner workings. This interaction facilitates the creation of insight and reasoning ability, which increases problem solving skills outside of the original environment. Although the

definition of transfer is not completely agreed upon, Detterman (1993) states that many studies present evidence showing that targeted interventions are able to teach people to think better within a particular subject matter. He states that some intelligence systems are organized in such a manner that their dimensions are integrated and easily connected in transfer tasks.

In sum, Shaw, et al. (1993), Cohen (2006), Zatorre (2007), Chong (2010) agree with Detterman's (1993) analysis, because each researcher presents supportive evidence showing that musical interaction is a targeted intervention that teaches students to think better within particular subject matter. Music therapist proposes that youth learn social skills that assist them with regulations of emotions and self awareness, while educational psychologists and neural scientists propose that musical interaction increases cognitive ability. Through surveying the ideologies and methodologies of human development researchers, literature from educational psychologists, empirical evidence form scientists, and research from practitioners who promote the usage of alternative methods in education, the general conclusion is that there is overlap between each group's beliefs about the ability of music to influence cognitive systems. Although each professional group expresses varying beliefs about usage of social competency training and musical interaction within standard curriculums, each group plays an integral part in understanding the larger issue of how to remediate at risk factors for youth and young adults.

Reasons for study, Statement of Purpose and Research Questions

When the issue is boiled down to the smallest component parts, both educators and therapists desire that youth develop cognitive and emotional skills in order to successfully transition into adulthood. Various music therapists and educational psychologist present evidence that musical interaction enriches academic performance and increases emotional well being, but their claims are denied due to lack of empirical evidence. The main focus of this research is to gather data that will help pinpoint where educators and therapist are in agreement on the issue of integrating secondary measures into standard curriculums. The proposed greater impact of this research is to create professional dialogue between educators and therapist in order to assist the newly emerging at- risk demographic, the middle class student.



The statement of purpose for this study is to examine the influence of educative music therapy on math aptitude and survey the perceptions of students about the purpose of alternative methods in education. This form of research is

needed in order to facilitate dialogue between professionals and begin the process of finding common ground, wherein educators and therapist place the needs of the students first, while utilizing sound measures to examine the socio-emotional and educational benefits of musical interaction within educational forums.

Research questions

1. Does music increase math scores on the math fluency and math calculations section of the Wechsler Individual Aptitude test 3rd edition?
2. Does educational music therapy influence math scores on the math calculations section of the Wechsler Individual Aptitude test 3rd edition?
3. Do students perceive that music is able to increase math aptitude?
4. Do students perceive that music is able to increase social competency?

Chapter 3

METHODS

Subjects

Subjects for this research endeavor were selected in two different settings. **Group A** was comprised of 23 youth from a preexisting beginning high school guitar class ages 15 to 17 with 1 to 3 years of musical experience. There were 18 males and 5 females within this data set. **Group B** was comprised of 4 youth from a high school after school program ages 14 to 17 with 1 to 3 years of musical experience. All 4 of the participants in the high school after school program were female. In total there were 18 males and 9 females, ages 14 to 17, with 1 to 3 years musical experience.

Group A – High School Beginning Guitar Class

The initial step in the formation of **Group A** involved contacting local high school administrative staff and informing them of the researcher's request to conduct research. To gain access to participants a standard research request form formulated by the unified school board was completed. A five page document outlining the individual research aims and time constraints for the research was given to the school board. After review of the materials, a letter of approval was sent to the researcher by the school board. Upon receiving consent from the school board a five page outline of the research and time constraints was give to three local high schools. The researcher was emailed by a prospective high school and a thirty minute interview with a high school principle occurred. The principal deemed the research possible, and connected the researcher with the choir director

of the high school. The director was given documentation describing the research study and was willing to help identify prospective participants.

Students were identified by willingness to participate and ability to provide parental consent. After three phone conversations the choir director stated that she was teaching a beginning guitar class that was recently created. She stated there were twenty three students who had little musical experience and were interested in the research. The researcher met the participants during class time and gave a thirty minute introduction to the research. At the end of the introduction the researcher asked for willing participants. The participants were given a permission slip to get signed by their parents. (See appendix A) After the permission slips were complete, the participants returned the forms to the researcher and research commenced.

Group B - High School After-School program

The students from the after school program were selected in a similar fashion as **Group A**. A flyer was given to the director of youth activities at a local after school program. The researcher met with the activities director for a thirty minute interview. After the interview, the activities director expressed his desire to help find prospective participants. He and other activities staff identified 4 girls who would be interested in joining the study. The girls were met in a thirty minute introduction session at the after school program headquarters. The researcher asked the group for their willingness to participate. The participants were then given a permission slip. (See appendix A). After the permission slips were signed research commenced.

Settings

Two settings were used for this research and are listed as followed:

Group A - High School Beginning Guitar Class

The 23 youth in the beginning guitar class attended research sessions in a local high school choir room. There were 18 boys and 5 girls ages 14 to 17 in the room. The choir room was large and setup with thirty chairs arranged in a semi circle around an acoustic grand piano. There was a visual projector which was used to present information. The school provided each student with either an acoustic steel string or nylon string guitar. The students sat with music stands in front of them. Music and educational materials were placed on the stands. The class met from 10:51 am to 11:51 am Monday through Friday.

Group B - High School After-School Program

This portion of the research endeavor utilized a local community services building equipped with instruments. There were 4 high school girls ages 14-17 who attended research sessions. The room was medium sized, decorated with posters of popular bands on the wall, and carpeted. A large closet of assorted instruments, including hand percussion, guitars, amplifiers, and keyboards was utilized. Before sessions the instruments were brought into the room and arranged in a rock band setting. The acoustic drum kit was in the back of the room to the left of the acoustic upright piano. The guitar equipment was placed facing in the middle of the room to the left of the keyboard. The bass guitar equipment was placed in between the acoustic piano and drum kit. Sheet music and educational materials were placed upon music stands. A small white board was used to

explain musical concepts. The group met Mondays and Thursdays from 3:30pm to 4:30pm.

Equipment

The equipment used in each setting was provided by either the school involved or the after school program sponsoring the research. In total between **groups A & B,** 1 grand piano, 2 acoustic upright pianos, 2 drum sets, 10 assorted hand percussion, 30 acoustic guitars, 4 electric guitars and 7guitar amplifiers were used. Due to the generosity of the high school and after school program each participant had access to high quality instruments and professional guidance. This facilitated learning and minimized the students' responsibility of bringing personal material. Personal equipment was used by the researcher, specifically, 1 guitar amplifier, 1 classical guitar, 1 electric guitar, and a laptop computer with speakers.

The sheet music used for the research was downloaded from music note.com and fall under the fair use copyright law. The songs used were: *Hey There Delilah, Beat it, Feel Good, Hotel California, Stairway to Heaven, The Unforgiven, Hearts Burst into Flames, Simple Man, Blackbird , Blitzkrieg Bop, Pachobell's Cannon in D, Bartender, Ordinary People, Love, Gold Digger, Fur Elise, All my life, You Got it Bad, Flashing Lights.*

Procedure:

The following procedures were used for both **groups A & B** for pre-test and post-test:

A pre-test, post test design was used, utilizing the Wecshler Individual Aptitude Test 3rd edition. The WIAT-III was deemed by the researcher to be the most accurate and efficient testing method to examine the influence of educative music therapy on math aptitude. The WIAT-III is suitable for use in a variety of clinical, educational, and research settings, including schools, clinics, private practices, and residential treatment facilities. The WIAT-III was nationally standardized on three thousand students and adults and features comprehensive normative information. Due to the quick administration and short amount of questions, both the math fluency and math calculations sections of the WIAT-III were deemed most suitable for research. After acquiring the test and making copies, a testing packet was created. The testing packet consisted of the math fluency and math calculations section of the WIAT-III edition and a questionnaire surveying student perceptions about the relationship between music, math and social competency. The math tests were the same for both two groups, and administered utilizing the same procedure. (See Appendix B).

During the first week of research, the subjects were asked to sit in a desk and prepare to complete two math tests and fill out a short questionnaire. The researcher gave a brief overview explaining how to properly complete the testing materials and explained the time factors involved with each test. Then both the math fluency and math calculations sections of the Wechsler Individual Aptitude test were given to each participant. The youth were reminded of the three minute math fluency time limit and the fifteen minute math calculation time limit. After the students were seated and in possession of a writing utensil, the researcher then

set a cellular phone timer to three minutes. The youth were told to find the test entitled math fluency. The students then found the correct test within the testing packet, while the researcher walked around to each youth to make sure they identified the correct testing material.

When all individuals indentified the proper test, the researcher started the cellular phone timer and the students were told to turn their papers over and complete as many questions as possible within three minutes. When the three minute math fluency test ended, the next test was taken out of the testing packet. The youth were told to wait for the timer to be set to fifteen minutes. The youth waited for the cue of the researcher and then started the fifteen minute math calculation test. After both math tests were complete the students were told to wait patiently for the questionnaire to be handed out. The participants were given a three minute explanation of the purpose of the questionnaire. The subjects were told the purpose of the questionnaire was to examine the subject's beliefs about social competency, music and math. After the introduction to the questionnaire, (See Appendix C.) the researcher handed each youth the questionnaire and told them to wait until prompted to start.

After all questionnaires were administered the youth were instructed to complete the survey. When all testing materials were complete the participants raised their hand and the materials were stapled together and placed in a folder. At the end of collecting the math tests and surveys, the data was placed into PASW 18 statistical software to create baseline data. The student's names were

converted into a coding system to protect their identities. At the end of baseline data entry the educative music therapy curriculum began.

Group A - High School Beginning Guitar Class

Group A attended research sessions from September 7, 2010 until November 5, 2010. The group was comprised of 18 boys and 5 girls who attended 30 sessions over a 9 week span. The sessions lasted 1 hour in duration. For the first 3 weeks research took place 2 times a week for 1 hour at a time on Tuesdays and Wednesday in the high school choir room. Due to the request of the Choir director the researcher was asked to give sessions more frequently, therefore, during the 4th week beginning September 27, 2010 a change in schedule occurred. From September 27, 2010, until the end of the research project November 5, 2010 the research became more intensive. During this time period research was conducted 4 times a week Tuesday, Wednesday, Thursday and Friday. In total 30 were completed over a 9 week span.

The white board was the primary way information was transferred. Music theory, guitar charts, and rhythmic and melodic dictation examples were shown on the white board. Also, Individual examples were handed to each student (See Appendix D.) Each session lasted for one hour. Within this time period 15 minutes were devoted to each section of the educative music therapy curriculum resulting in 4 topics per session to be addressed.

Educative Music therapy Curriculum

(Week 1) Basic Music theory/ solfege/singing, *Hey There Delilah*

(Week 2) # Key structure / Flat key structure /Rhythmic dictation/ *Feel Good*

(Week 3) ear training/triads/ extended harmony /*The Unforgiven*

(Week 4) numerical systems/ chord symbols/ Circle of 5th's movement/ *Hotel California*

(Week 5) (Minor/major/diminished rules)/ *Stairway to Heaven*

(Week 6) chord charts/scales/arpeggios/ *Blitzkrieg Bop*

(Week 7) sight reading/small ensembles/ *Pachobell's cannon*

(Week 8) Song rehearsal sectional practice/ *Beat It*

(Week 9) Song rehearsal /sectional practice

(Week 10) Recital (performance of 1 to 3 music selections)

Group B. High School after school program

Group B After School High School Program attended sessions from Sept 7- Nov 5, 9 sessions were completed all 4 participants were female. The research endeavor lasted for 9 weeks and the girls completed 18 educative music therapy sessions. The sessions lasted 1 hour in duration. During this time period research was conducted 2 a week Monday and Thursday. In total 18 sessions were completed over a 9 week span.

The white board was the primary way information was transferred. Music theory, guitar charts, rhythmic, and melodic dictation were conducted on the board. Individual examples were handed to each student (See Appendix D.) Each session lasted for 1hour and four topics were covered per session. Fifteen minutes was spent on each skill area.

(Week 1) Basic Music theory/ solfege /singing, *Bartender*

(Week 2) # Key structure guitar/ Flat key structure /*Rhythmic dictation/ Gold Digger*

(Week 3) ear training/triads/ Extended harmony /*Ordinary People*

(Week 4) numerical systems/ chord symbols/ *Circle of 5th's movement/ Love*

(Week 5) (Minor/major/diminished rules)/ *All my Life*

(Week 6) chord charts/scales/arpeggios/ *You Got it Bad*

(Week 7) sight reading/small ensembles/*Fur Elise*

(Week 8) Song rehearsal sectional practice/*Gold Digger*

(Week 9) Song rehearsal /sectional practice

(Week 10) Recital (performance of 1 to 3 music selections)

Difference in ages and session numbers between groups

In regards to differences in group sizes there were 4 participants in **Group B High School After- school program** which was far less in comparison to **Group A High school Guitar Class** which was comprised of 18 participants.

To address differences in session numbers **Group A** completed 30 sessions in comparison to **Group B,** who completed 18 sessions. This occurred, because the research with **Group A** took place during school hours. **Group A,** had an increased necessity to attend research sessions due to the requirements of their high school curriculum, in comparison to **Group B** who had no requirements influencing their attendance. This caused attendance to be steadier of **Group A** and offered opportunity for more sessions to occur. **Group A**, also completed more session, because the director of the high school guitar program made

recommendation that the researcher come more frequently due to her assessment that the youth were learning needed musical skills.

Data collection

The same procedure was used to collect the pre-test and post-test data for all testing groups. The pre-test post-test design involved administering the math fluency and math calculations sections of the WIAT 3rd edition to participants. The Wechsler Individual Aptitude test version three math calculation and fluency sections were deemed most useful by the research because, the WIATIII is considered a valid measure to test intelligence and is a standard metric used by academic forums. Additional reasons for using this measure were that the WIATII is sturdy against environmental shifts and factors that can skew data. Both the math fluency and calculations sections of the WIATIII are short in duration, which lends to easy facilitation and quick interpretation of results. For these reasons, the WIATIII was deemed most suitable for the pre- test post- test design chosen by the researcher. The math calculations section is a series of one hundred and sixty basic multiplication, subtraction, addition and division problems. The duration of this test is 3 minutes. The second math test used was the math fluency section of the WIATIII, which is a set of forty five math questions involving math skills from basic division up to algebra two and beyond. This test is fifteen minutes in duration.

In order to examine the student's perceptions about the relationship between, music, math, and social skills, a questionnaire was administered utilizing the same procedure as the one used during the administration of the WIATIII. The

questionnaire surveyed the participant's responses to questions about age, race, year in school, and other demographic descriptors such as social class and preferred instrument. After inputting all data from the pre- and post-test math measures and the surveys examining the participants' perceptions, PASW statistical software was used to examine the statistical difference between pre-test and post- test data on the WIATIII. A pair means *t*-test was chosen for analysis of math and questionnaire data, because as recommended by a trusted statistician, utilization of *t*-tests is an efficient way to test pre- test post test data. This information was then used to address the formulated research questions.

The following null hypotheses were formulated for this research:

1. Educative Music therapy will not increase participant's scores on the Wechsler's math fluency test.

2. Educative music therapy will not increase the participant's scores on the Wechsler's Math calculations test.

3. Students will not report that music interaction influences math aptitude.

4. Students will not report that musical interaction influences social competency.

Insert your text here]

Chapter 4

DATA ANALYSIS

The purpose of this research endeavor was to use educative music therapy with high school students in order examine the influence of musical interaction on math aptitude and to survey students' perceptions of the usage of social competency and musical interaction in high school curricula as secondary educational measures. The research design involved a pre-test post-test design utilizing the math fluency and math calculations sections of the WIATIII and a survey that contained demographic and qualitative questions. In this section quantitative results of math tests and surveys are presented in the original order of the null hypotheses research questions.

Quantitative Results

Null Hypothesis 1. Educative Music therapy will not increase participant's scores on the Wechsler's math fluency test.

Table. 1

Means and Standard deviations on WIAT 3rd edition math calculation test

	Mean	N	Std. Deviation	Std. Error Mean
Pre calculation	24.7037	27	4.22278	.81268
Post calculation	25.0741	27	4.34056	.83545

Table 2.

Paired Samples Correlations

	N	Correlation	Sig
Pre calculation & Post calculation	27	.893	.000

p< .01

Table 3.

Results of *t* test for WIAT 3rd edition Math Calculations test

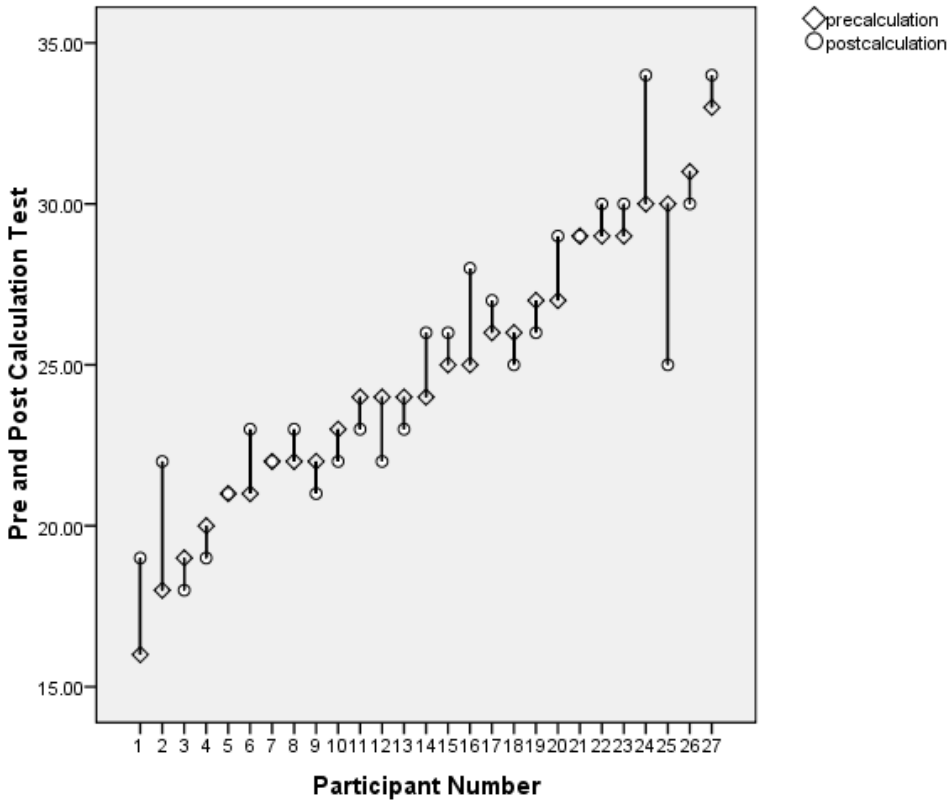
				95	95
	Mean	Std. Deviation	Std. Error Mean	lower	upper
Pre calculation & Post calculation	-.37037	1.98355	.38173	-1.15504	.41430

	t	df	Sig(2-tailed)
Pre/Post	-.970	26	.341

Means of pre- and post-calculations showed a small gain between the two groups (X = 24.7 for pre- and X = 25.1 for post-calculation). There was a positive correlation (r =.89, p < .01) between pre- and post-test calculations, showing that scores were quite similar. The results of a paired sample *t*-test ($t(26)$ = -.97, p

=.34) also indicated that there was no statistically significant difference between pre- and post-test results.

Figure 1. Graph of pretest and posttest WIAT 3rd Math Calculations



Null Hypothesis 2. Educative music therapy will not increase the participant's scores on the Wechsler's Math calculations test.

Table 4.

Means and standard deviation for

	Mean	N	Std. Deviation	Std. Error

				Mean
Pre Fluency	1.1404	27	30.26610	5.82471
Post Fluency	1.1489	27	33.15852	6.38136

Table 5.

Paired Samples Correlations for

	N	Correlation	Sig
Pre Fluency & Post Fluency	27	.922	.0000

(See Table 5) **Table 6.**

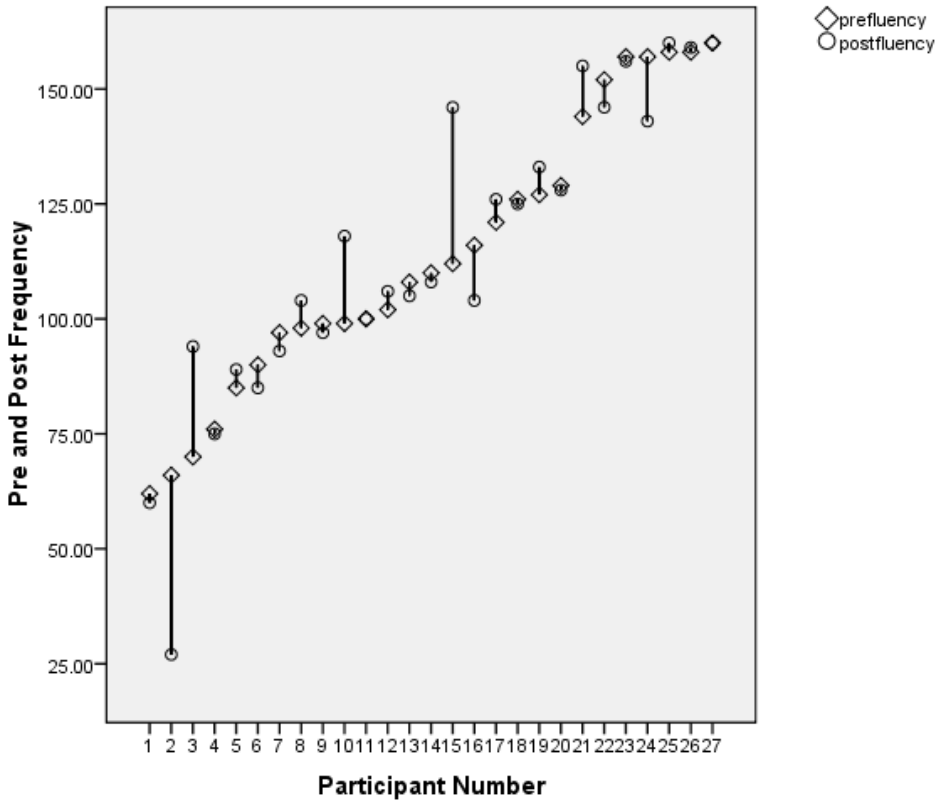
Results of *t* test for WIAT 3rd edition math fluency

				95	95	
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t
Pre Fluency & Post Fluency	-.85185	12.84734	2.47247	-5.93409	4.23039	.-345

	df	Sig.(2-tailed)
Pre/Post Fluency	26	.733

Means of pre- and post- calculations showed no gain between the groups. There was a strong positive correlation (r = .92 p <.01) between pre- and post-test calculations, showing that scores were quite similar. The results of a paired sample t-test (t (26) = -.35, p =.73) also indicated that there was no statistically significant difference between pre- and post-test results.

Figure 2. Graph of pre-test and posttest math fluency



Null Hypothesis 3. Students will not report that music interaction influences math aptitude.

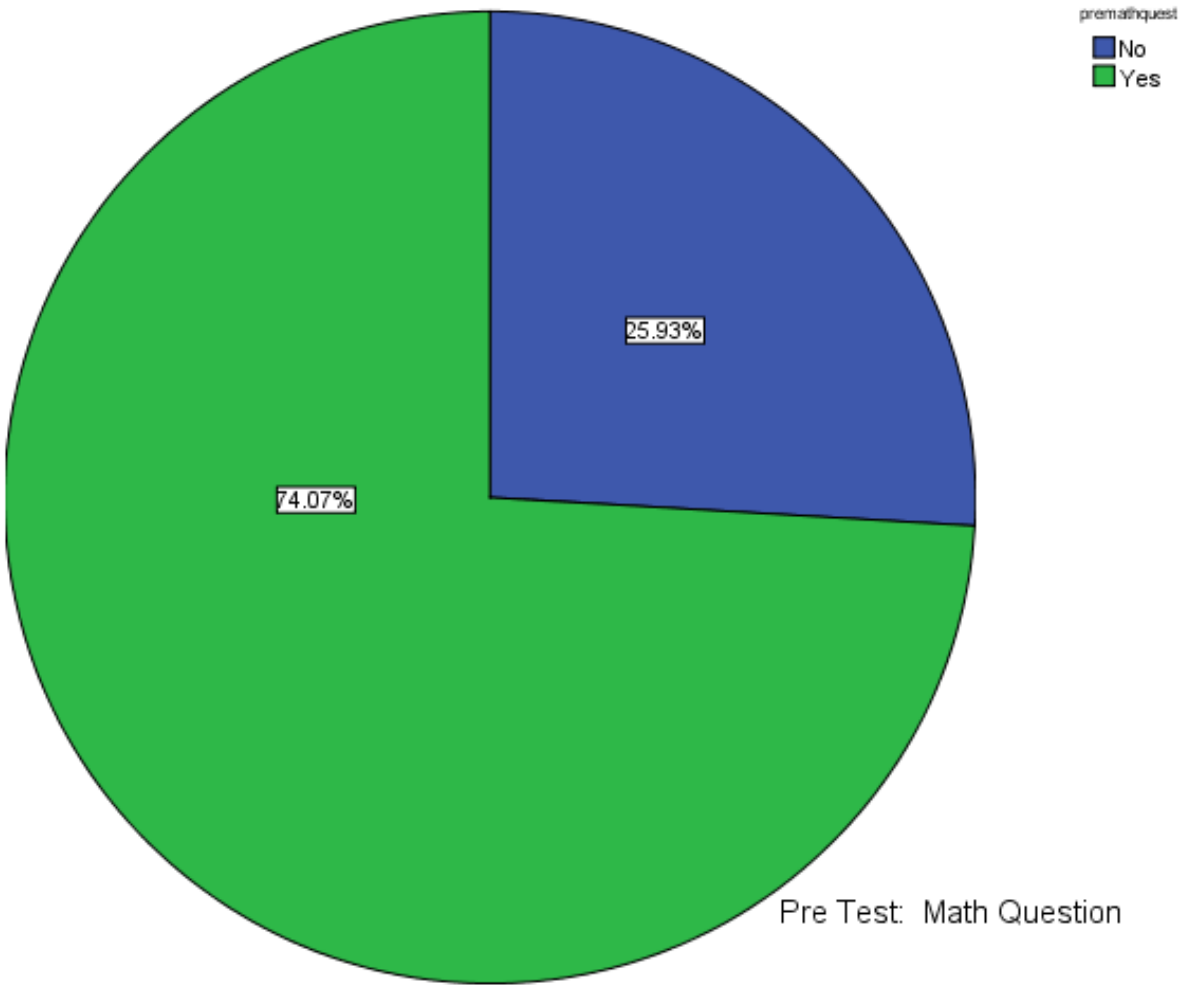
Table 7.

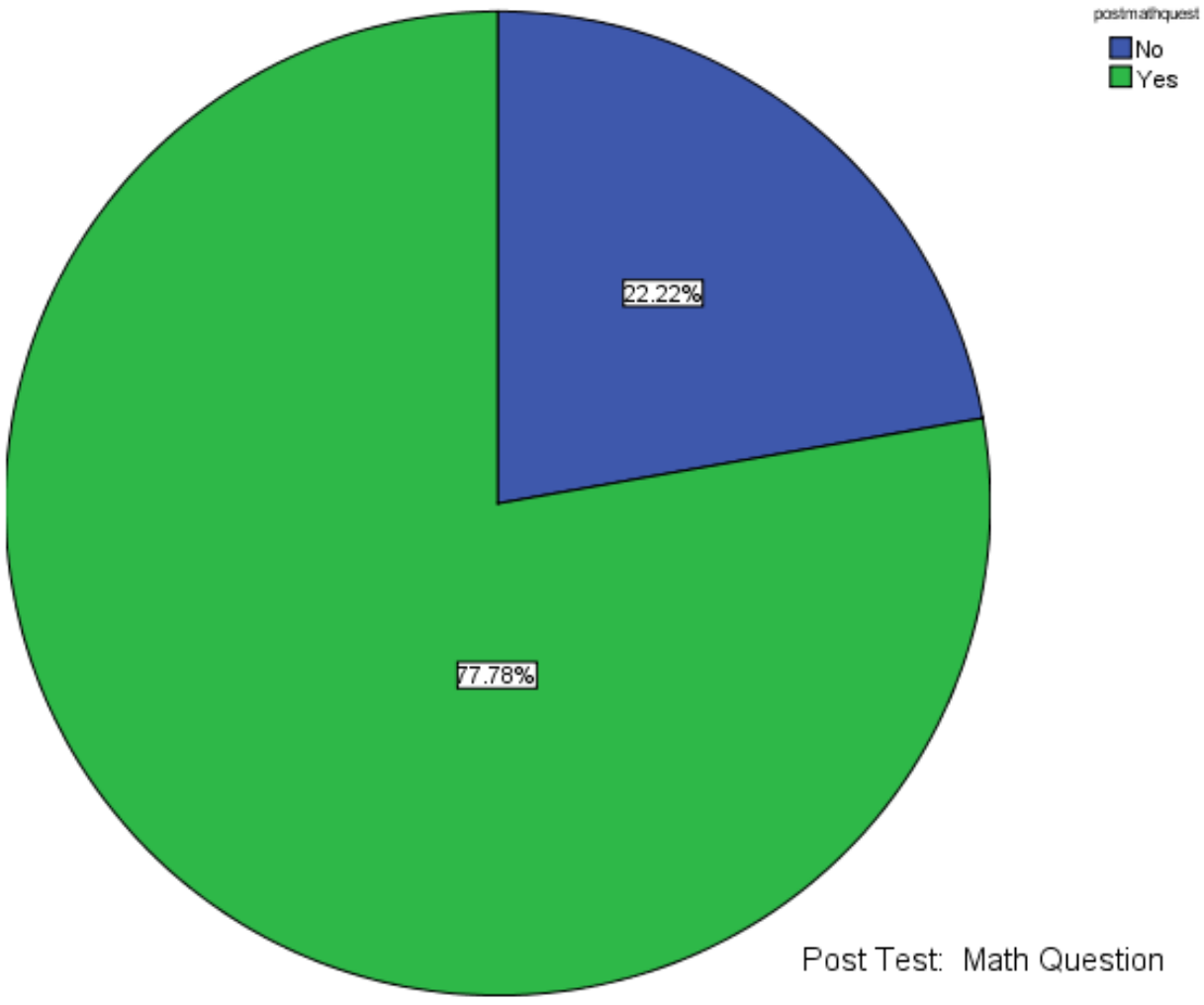
Means and standard deviations of student's perceptions about musical interaction and math aptitude

	N	Minimum	Maximum	Mean	Std. Deviation
Pre test Math Questionnaire	27	1.00	2.00	1.7407	.44658
Post test Math Questionnaire	27	1.00	2.00	1.7778	.42366

A somewhat weak positive correlation was found (r =.29 p <.14) but, a paired sample t test (t (26) = - .37, p =.71) showed no statistical difference between educative music therapy and students perceptions of math aptitude.

Figure 3. Graph of perceptions about relationship between musical interaction and math aptitude





Null Hypothesis 4. Students will not report that musical interaction influences social competency.

Table 8.

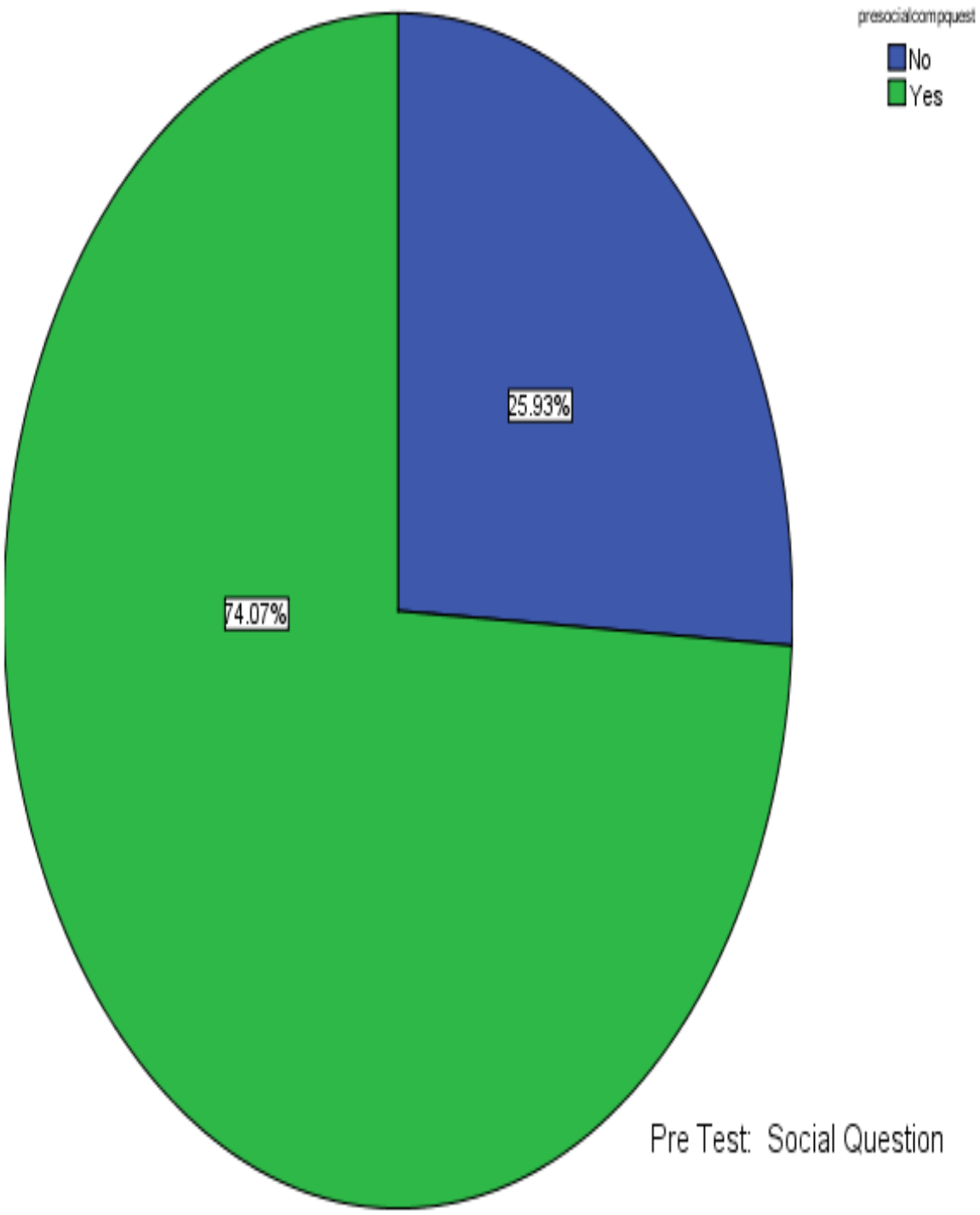
Means and Standard Deviations of student's perceptions about musical interaction and social competency

	N	Minimum	Maximum	Mean	Std.

					Deviation
Pre Social Competency Questionnaire	27	1.00	2.00	1.7407	.44658
Post Social Competency Questionnaire	27	1.00	2.00	1.8519	.36201

Means of pre- and post-calculations showed a small gain between the two groups (X= 1.74 pre- and X= 1.85 for post-test). A positive correlation was found ($r = .47$ $p < .05$), but a paired sample t test (t(26) =-1.36 p=.19) showed no statistical difference between educative music therapy and perceptions of social competency.

Figure 4. Graph of perceptions about the relationship between musical interaction and social competency


presocialcompquest
No
Yes
25.93%
74.07%
Pre Test: Social Question

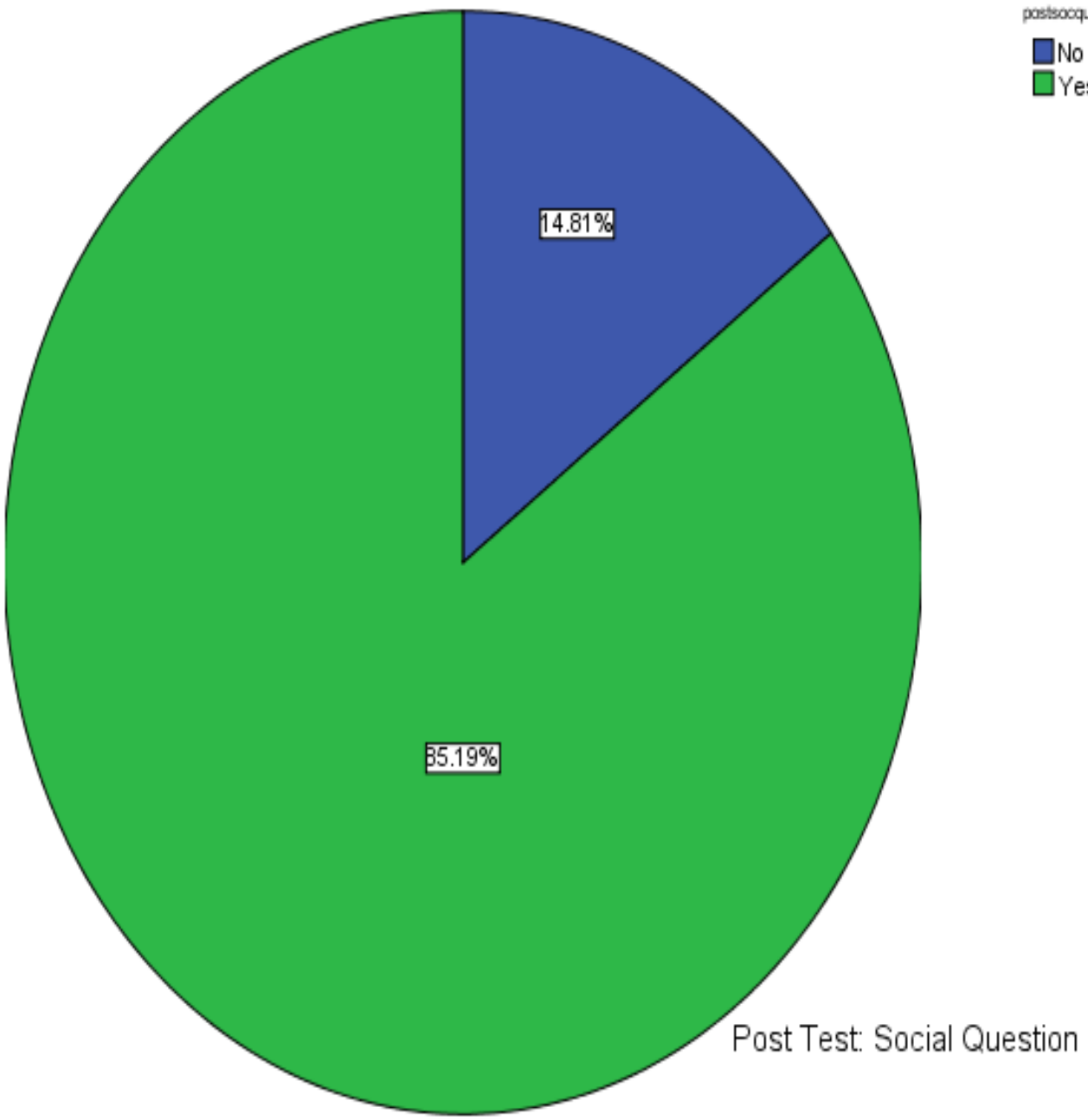

postsocquest
No
Yes
14.81%
85.19%
Post Test: Social Question

Table 9. Demographic Descriptors

Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Asian	1	3.7	3.7	3.7
	Black	1	3.7	3.7	7.4
	Hispanic	15	55.6	55.6	63.0
	Native	1	3.7	3.7	66.7
	White	9	33.3	33.3	100.0

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	f	9	33.3	33.3	33.3
	m	18	66.7	66.7	100.0
	Total	27	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	14	9	33.3	33.3	33.3
	15	13	48.1	48.1	81.5
	16	4	14.8	14.8	96.3
	17	1	3.7	3.7	100.0
	Total	27	100.0	100.0	

Social Class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	lower	9	33.3	33.3	33.3
	mid	1	3.7	3.7	37.0
	middle	1	3.7	3.7	40.7
	middle	13	48.1	48.1	88.9
	middle	1	3.7	3.7	92.6
	upper	2	7.4	7.4	100.0
	Total	27	100.0	100.0	

Chapter 5

DISCUSSION

Discussion of Results

The purpose of this study was to examine the influence of educative music therapy on math aptitude and survey the perceptions of students about the relationship between music, social competency, and math aptitude. To establish the groundwork for examining the statistical differences between research questions, the null hypotheses formulated were as follows:

1. Educative music therapy will not increase participant's scores on the WIATIII math fluency test;

2. Educative music therapy will not increase the participant's scores on the WIATIII;

3. Students will not report that music interaction influences math aptitude;

4. Students will not report that musical interaction influences social competency.

To address the null hypothesis educative music therapy will not increase participant's scores on the WIATIII math fluency test, a *t* test (t (26) = -.35, p =.73) showed no statistical difference. To address the second null hypothesis educative music therapy will not increase the participant's scores on the WIATIII, results from a *t* test (t(26) = -.97, p =.34), again showed no statistical difference. From these outcomes, the researcher maintained the null hypotheses.

Outside of statistical significance, during pre- and post-test, the scores of the math fluency test remained close together for the majority of the students, indicating that the treatment did not affect them in a negative way. There are 3

scores that significantly increased for participant 3, 10, and 15. Although these scores may be exceptional cases, treatment may have influenced their individual scores. There were also 3 participants whose scores significantly decreased. These scores indicate that the students were either distracted or lost interest in completing the test, which significantly decreased their scores.

When examining the pre-test/ post-test data of the math calculations test, it is important to note that there were 7 scores that significantly increased for participants 1, 2, 6, 14, 16, 20, and 24. These scores may indicate that the usage of educative music therapy increased the math aptitude skills of these participants. Participants 5, 7, and 21 scored the same on pre-test and post-test measures indicating that educative music therapy did not minimize their performance. Two participants, 12 and 25, scored worse during post test indicating they may have been negatively affected by stress or lack of concentration during the testing trials. These results suggest that the research endeavor was ambitious, but the researcher was too far reaching in the hypothesis that educative music therapy influences scores on the math fluency and math calculations section of the WIAT 3rd edition.

One complication that limited the researcher's chances of finding statistical differences between the pre-test and post-test math data was the structure of the metric used. The WIAT 3rd edition was created to be somewhat impervious to short-term environmental changes. This study lasted for ten weeks, therefore, due to the short duration of the research and the somewhat impervious nature of the WIATIII to short term changes, finding statistical significance on

this measure was challenging. Also, the varying grade levels of the students may have influenced their testing results. The measurement is engineered to test up to senior year math, and the majority of the population was comprised of individuals who were in the ninth and tenth grade. These were some factors that may have influenced results, but the findings are still of value. The results suggest that in further research alternate experimental designs, and additional aptitude metrics should be used to examine short term changes in math aptitude.

The second aim of the research procedure was to examine the perceptions of students about the relationship between music, math, and social competency. In regards to the null hypothesis students will not report that music interaction influences math aptitude , a *t* test (t (26) = - .37, p =.71) showed no statistical significance. To address the null hypothesis students will not report that musical interaction influences social competency, a *t* test (t (26) =-1.36 p=.19) showed no statistical significance. From these finding the researcher maintained the null hypothesis. Outside of the statistical findings, the responses from the surveys offered promise for future research. The results suggest that alternative educational measures may have the ability to change student's perceptions. For example, results from the questionnaires surveying influence of educative music therapy on social interaction display that 10 percent more individuals reported that musical interaction influences social competency during post test. This is a considerable increase in responses within this small population. This evidence may suggest that as a result of educative music therapy student's perceptions

changed about the usage of alternative measures within education. With a larger testing population, a more significant increase may be seen.

An additional salient result is that the majority of the students perceived that musical interaction increases social competency and math aptitude. This finding is significant, because it serves as a qualitative substantiation that students' perceive benefit from musical interaction. This perception may in turn manifest into increased academic and social performance, strictly due to students showing personal investment and perceiving benefit from additional measures to remediate at-risk factors. This finding offers promise for educative music therapist for two reasons. First, changing student perceptions may help augment social and academic performance and second, middle class youth are often forgotten about in regards to mental health interventions. Since the majority of the individuals who responded to the surveys were middle class, the results from the surveys may suggest that there is a new demographic that perceives benefit from music interaction. Further research examining the relationship between middle class youth and alternative measures in education will give opportunity for educative music therapists to service an underrepresented population within music therapy practice.

Comments on Research Procedure

Upon examination of the current research procedures, several areas of concern were identified. First, the majority of the participants identified themselves as middle class individuals. Even though the term, middle class, was defined, there was no opportunity to verify this determination through factual

records. The subject's report of middle class status may, therefore, have been inaccurate. However, if the self-report holds true, the testing population was ideal for this research. The presence of predominantly middle class students supported the proposed greater impact of the research, which was to gather data from middle class youth needed to examine at-risk factors.

A second issue of concern relates to characteristics of the sample, including gender, age, race, and number of sessions completed by participants. There were twice as many boys as girls. A more even testing sample may have yielded better results, because some studies show that males may perform better on math tests. Since standardized math test are considered to be biased towards males, the results of the standardized tests may not accurately describe the math skills of the female participants. A more homogeneous gender ratio may have limited some of the effects of the proposed internal bias of standardized math test. In regards to group differences between **Group A** High School Guitar Class and **Group B** High School after School program, the research sessions took place during different parts of the day, which may influence data. Factors like fatigue from a day of school or even hunger could influence the results of the after school groups compared to groups held during the day. **Group A** was considerably larger than **Group B.** A more even distribution of participants between groups would likely yield more accurate results.

A more even distribution between groups would allow for opportunity to examine the difference between in school application of treatment versus after school application. Due to the small size of **Group B,** making a distinction

between the effectiveness of educative music therapy between the two groups was more difficult. Also, **Group A** attended more research sessions than **Group B**, which may have minimized the overall influence of educative music therapy on math aptitude and perceptions of the benefits of social competency and musical interaction. With more sessions, **Group A** had a longer period of time to learn the music skills, become familiar with the researcher, and develop a sense of trust and companionship with other subjects, which would likely influence results.

In relation to demographic information, the most prominent ethnic group in the sample was Hispanic males. One complication was that there were only two Black and Asian individuals in the study. More even representation of racial groups would allow broader generalization of results. This will be pursued in future research. Age was not seen to be a limitation between the testing populations, however, in future research ninth and tenth graders will be examined separate from eleventh and twelfth graders to more clearly examine individual group differences. A third concern was population size. The 27 subjects used were adequate, but not ideal. A larger sample is desirable and should be used in future research. The larger sample could possibly bring significant results.

Changing the research design could also create opportunity for significant results. Utilizing a control group may allow for clearer determination of the differences in math scores between those who received treatment and those who did not. The usage of a pre-test/post-test design made finding a statistical difference more challenging than utilization of a control group/experimental

group pre-test/post-test design. A pre-test/post-test design was the most accessible method to implement the educative music therapy curriculum, due to logistical and time constraints. Under different conditions, usage of a control group/experimental group will be utilized. The pre-test/post-test design without the control group greatly decreased the chances of finding statistical significance.

Although there is opportunity to utilize other research designs, the methods used were efficient and controlled. The tests were administered in the same fashion and the time limits were strictly adhered to during the testing trials. The testing design was appropriate for the conditions presented during the research. Using an in school group and an after school group increased the amount of participants. Both the in school group and after school group were very steady in their attendance of research sessions. This was helpful in minimizing complications of attrition. Although there was little attrition, one complication within the testing trials was observed. Some students during the post-test appeared to be less interested in completing the test. They looked around, stopped taking the test, made disparaging comments, and expressed displeasure in having to "take the test again." This caused individuals who previously scored well on the measures to score worse the second time. This is a clear contamination to the research results. For example, on the math fluency test participant 24 scored highly on the first test and showed a considerable decrease on the second testing trial. Variables such as participant fatigue will be accounted for in future research.

To address data collection methods, the usage of a *t* test to analyze the data may have been a less sophisticated level of statistical examination; however,

t tests are designed specifically to examine pre-test/post-test data. In future research, additional statistical testing will be pursued.

Recommendations

In future research a larger testing sample is necessary. A larger number of participants provides more opportunity to generalize results pertaining to student's perceptions of alternative measures in education. A larger testing sample also allows for more comprehensive examination of specific need areas of students. The results of this research suggest that music therapist must be more specific in their examination of factors that influence student performance. In this study two questions were asked to participants about math and social competency. Research suggests that there are many other factors that influence student performance. Therefore, more questions should be presented to participants to examine other areas of student perceptions pertaining to academic and social performance. For example, surveying a wide array of responses may allow students the opportunity to voice what complications they face and how they feel changes can be made within the educational system. This information may in turn promote the usage of interventions that are more student centered.

Initially, the researcher intended to use the MSCEIT and Woodcock Johnson in conjunction with the WIATIII and survey of student perceptions. The WIATIII is considered to be a gold standard in educational forums, however using additional tests offers researchers more opportunity to accurately represent the math aptitude of participants. In addition, future research utilizing the MSCEIT will provide opportunity to examine the influence of educative music

therapy on norm referenced social competency tests. Through using additional standardized tests and the MSCEIT, a more comprehensive examination of the influence of educative music therapy on students academic and social functioning will manifest. Through this form of research there is more opportunity to substantiate the importance of alternative measures in education. Educative music therapists speak of the academic and social benefits students receive from musical interaction, but due to lack of empirical evidence their claims are refuted. If statistical significance is found on measures that educators feel are important to student functioning, educative music therapist will increase their credibility and expedite the rate at which alternative measures are integrated into standard curriculums. If educative music therapist and educators find agreement on interpretation of results from norm referenced tests, this will serve as the catalyst for creation of common ground between traditional education paradigms and secondary measures within education.

The most significant finding from this study was that after exposure to educative music therapy many students reported that their perceptions changed about the relationship of musical interaction, social competency, and math aptitude. Continued examination of student perceptions gives a form of qualitative substantiation for the usage of educative music therapy to address specific academic needs for students. More research should be conducted on the effectiveness of alternative educational measures as a function of the perceptions of students. The study of perceptions is not always valid, due to the qualitative nature of self-report measures. However, the students in this research reported and

voiced in a post-test informal interview that they believe in the power of music to influence math aptitude. Scientists often scoff at making claims based on personal beliefs, but from a therapeutic aspect if a client expresses interest in a particular therapeutic device, behavioral and cognitive changes are more likely.

Future Research

There are many interrelated factors involved in the integration of alternative measures into educational forums. This research examined only a small portion of the larger issue. Varying educational paradigms, funding, and limitations of resources influence the rate at which secondary measures are integrated into standard curriculums. In future studies educative music therapists should research the varying ideologies and cost effectiveness of using secondary measures within education. Although this may be difficult, if educative music therapist find exactly where the overlap lies between the academic requirements of educational forums and the therapeutic goals of music therapists, we can focus on this specific area. This will maximize efforts by economizing time and creating more realistic research aims. One possible way to facilitate this effort is to examine the goals of educators and the goals of therapists through survey and interview. This will generate anecdotal accounts of the similar and dissimilar ideologies between educators and therapists. Once this qualitative evidence is collected, researchers will have the ability to compare the theoretical underpinnings and beliefs of educators and therapists. Through finding the overlap between these professional paradigms, educative music therapist will benefit by presenting information that is specifically tailored to direct application

of educative music therapy to areas that coincide with educators' philosophies of education.

Using the traditional argument that kids need social skills and academic skills is plausible, but we must formulate new methods to examine each aspects of the student experience. For example, researchers should identify appropriate metrics to examine aptitude, intelligence, social awareness, locus of control, resilience, identity and autonomy. If these tests are used and results show increase in these areas, this will further support the effectiveness of educative music therapy. In sum using future researchers should use a battery of social and academic metrics, pinpoint more specific areas of research, and change research designs. Implementing these changes will increase the success of future researchers. For example, when conducting research, educative music therapists should arrange their research aims to fit within a three-tiered design. Within this framework a surface level goal such as increased musical aptitude should be tested first. This will proved evidence that music therapy increases skills needed for musical performance. This may initiate further conversation with music instructors. Gaining their trust will help substantiate the need for educative music therapy within music curriculums. In the next tier, a more far reaching claim should be addressed. For example, outside of musical skills social competency and self awareness can be tested. As stated previously, there are many areas that influence student functioning. If educative music therapy is shown to increase musical skills, then the results can be tested against social functioning within education. After this claim is supported, then academic goals can be addressed.

This research was ambitious, but a more clear delineation of how music therapy addresses additional student needs may increase significance of results. Organizing research aims in this fashion facilitates better data collection and research methodology by placing the goals of the research endeavor into a hierarchy. From this framework more powerful educative music therapy studies will manifest.

Conclusions

The results of all statistical analyses were not significant and the established null hypotheses could not be rejected. However, in an informal question and answer session at the end of the research, the participants vocalized that they enjoyed learning new musical techniques and interacting with their peers. The responses of the students gave qualitative substantiation to the importance of music instruction to these high school students. Also, the teacher of the high school and the director of youth activities at the after-school program both said that they witnessed some positive behavioral changes within the youth. This anecdotal evidence further supports the effectiveness of musical interactions in assisting youth in various ways including academic performance and social development. This study was beneficial for the participants. They improved their musical skills and were introduced to additional ways to engage in process oriented activities.

The general premise of the research is still pertinent, although the results were not statistically significant. The research suggests that the use of alternative measures within education is in need of further review, due to more students

being at-risk. Along with various human development researchers and educational psychologists, educative music therapists present evidence that youth receive additional socio-emotional and academic support from musical interaction. These claims are often considered to be anecdotal; however scientists are presenting empirical evidence that musical interaction increases cognitive abilities. Outside of the varying professional paradigms between educators and therapists, something must be done to address the needs of all students. Social competency training and musical interaction are not new interventions, but through additional research a more comprehensive approach will be fashioned, which will increase the success rate of the most important demographic in education the "forgotten middle."

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APPENDIX A

STUDENT PERMISSION FORM

The Mozart effect and social learning I have been told that my parents have given permission for me to take part in a research project about music and social learning with children and young adults.

I will be asked to come between one to three times a week during or after school for one hour to learn guitar, piano and music theory. I will participate in music instruction between six to ten weeks.
I am taking part in this research endeavor because I want to. I know that I can stop at any time for any reason.

---------- ----------
---------- Sign name here
Print name here

Date

The Mozart effect and social learning
PARENTAL LETTER of PERMISSION

Dear Parent:

I am a graduate student under the direction of Professor Barbara Crowe in the department of music therapy at Arizona State University. I am conducting a research study using youth and young adults to examine the effects of music interaction and social learning and math skills. I am sending out this permission slip in order to request your child's participation. The study will begin in September and end in mid November 2010. Your child will be asked to come between 1 to 3 times a week for 1 hour. Your child will be given a social competency test and two math tests at baseline. Then for 6 to 10 weeks we will learn guitar, piano, music theory, and performance practice for small ensembles. At the end of the 6 to 810 week period the youth will be retested to see the interaction between math, social learning and music.

The sessions are voluntary. If you or your child chose to discontinue the study at any time for any reason there will be no penalty. The results of the study are for a master's thesis so they will be published, but no identifying criteria will be used such as names of participants or school. The children will receive free music lessons, learn how to perform simple musical pieces, and interact in a safe environment to promote social learning. There are no foreseeable risks. Just basic music interaction.

To protect confidentiality, the children's names and reference to the school involved will not be used. All records will be safe guarded in a locked cabinet and computer file. The results of the study will be handed in for credit

towards completion of a master's degree and a presentation will be given about the results, but yet again no one will be identified by name.

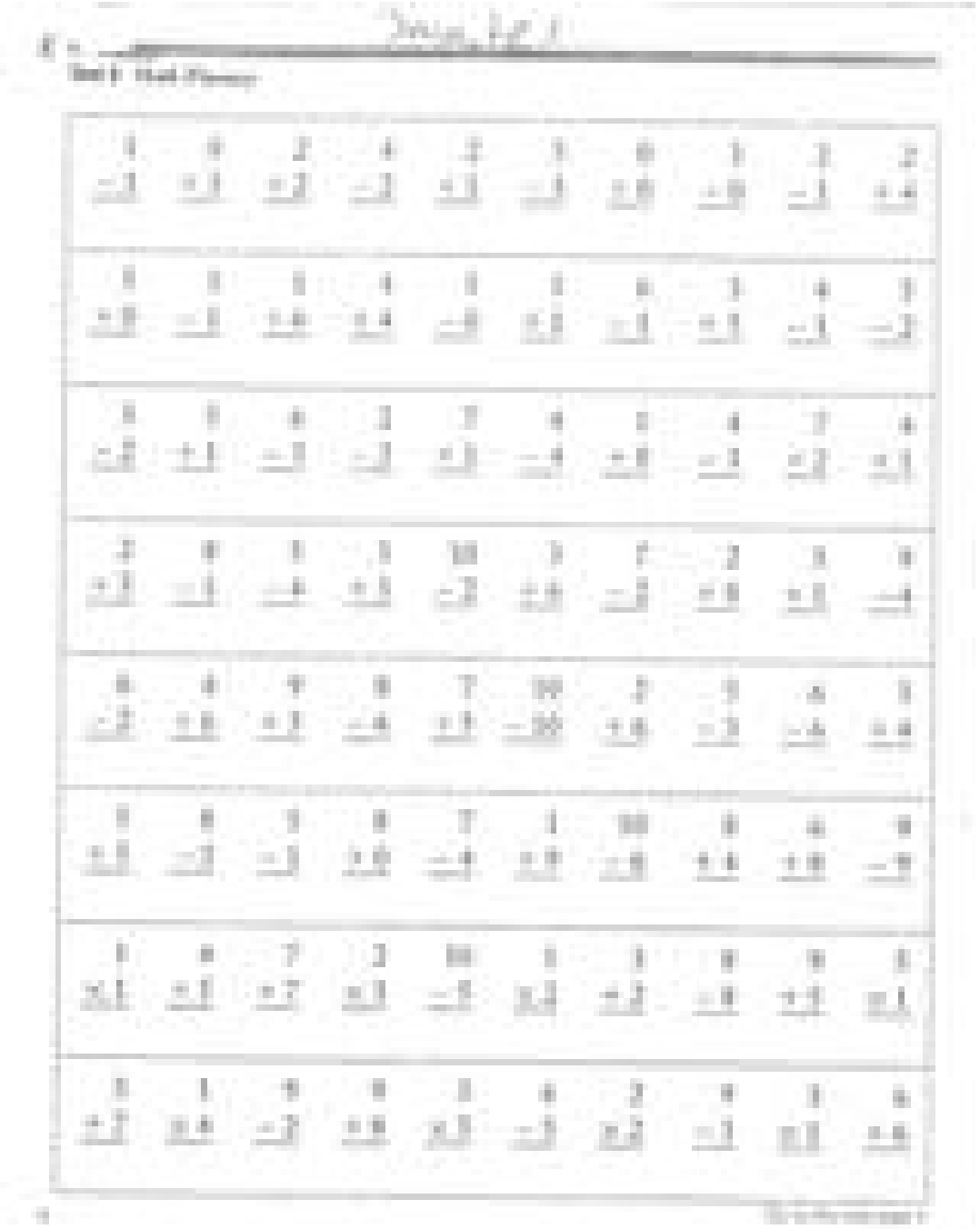
If you have any questions please contact me via email or cell phone.
jamesheiskell@hotmail.com

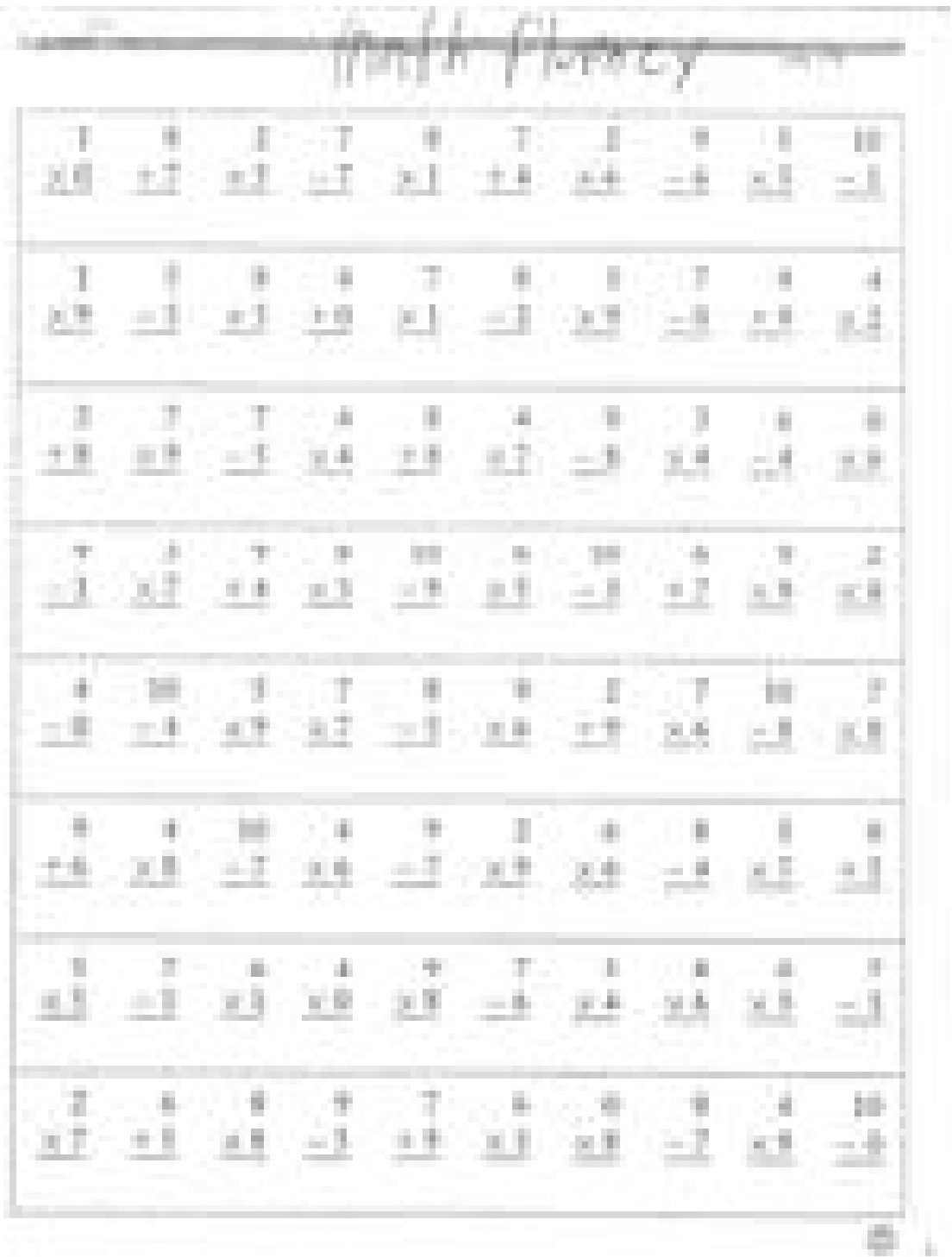
Sincerely,
James D. Heiskell

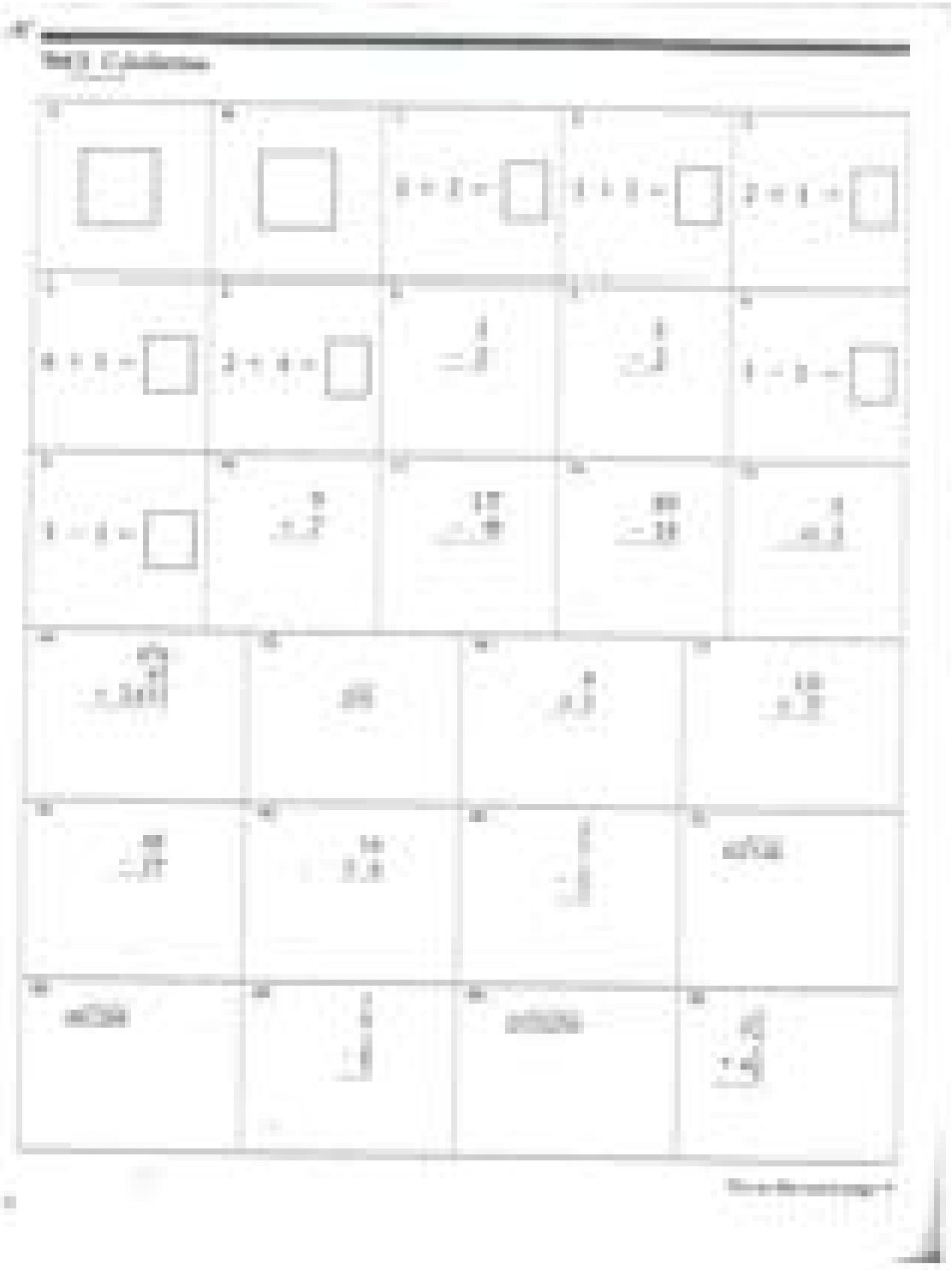
Parent Signature----------

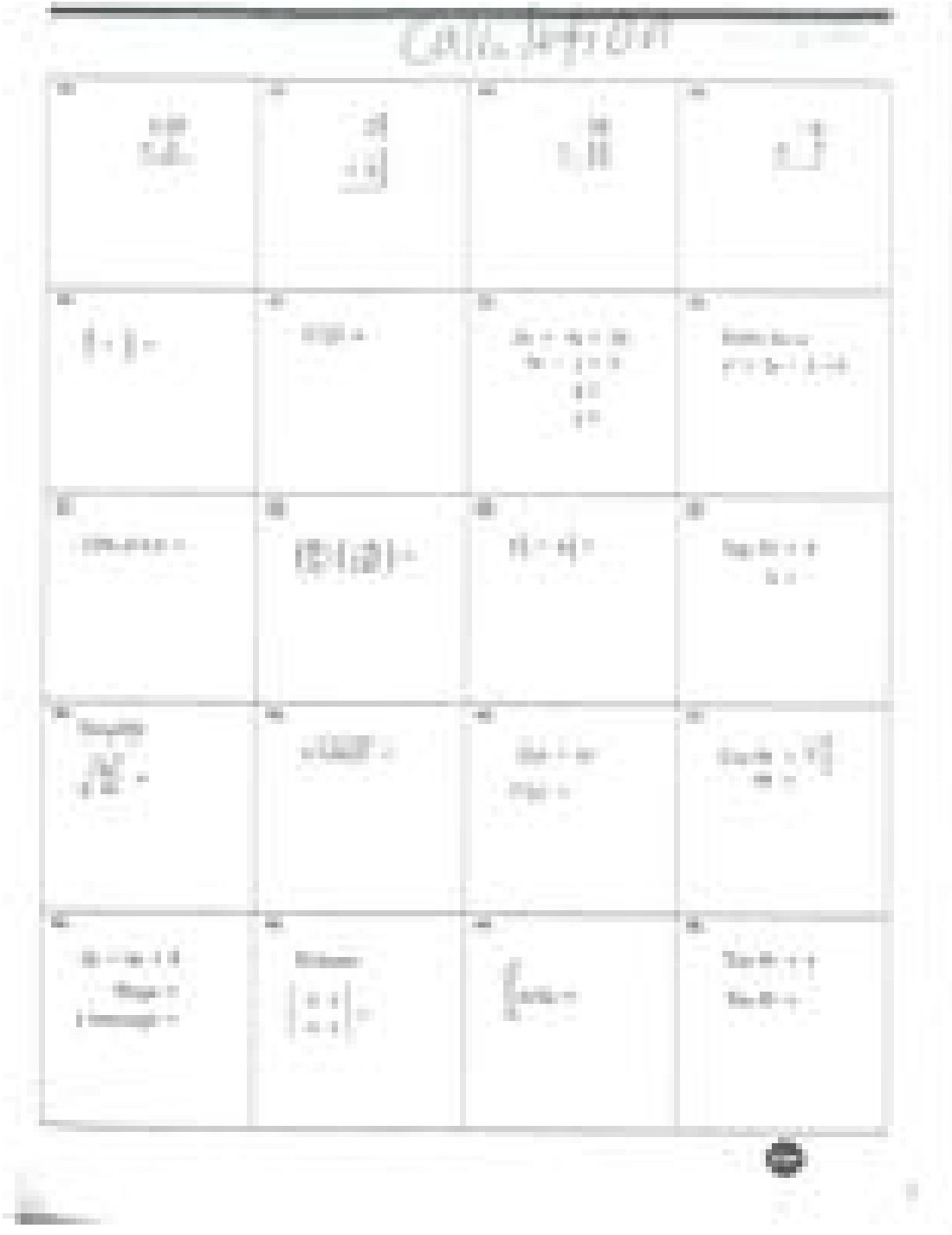
APPENDIX B

MATH FLUENCY AND MATH CALCULATIONS TEST









APPENDIX C

STUDENT QUESTIONAIRE

1. [Circle your age (9 10 11 12 13 14 15 16 17 18)
2. Circle your Gender: M or F
3. Circle what Grade you are in: 4 5 6 7 8 9 10 11 12
4. Circle your race Hispanic, Black, White, Asian, Native American,

   other----------
5. Circle your family's social class Lower($15,000- 25,000) Middle ($30,000- 60,000)

   Upper

   (above 65,000)
6. Have you had prior musical training (Circle) y or n
7. If so what instrument ---------- Fill in instrument
8. How long have you taken lessons Circle (1 2 3 4 5 6 7 8) years
9. Circle What instrument would you like to learn

   Guitar piano drums other----------
10. Do you believe music increases social competency skills (Circle) y or n

11. Do you believe music increases Math scores (Circle) y or n

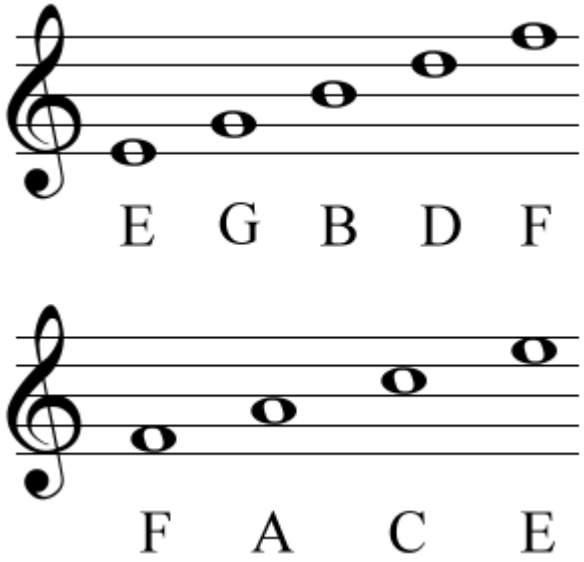
    Insert text of appendix here. Do not repeat appendix title.]

APPENDIX D

MUSIC THERAPY CURRICULUM

Basic Music Theory

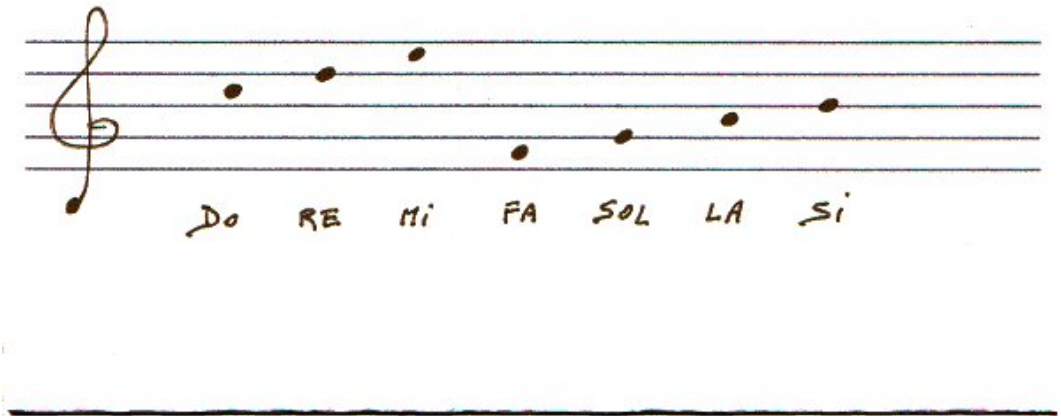
Participants were shown that musical dictation is a system that operates off of basic principles that are based on the musical alphabet.



Appendix D. (continued)

Solfege

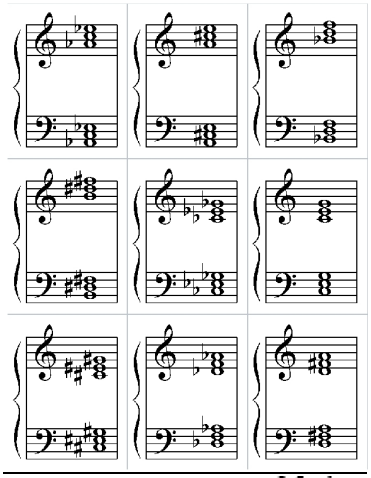
The basic musical alphabet was translated into Do, Re ,Mi, Fa, So, La, Ti, to show alternate ways to perform short melodies.



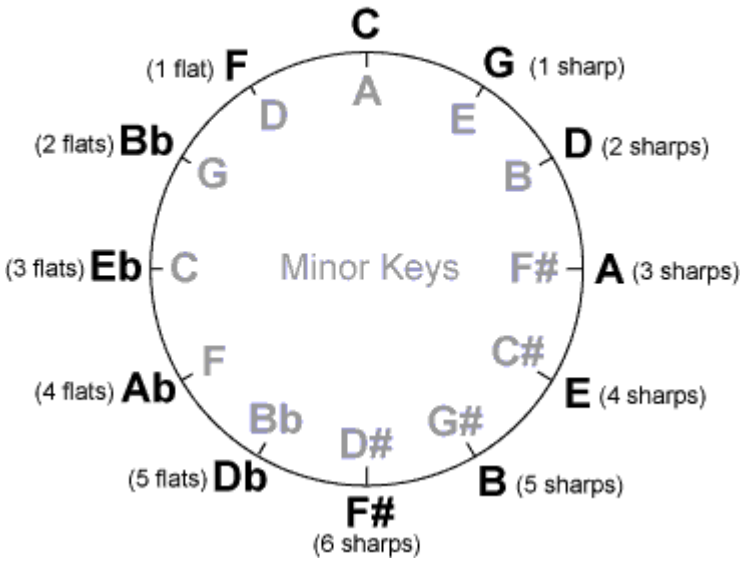
Appendix D. (continued)

Key Structure

The C major scale was used to show that all keys operate off of similar concepts.



Major Keys



Appendix D. (continued)

Rhythmic dictation

Symbols were used to show how rhythms operate as a function of fractions.

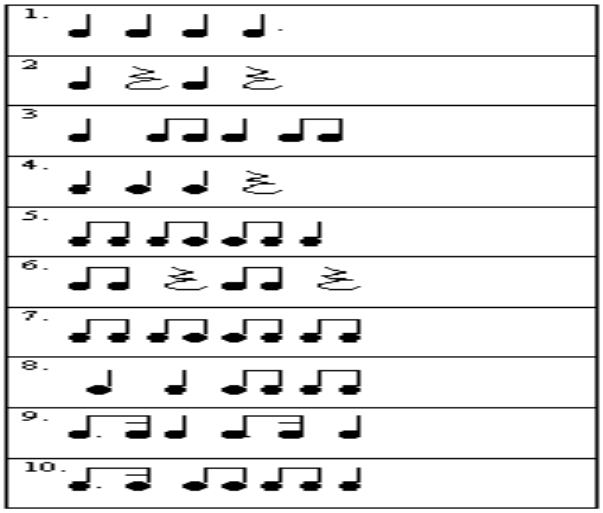
O=0 hits
X=1 hit
X/X=2 hits
ddd=3 hits
^^^^=4 hits

Example 1.

1	2	3	4
X	X	X	X

Example 2.

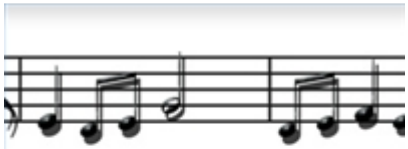
1	2	3	4
X	0	X	O



Appendix D. (Continued)

Ear training

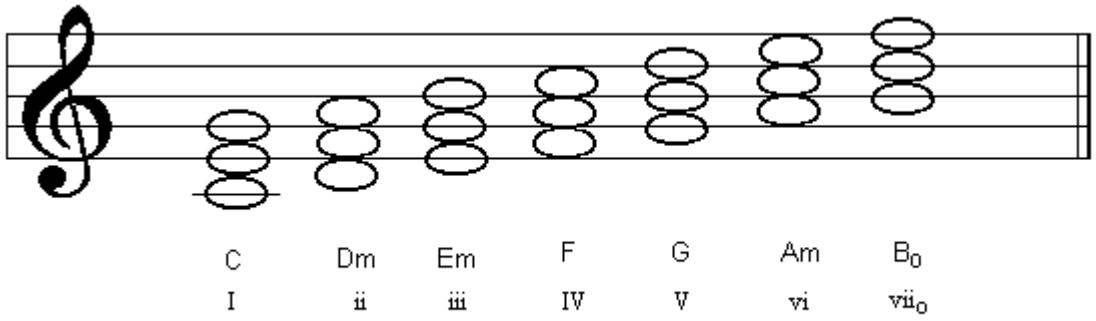
Short examples were used in the key of C to show that using your ear along with musical notation increases the ability to remember tone sequences.



Appendix D. (Continued)

Triads

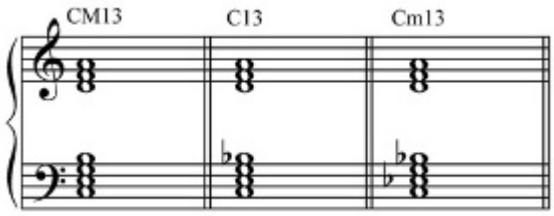
The idea that the triad is similar to a ruler that services as the fundamental grouping mechanism of harmony.



Appendix D. (Continued)

Extended harmony

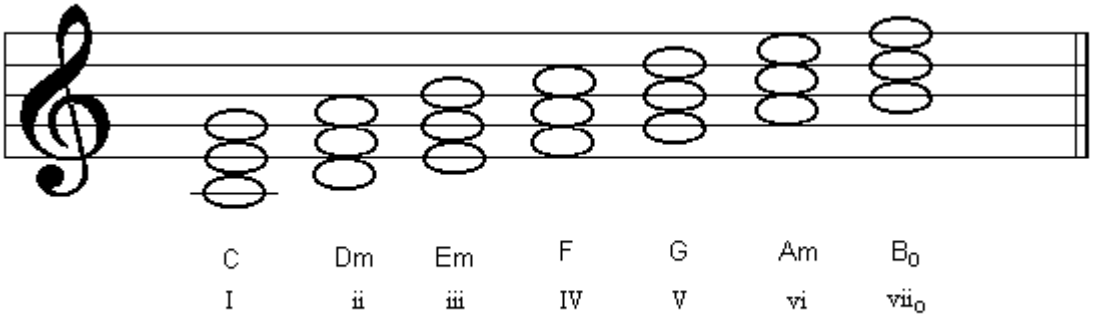
The idea that color tones are used to enrich basic triads was used to show how more complex forms of music integrate other harmony configurations outside of triads.



Appendix D. (Continued)

Roman Numeral Analysis

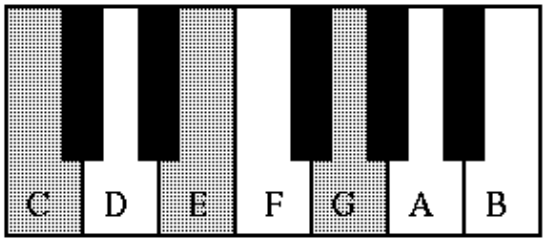
The idea that scores of music can be compartmentalized by numbers in order to examine harmony was explained.



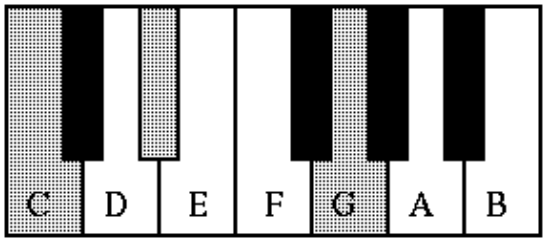
Appendix D. (Continued)

Minor/ Major/ Diminished Relationships

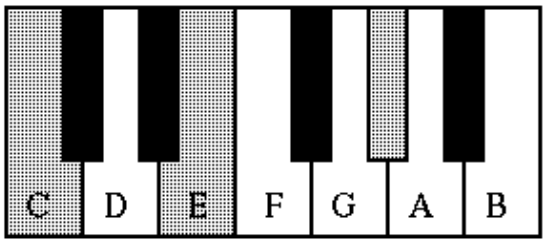
The participants were introduced to the rules that govern basic musical progressions as a function of interval relationships.



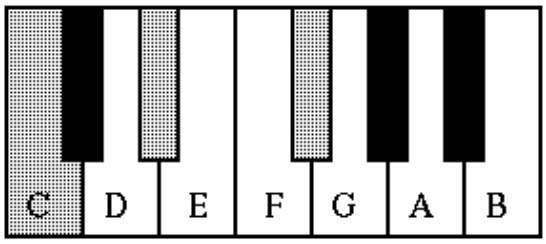
C–Major Triad (M)



C–Minor Triad (m)



C–Augmented Triad (a)



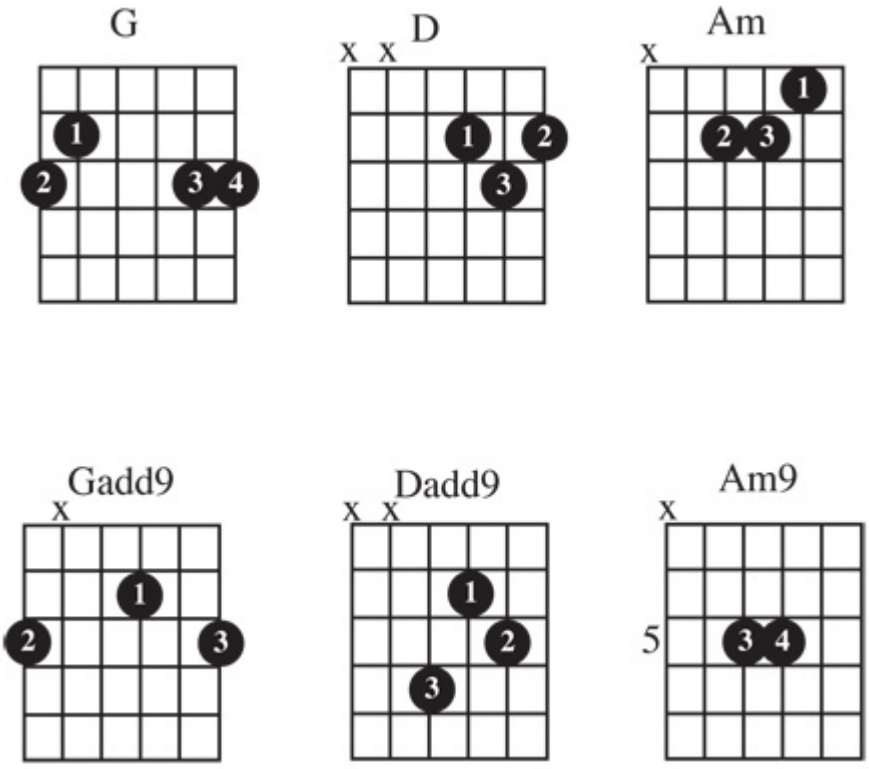
C–Diminished Triad (d)

The four types of triad.

Appendix D. (Continued)

Chord charts

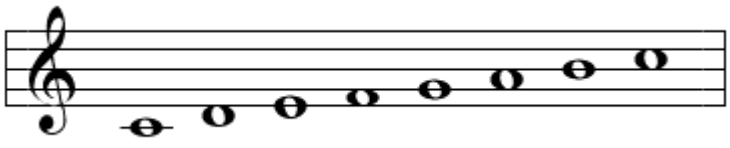
Guitar instruction was facilitated through usage of chord headings and guitar fret board diagrams



Appendix D. (Continued)

Scales

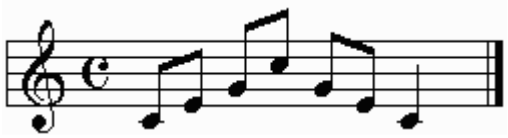
The idea that musical content operates in a linear fashion was explained



Appendix D. (Continued)

Arpeggios

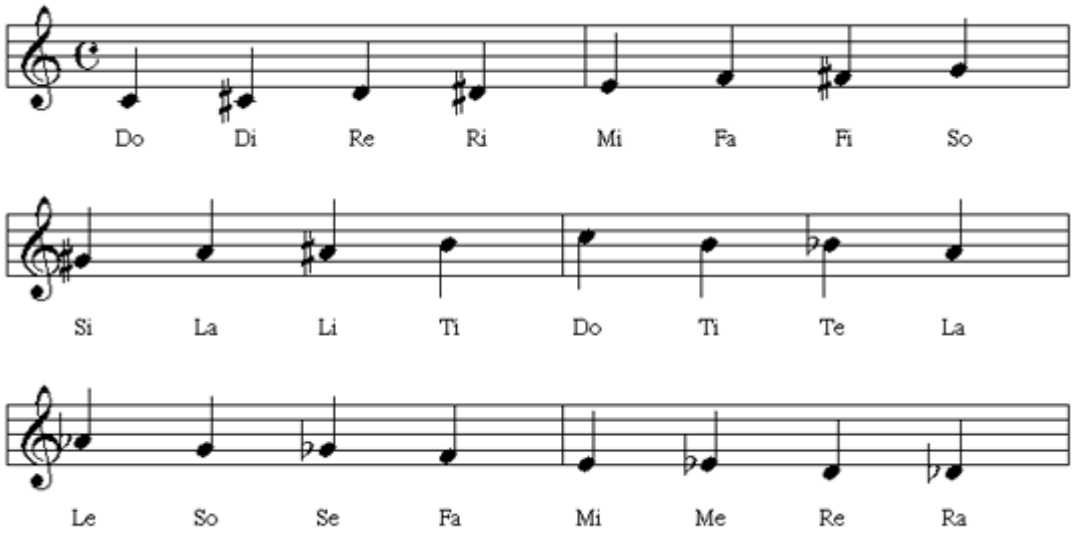
Broken chords were used to show how basic scales organize into root, third, fifth, and octave relationships was explained



Appendix D. (Continued)

Sight reading

Short examples were used to show that being able to analyze and perform musical content with minimal rehearsal was used.



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