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The Impact Of A Formal Public School Instrumental Music Instruction Program On An Eighth Grade Middle School Student's Reading And Mathematics Achievement

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**THE IMPACT OF A FORMAL PUBLIC SCHOOL INSTRUMENTAL MUSIC
INSTRUCTION PROGRAM ON AN EIGHTH GRADE MIDDLE SCHOOL
STUDENT'S READING AND MATHEMATICS ACHIEVEMENT**

BY

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**Submitted in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education
Seton Hall University**

2001

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CHAPTER I

Introduction

A subtle, yet pervasive attitude exists throughout the public schools of the United States that downplays the important role of music education in the edification of its youth, specifically instrumental music instruction. Public schools universally, in an effort to create an intellectual climate, have marginalized the importance and/or significance of the Arts in general, to assist in fostering this desired intellectual paradigm (Eisner, 1992). In a 1992 survey of Principals by the U. S. Department of Education, only 12 percent of those who responded believe that the visual and performing arts are important enough to receive attention; the other 88 per cent did not share the same opinion (Wright, 1994).

In an effort to promote and measure accountability and student performance through state mandated standardized testing, a "back to the basics" movement has been championed by a majority of educational policy makers. These policy makers have conveniently forgotten what Horace Mann, founder of the American School System, believed; that "music is essential to the education of the young for the development of aesthetic appreciation, citizenship, and thinking" (Miller & Coen, 1994, p. 459).

Focusing on the "thinking" component of Horace Mann's statement, there is an increasing yet still limited number of music educators and concerned policy makers in the past 25 years who have begun to look at empirical research that examines the relationship between instrumental music instruction and academic achievement. The intuitive speculation that music and academic achievement have some type of relationship has been the subject of many inquiries (Phillips, 1976). If the existence of a positive relationship can be argued between music and other content area subjects, than a policy

rationale that includes instrumental music instruction as a core academic subject can be supported.

Some studies suggest that there is a positive correlation between instrumental music instruction and academic achievement (Robitaille & O'Neal, 1981; Hill, 1987; Dreyden, 1992; Trent, 1996), while others contradict these findings by stating that there is no significant relationship (Anello, 1972). Still, others suggest that it may be that those students who achieve academically are naturally drawn to participate in instrumental music programs (Phillips, 1976; Gordon, 1979; Hedden, 1982; Hill, 1987; Trent, 1996; Holmes, 1997). The question as to whether there is a relationship between instrumental music and academic achievement remains generally unresolved. If there is a relationship, is it possible that the nature of the relationship is causal?

The field of neurological science has started to yield some interesting findings concerning this dichotomy that may infer a greater positive relationship between instrumental music instruction and academic success. Research into understanding higher brain functioning, using music as a "window," conclusively finds that the area of the brain that is stimulated by music and music instruction is the same area of the brain that controls spatial reasoning and spatial reasoning is directly connected to both mathematics and science ability (Leng & Shaw, 1991).

Using a group of pre-school children as her subjects, psychologist Frances Rauscher noted that there is a direct connection between formal musical instruction and enhanced spatial reasoning ability (Viadero, 1998). From these findings, an assumption can be made to support the notion that instrumental music instruction indeed has a positive impact on academic achievement.

Based on previous research into the relationship between instrumental music and academic achievement and the neurological studies by Rauscher (1995) and Leng & Shaw (1991), this researcher will build upon the knowledge base in an attempt to infer if a causal relationship between instrumental music instruction and academic achievement exists. This study proposes to 1) look at a specific age group (eighth grade middle school students); 2) take into account the number of years each student has been involved in formal public school instrumental music instruction, and, 3) control for the variables, gender, I.Q., and Socio-Economic Status (SES), which have been ignored in part or accounted for differently, in previous research, in order to disassociate the impact of these variables upon academic achievement.

Statement of the Problem

Hypotheses for this research project are based upon the following problem and sub-problems:

Problem.

Does formal instrumental music instruction, and the number of years of instruction, have an impact on an eighth grade middle school student's academic achievement?

Sub-Problems.

- 1) Does formal instrumental music instruction, when controlling for socioeconomic status, have an impact on an eighth grade middle school student's academic achievement?

- 2) Does formal instrumental music instruction, when controlling for gender, have an impact on an eighth grade middle school student's academic achievement?
- 3) Does formal instrumental music instruction, when controlling for I.Q., have an impact on an eighth grade middle school student's academic achievement?
- 4) Does formal instrumental music instruction, when controlling for gender, socioeconomic status, and I.Q. as multiple variables, have an impact on an eighth grade middle school student's academic achievement?

Hypotheses

Using a methodology that allows for model building, the following Hypotheses are proposed for study in this research project:

HO₁ - There is no significant difference in reading achievement between eighth grade instrumental music students and eighth grade non-instrumental music students.

HO₂ - The number of years of instrumental music study has no significant impact on an eighth grade student's reading achievement.

HO₃ - Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Socioeconomic Status (SES) is controlled.

HO₄ - Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Gender is controlled.

HO₅ - Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Intelligence Quotient (I.Q.) is controlled.

- HO₆ - Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variables of Socioeconomic Status (SES), Gender and Intelligence Quotient (I.Q.) are controlled.
- HO₇ - There is no significant difference in mathematics achievement between eighth grade instrumental music students and eighth grade non-instrumental music students.
- HO₈ - The number of years of instrumental music study has no significant impact on an eighth grade student's mathematics achievement.
- HO₉ - Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Socioeconomic Status (SES) is controlled.
- HO₁₀ - Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Gender is controlled.
- HO₁₁ - Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Intelligence Quotient (I.Q.) is controlled.
- HO₁₂ - Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variables of Socioeconomic Status (SES), Gender and Intelligence Quotient (I.Q.) are controlled.

Significance of the Study

This study is designed to examine the implication that enrollment in a formal public education instrumental music program may have a causal effect on a middle school student's academic achievement. If this is the case, the study then has significance on two levels, one curricular, and the other, educational policy. Results from this study will build upon previous research on the topic and provide implications for teachers, administrators, parents and most importantly, students.

On the curricular level, Norman Weinberger (1998) in his article "The Music in our Minds," states, "music has the ability to facilitate language acquisition, reading readiness, and general intellectual development" (p. 36). This is being discovered in the cognitive sciences and through current research, in which actively engaging in music performance increases the student's brain capacity by strengthening the connections among brain neurons. Learning and performing music exercises the brain in ways that are discovered as new technology allows researchers to measure this effect (Weinberger, 1998).

It has been ascertained through recent research that both hemispheres of the brain are involved in both listening and performing music. Musical experiences are said to be multi-modal in that they involve the use of visual, auditory, cognitive, affective and motor systems (Black, 1997).

If a causal relationship is suggested through this research project then it goes to supporting the views of Weinberger and the research of Frances Rauscher, Xiaodan Leng and Gordon Shaw. This relationship may have far reaching implications for cross content curricular initiatives and policy mandates.

On an educational policy level, most states have adopted some form of standards that delineate visual and performing arts. In most cases though, these standards have been put in place to simply satisfy a need for aesthetic education. While it may be true that the importance for aesthetic education cannot be championed enough, if the arts are to survive on this premise alone, their existence may become tenuous.

In his article, "The Stronger Rationale for Music Education," Kenneth Phillips (1993) reports that music programs are losing out based on the argument for aesthetic education. The music education profession needs a rationale to help in the fight for maintaining its place in the curriculum. Phillips succinctly states that educational policy makers need "a philosophy that embraces both utilitarian and aesthetic objectives" (p. 17).

Frank Wilson (1985) believes that policy makers should be concerned with the survival of music because of the deplorable state of public educational policy on music due to finances. At times, when financial resources are limited, programs are asked to prove their worth. Wilson states, "Music belongs in the curriculum as an important adjunct to verbal and computational skills" (p.41).

Joyce Kelstrom (1998) proposes that the future of music education and all the arts in this country depends upon administrators and their awareness of the benefits of providing a comprehensive music curriculum. She believes that this commitment will not be made unless the positive effect music and the arts has on a student's academic achievement is quantified and known.

Definition of Terms

1) Instrumental Music Student (IMS) – a student who is currently enrolled (when data is

collected) in a formal public school band/orchestra musical instrument instructional program that includes a minimum of 45 minutes of instruction per week.

- 2) **Non-instrumental Music Student (NMS)** – a student who is not currently enrolled (when data is collected) in a formal public school band/orchestra musical instrument instructional program.
- 3) **Formal Instrumental Music Instruction (FIMI)** – is considered to be either a small group lesson, a musical performance ensemble rehearsal or both.
- 4) **Reading Achievement (RA)** - is defined as a student's percentile performance/score in reading on a district wide standardized assessment (i.e. California Achievement Test (CAT)) and/or a statewide-standardized assessment (i.e., The New Jersey Grade Eight Proficiency Assessment (GEPA) language arts total score.
- 5) **Mathematics Achievement (MA)** - is defined as a student's percentile performance/score in mathematics on a district wide standardized assessment (i.e. California Achievement Test (CAT)) and/or a statewide standardized assessment (i.e., The New Jersey Grade Eight Proficiency Assessment (GEPA)).
- 6) **Academic Achievement (AA)** – is defined as a student's percentile performance/score in reading and/or language arts and mathematics on a district wide standardized assessment (i.e. California Achievement Test (CAT)) and/or a statewide standardized assessment (i.e., The New Jersey Grade Eight Proficiency Assessment (GEPA)).
- 7) **Socioeconomic Status (SES)** – is determined upon a student's enrollment in the state of New Jersey's free and reduced price lunch program.

- 8) Intelligence Quotient (I.Q.) is defined as the Standard Age Score as measured by the district wide assessment tool (Cognitive Abilities Test) in use to measure said variable in which the study takes place.

Assumptions

- 1) The students involved in the study receive equally effective instruction in instrumental music, mathematics, and reading instruction.
- 2) The sample of students from both middle schools is representative of the population of an average northeast middle class community.
- 3) The standardized test data collected measures what it purports to measure.

Limitations

- 1) The data sample used in this study is confined to eighth grade students enrolled in two separate middle schools from the Union Township Public School District during the 1998-1999 school year.
- 2) Instrumental music students are defined as only those students who were enrolled in the formal instrumental music program, limited to band and orchestra, during the 1998-1999 school year.
- 3) Instrumental music students who received out of school instruction from a private teacher are not accounted for as an added variable.
- 4) The study focuses on reading and/or language arts and mathematics achievement, only as measured by commercial and State standardized assessment tools.
- 5) The design of this study is post facto.

CHAPTER II

Review of the Literature

This chapter outlines some of the important literature that pertains to the primary problem and its sub-problems. The chapter is divided into eight parts: five sections relate to the main problem, Instrumental Music Instruction and Academic Achievement, including Instrumental Music Pullout Programs and its Effect on Academic Achievement, Instrumental Music and Intelligence, Instrumental Music and Academic Achievement, Instrumental Music and Mathematics Achievement, and Instrumental Music and Brain Research. The other three sections examine a sample of the relevant literature concerning each variable listed in the sub-problems: Gender and Academic Achievement, I. Q. and Academic Achievement, and Socioeconomic Status and Academic Achievement.

Instrumental Music Pullout Programs and its Effect on Academic Achievement

For years, instrumental music instructors had to fight just to keep their programs viable; many teachers, parents and administrators believed that pulling students out of academic classes for instrumental music lessons was a disservice to these children. It was thought that students in instrumental music miss valuable class time, which then has detrimental effects on their grades. Not only did research show that this was not the case, but many felt the research suggested that student involvement in instrumental music could possibly improve their academic growth.

Joseph Corral (1998) examined the effect of an instrumental music pullout program on elementary school students' achievement as measured by the California Test of Basic Skills. He investigated the difference between music students and non-music

students on the reading, language, math comprehension, science and social studies sections of the test.

Corral's study (1998) used a two-group static-group comparison design of 223 fourth and sixth grade students from a diverse socio-economic and blue-collar community. The scores are analyzed using an independent two-sample t-test.

Instrumental music students are excused from class twice a week on a rotating basis. The CAT scores are used to compare the instrumental music students to the non-instrumental music students in the subjects previously mentioned. Corral argued that the instrumental music students' mean scores were higher in reading, language, and social studies. He also noted that even though the instrumental music students' scores were slightly lower in math and science than the non-instrumental music students' were, there was no significant difference in the mean scores. His hypothesis that there is no significant difference in achievement scores between instrumental music students and non-instrumental music students was supported. Corral's argument that instrumental pullout programs have no detrimental effect on a student's academic success was upheld.

Not only does Corral's study (1998) debunk the myth that instrumental pullout programs have a negative impact on a student's academic success, but his results build upon the implication that instrumental music programs may be a contributing variable to a student's academic proclivity.

A New York City supervisor of music, Bernard Friedman (1959), designed his doctoral study to dispel the fears of concerned administrators and parents that students involved in instrumental music were being hurt academically due to the fact they were in the classroom less than the other students. An added proponent of the research was to

develop an alternative program of instruction for instrumental music students instead of the traditional pullout program.

The objective of Friedman's study (1959) was to determine if children who are enrolled in elementary school instrumental classes in which a part of the day is devoted to music activities, are adversely or positively affected in reading and mathematics achievement. Friedman arranged the design with the control group as a typical elementary classroom taught by an elementary education certified teacher. The experimental group was a group of instrumental music students taught by a teacher with an elementary education certification along with some type of instrumental music experience (i.e. teaching, performing). Students were cross-matched between groups to safeguard the reliability of the experiment.

Friedman (1959) hypothesized "that the difference in the amount of improvement between music groups and control groups in arithmetic and reading would be attributable to chance factors and not to the kind of class organization" (p.2). By stating the hypothesis in the null, Friedman was specifically examining the impact of music as a contributing variable to academic achievement.

Four elementary schools in New York City school districts 23-24 were used for the study with only fifth and sixth grade classes considered. Parallel group procedures were used; two groups – one that devoted a part of the day to musical activities, the other a regular classroom setup. The instrumental music classroom teacher spent 230 to 274 hours of instructional time on music activities, up to 27% of classroom instructional time if the school year is based on 950 hours of possible instructional time. The test used by the researcher was the Stanford Achievement Test's intermediate battery. This battery

consists of nine achievement tests: paragraph meaning, word meaning, spelling, language, arithmetic reasoning, arithmetic computation, social studies, and science and study skills. A pre-test was administered in September and October incorporating all batteries. A post-test was administered at the end of the school year in reading and arithmetic only. Friedman incorporated all the testing batteries for the pre-test so as not to influence the year's instruction for any subject in particular. A t-test for dependent groups was run with the data accumulated from the experiment.

The results indicated that there was no significant difference in academic achievement between the groups. "The only significant difference between methods was observed in reading meaning in grade five. This difference favored the Music group. It would seem, therefore, that there is no difference between the two methods concerning these variables in these grades with the possible exception of reading meaning for which the music method may be superior in grade five in these schools"(Friedman, 1959. p.73). He concluded that the difference in the amount of the improvement between the experimental group (instrumental music classes) and the control group (regular education classes) in arithmetic and reading was attributable to chance factors and not class organization.

Another study concerning instrumental music pullout programs conducted by David Holmes (1997) "was designed to examine the effects of selected factors of students who participate in 'pull-out' instrumental music programs on their music and academic achievement"(p.2). Comparing 5th grade scores on the Music Achievement Test Level 1 (MAT1) and the Comprehensive Test of Basic Skills (CTBS), Holmes evaluated a fifth grade instrumental music pull-out program and measured the effects of participation on

both music achievement and academic achievement compared to students not involved in the program.

Holmes (1997) studied five sub problems: 1) to what extent do fourth grade academic achievement scores differ for students involved in instrumental music and students who do not participate; 2) to what extent do fifth grade music achievement scores differ for students who participate in instrumental music from students who do not participate in instrumental music at the beginning of the fifth grade year; 3) to what extent do fifth grade music achievement scores differ for students who participate in instrumental music from those students who do not at the end of the fifth grade year.; 4) to what extent do sixth grade academic achievement scores differ for students who participate in instrumental music from those students who do not; 5) to what extent is the relationship between selected demographic factors and participation in instrumental music education programs?

The sample of 389 students was selected from three school districts in the state of Washington covering a three-year period. All scores were analyzed for homogeneity of variance and statistical differences using a one-way analysis of variance (ANOVA).

Results for each sub problem are listed: 1) an ANOVA demonstrated a significant difference between students who participated in instrumental music instruction and those who did not participate in instrumental music instruction on fourth grade CTBS scores; 2) an ANOVA demonstrated a significant difference between students who participated in instrumental music instruction and those who did not participate in instrumental music instruction on MAT 1 pretest scores; 3) an ANCOVA demonstrated a significant difference between students who participated in instrumental music instruction and those

who did not participate in instrumental music instruction on MAT1 post-test scores (using the MAT 1 pretest as a covariate); 4) an ANOVA demonstrated a significant difference between students who participated in instrumental music instruction and those who did not participate in instrumental music instruction on sixth grade CTBS scores; and 5) no demographic variable reached a significant chi-square value at the .05 level, although piano proficiency came close.

“Data demonstrated that participation in instrumental music instruction had a significant relationship with academic achievement”(Holmes, 1997, p.64). The data also indicated that students with higher CTBS scores in fourth grade are those students who sign up for instrumental music. Holmes concluded that students most inclined to sign up for instrumental music are the same students who achieve academically.

Instrumental Music and Intelligence

The inevitable association between music and intelligence has been pondered for years. The most common assumption is that students who demonstrate a high level of intelligence are more likely to become involved in schools extra-curricular programs such as instrumental music. Thus, the on-going question prevails, are students who show above average intelligence more likely to get involved in instrumental music, or are students who show a musical proclivity more likely to be of higher intelligence? The following two studies present varied opinions in their reported findings.

Douglas Phillips (1976) sought reasons for the dichotomy that exists between low positive correlation between intelligence and musicality and the common sense argument that indicates musical behavior is itself a manifestation of intelligence, subsequently, he embarked upon a research study. He argues that there is a body of evidence indicating

that musical ability is developmental in much the same way that Piaget believed the same thing to be true of intelligence.

Phillips (1976) tested two third year classes, consisting of 60 children in four junior high schools. Correlation coefficients are calculated between each aspect of musical aptitude and cognitive ability tested. The scores for each test are arranged according to schools and t-tests performed using these scores. An analysis of variance (ANOVA) is performed on scores of subjects randomly selected from the total sample using music scores as the independent variable and IQ scores as the dependent variable.

Correlations obtained are $r = .61$ and $r = .69$, respectively, indicating a significant relationship between musicality and intelligence. Phillips (1976) surmised that children who are musical are far more likely to be intelligent than those who are not musical. Musical children, in general, tend to be more intelligent as demonstrated by the positive relationship between musicality and intelligence. Phillips put forth that the connection appears to be environmental; a home that fosters musicality is also likely to foster intelligence. Musicality, musical background and intelligence appear to be closely associated with social status.

The purpose of the dissertation, An Investigation of the Relationship of Musical Aptitude and Intelligence of Students at the Third Grade Level by Marjorie Webb (1984), is to determine the relationship, if any, between tests scores in musical aptitude and intelligence for third grade students. The study also considers factors, other than intelligence, in the identification of musical aptitude.

Webb (1984) selected the Cognitive Abilities Test (CAT) to measure IQ scores and the Primary Measures of Music Audation (PMMA) to measure musical aptitude. 415

Students in the third grade of the Burlington City Schools in Burlington, North Carolina are used for the author's data pool. Students attend general music classes once a week for 30 minutes taught by a music specialist. Scores on the CAT and PMMA are compared for correlation. "Data were analyzed by the computer using the SPSSx program. The Pearson product-moment correlation coefficient was determined, and a stepwise regression was used to determine the variance in music aptitude that could be attributed to IQ score" (p.38).

Webb's statistical data reports that a positive relationship (+. 37) is found between musical aptitude test scores of PMMA and CAT scores. The significance reported is $p < .01$. There appears to be a relationship between musical aptitude and intelligence at the third grade level, although the positive correlation is low. The researcher professed that the factors of sex and school attended has no significance in the results.

The stepwise regression was applied to the data to determine variance in musical aptitude that could be attributed to IQ score. The variance found was R Square equals .14. When the additional variables of sex and school attended were added to the equation, the variance did not change significantly. Since IQ score, sex, and school attended accounted for only a small part of the variance there appeared to be other factors, which affected the scores on the musical aptitude test (Webb, 1984, p.56).

Additionally, Webb (1984) clarifies student performance by adding that students with IQ scores between 80-89 have a PMMA mean score of 66 while students with IQ

scores above 127 have a mean PMMA score of 67. The total PMMA mean score is above the expected mean for both IQ groups. "These findings indicate that IQ scores alone do not appear to be reliable indicators of the individual student's ability in musical activities"(p.60). This study suggests that factors other than measured IQ influence musical aptitude test scores.

John Anello (1972) bases his rationale for a study on the premise that the "discipline required to learn to play a musical instrument develops the student's study habits, self-discipline, and self-motivation to the degree that it tends to increase the general academic excellence of the student"(p. 1). The purpose of his study is to determine if there is a significant difference in achievement in certain academic subjects between instrumental music students and non-instrumental music students.

Anello (1972) hypothesized that there is no significant difference in achievement academically in certain subjects between instrumental music students and non-instrumental music students. Also, that there is no significant difference in achievement academically in certain subjects between instrumental music students and non-instrumental music students in El Dorado High School compared to students in Valencia High School of the Placentia Unified School District. That there is no significant difference in academic achievement in certain subjects among the students in grades nine through twelve. That there is no significant difference in academic achievement in certain subjects between males and females and that there is no significant difference in academic achievement in selected subjects in the interaction of groups, schools, grades, and sex.

In his statistical treatment of data, using ANOVA and ANCOVA, Anello notes a significant difference at the .01 levels in Math, English and Social Studies GPA's between 163 instrumental and 163 non-instrumental music students. However, when intelligence is controlled through an analysis of covariance (ANCOVA) there are no significant differences found.

Anello (1972) concludes that the differences in academic achievement between instrumental music students and non-instrumental music students are attributable to the intelligence factor of the instrumental group. An interesting side factor is that high school females involved in instrumental music at the above-mentioned high schools, are more successful academically than non-instrumental music females and males in both instrumental and non-instrumental categories.

Instrumental Music and Academic Achievement

The National Center for Educational Statistics followed the progress of 18,000 students from the eighth grade to the tenth grade and showed that students who are involved in music receive grades between 6 to 10 percent higher than those students who are not involved in music. The College Boards association reports that students involved in musical performance ensembles outscore their classmates on the SAT; 49 points on the verbal section, and 36 points on the math section (Berlin, 1995)

In a study by the Colorado High School Association on band and orchestra students to measure the effect of involvement in the instrumental music program on their test scores in math, reading and language compared to non-music students, Kelstrom (1998) reports that music students score significantly higher. It is also noted that not only

are their GPA's higher than their counterparts, but attendance records indicate instrumental music students are absent significantly fewer days.

A study of fifth grade Albuquerque students reveals that instrumental music students score 10 percentile points higher in reading, and 12 percentile points higher in language than the total population of fifth grade students. It is also noted "students who participate in the instrumental music program for two or more years also score higher on the CTBS than students who participated for only one year" (Robitaille & O'Neal, 1981, p.213).

Susannah Dreyden (1992) investigated the influence of instrumental music instruction on academic achievement with a group of fifth grade students. She proposes hypotheses based on examining the association between instrumental music instruction and academic achievement, instrumental music students' gender and academic achievement (AA), instrumental music students' race and AA, instrumental music student's socio-economic status and AA, instrumental music students' mother's formal education and AA, instrumental music students' family structure and AA, and instrumental music students' length of time in the school district and AA. The dependent variable was the Comprehensive Tests of Basic Skills, fourth edition, Level 15.

Dreyden (1992) conducted her study in a Southwestern Kansas school district of 4500 students. The sample includes all fifth graders enrolled, which includes a total of 270 students consisting of 135 females and 135 males. The instrumental music students include 95 females and 69 males for a total of 164 students. Scores from the CTBS fourth edition Level 15 in reading comprehension, reading vocabulary, math computation, math concepts and application, reading total, math total, and total scores

were used as dependent variables. The same scores from the CTBS fourth edition Level 14 were used as covariate measures. The hypotheses were tested at the .05 level of significance. A single factor analysis of covariance is employed in all hypotheses for main effects (p.69).

Results of Dreyden's study (1992) support these following generalizations: 1) an association in band and achievement in reading vocabulary and reading total; 2) an association between the gender of instrumental students and achievement in reading vocabulary; 3) an association between the race of instrumental music students and achievements in math total; 4) an association between the SES of instrumental music students and achievement in total score; 5) an association between instrumental music students' mother's level of formal education and achievement in reading vocabulary and reading total; 6) an association between instrumental music students' mother's level of formal education and achievement in math computation and math total; 7) an association between instrumental music students' mothers level of formal education and achievement in total scores. Although Dreyden's research shows significant associations between the above-mentioned generalizations, she suggests that future studies employ a factorial design and study a different grade level.

In a study similar to Dreyden's (1992), Daryl Trent (1996) looks at 136 high school seniors in an "attempt to determine the relationship participation in instrumental music has with other areas of academic achievement" (p. 6). The specific academic areas Trent examined and compared are math, language arts and reading.

Trent uses two instruments to collect student data: the Texas Assessment of Academic Skills (TAAS) and the Texas Educational Assessment of Minimal Skills

(TEAMS). The sample group is defined as 136 seniors enrolled in selected high schools, 45 music students, 43 students not involved in any school related activity and 48 students in UIL (University Interscholastic League governing body for extra curricular events) - activities not related to the performing arts.

These hypotheses are investigated by Trent (1996); 1) there is no significant difference in TEAMS math scores of high school senior music students, senior students involved in non-music UIL activities and seniors not involved in school related ex-curricular activities; 2) there is no significant difference in TAAS math scores with the same subjects; 3) there is no significant difference in TEAMS language arts scores with the same subjects; 4) there is no significant difference in TAAS reading scores with the same subjects.

Using a one-way analysis of variance, (ANOVA), Trent notes that there are significant differences in TEAMS math scores of high school senior music students, senior students involved in non-music UIL activities and seniors not involved in school related ex-curricular activities, and TEAMS language arts scores with the same subjects. He found no significant differences in TAAS math and reading scores with the same subjects. Results of the ANOVA display a significant difference in math and language arts scores on the TEAMS between subjects. However, the data on the TAAS shows no significant difference. Trent explains the lack of significance with the TAAS scores as the result of a small sample size.

Trent's findings (1996) partially support the notion that instrumental music instruction has a positive effect on other academic areas. Trent suggests that there may

be a relationship between the music students' drive for excellence in musical performance and their drive for excellence in all academic areas.

In his doctoral dissertation, The Effect of Instrumental Music Instruction on Academic Achievement, Daniel Zanutto (1997) looks at what long-term relationships exist between academic achievement and participation in instrumental music programs. Zanutto examines the effect of a five-year enrollment in instrumental music courses on academic achievement by comparing mean grade averages between students enrolled in instrumental music and students not enrolled in instrumental music. The author includes a group of some music (1-2 yr.) and other music (non-instrumental) students to provide specificity in the study. The study explored the causal relationship, if any, that instrumental music contributes to academic performance or if instrumental music instruction attracts academically motivated students.

Zanutto (1997) hypothesizes that there will be no significant difference between groups of instrumental music students and non-instrumental music students as measured through differences in mean GPA for Math, English, Science, and Social Studies over a five year period; that there will be no significant differences in proficiency test scores as measured by Degrees of Reading Power (DRP), writing proficiency, and math proficiency over a five-year period; and that there will be no significant differences in attendance patterns between groups as measured by school attendance records over a five-year period.

Zanutto (1997) proposes that the study's significance is the examination of the long-term academic benefits for students participating in instrumental music programs. He questions whether instrumental music improves academic success or does

instrumental music attract academically motivated students, and how this can best be answered through analysis of the "trends" in academic growth.

Student performance is measured at yearly intervals beginning with seventh grade students through grade eleven. A look at the five-year period was done to identify and determine trends associated with instrumental music and its effect on specific academic indicators, grade point averages (GPA), the comprehensive test of basic skills (CTBS), and degrees of reading power (DRP). Using a sampling of students from the Clovis Unified School District, Clovis California, the researcher divided the sample into four cohorts, labeling them Instrumental, Other Music, Some Music and No Music.

Using t-tests, the researcher discovered consistently higher GPA's for instrumental music students in Math, English, Science and Social Studies, with significant gains specifically in Math and Science. Instrumental music students showed a slight advantage in English GPA's that increased in grade eight thru ten over non-instrumental music students. Instrumental music students' Social Science GPA's also showed an advantage over non-instrumental music students.

Zanutto's research (1997) shows higher mean test scores in CTBS Reading, Language and Math, as well as a higher DRP for instrumental music students. The Clovis district test in writing shows no significant difference between groups. Instrumental music students also achieve better attendance than non-instrumental music students do. Based on these findings, Zanutto suggests that instrumental music has a positive effect on a student's academic achievement.

In research that views the strength of the relationship between artistic literacy in instrumental music (levels of participation and performance) and academic literacy

(GPA's in Reading, Language and Math), while controlling for SES, gender and ethnicity, Hill (1987) measures test data and information secured from school records of seventh and eighth grade students of the Denver Public School District. 249 subjects are divided into three levels of participation: 83 from citywide instrumental music (band and orchestra), 83 from local instrumental music, and a control group comprised of 83 students who did not participate in instrumental music. All groups were selected with consideration to SES, gender, ethnicity, grade level and years in district.

Hill's study (1987) is comparative in nature. Data is analyzed using the Pearson product moment correlation coefficient, multiple regression, linear regression and one-way analysis of variance (ANOVA). The independent variables are identified as: SES, gender, ethnicity, grade level, level of participation, private lessons, years of participation, families of instruments, and parents musical background. The dependent variables are identified as: scores from ITBS, reading, language, math; GPA, attendance, and level of performance from citywide band or orchestra auditions.

The researcher finds that there is a correlation between level of participation in instrumental music and academic achievement in reading, language and math as measured by ITBS scores: the higher the level of student participation the higher the ITBS score. This is also consistent with the student's GPA and attendance record.

The data reveals no relationship between level of participation in instrumental music and SES, gender, and ethnicity. It also confirms no relationship between level of participation in instrumental music and musical backgrounds of the students and their parents.

Hill's study (1987) suggests that students, who are involved in school instrumental music programs at a high level, tend to perform better on the ITBS, have higher GPA's, and better attendance records. SES, ethnicity and gender are not related to levels of participation or performance. Generally, instrumental music students perform better academically than non-instrumental music students and the superior instrumental music students perform the best overall academically.

Pelletier (1963) tested the theory that instruction on a musical instrument develops auditory discrimination, which assists the learning of written language related to phonetic skills. His primary goal is to broaden the area of knowledge that concerns "transfer of training from the learning of instrumental music to the learning of reading" (p.17).

Pelletier's research (1963) uses all the third grade classes from the Maricopa County schools in Arizona. Students are divided into two equivalent matched pairs groups. Standardized testing is used to define ability levels of students. Groups are divided into the experimental group, which received music instruction once a week for 45 minutes. The control group received no music instruction. Students in the experimental group received music instruction on an instrument designed by the author called a prep-fiddle, a type of stringed instrument similar to a violin in structure. All aspects of instrumental music instruction covered, included rote playing to the learning of musical notation.

The author's tentative findings led him to conjecture that instruction on a musical instrument facilitates the development of reading ability, based on a difference in reading comprehension mean gain of 1.9 months for the experimental group. However, the

statistical design reported the difference was significant at the .10 level. Pelletier (1963) discovered that the benefits of instrumental music instruction on reading achievement are greater for those who initially display a lower reading ability. He found no significant improvement in spelling ability or reading vocabulary for instrumental students. The author's original hypothesis is partially but not conclusively supported by the findings.

Instrumental Music And Mathematics Achievement

What lead this researcher to believe that music, specifically instrumental music, might impact academic achievement is the commonly held belief that students who tend to be musical also tend to be successful in mathematics. A common assumption among educators is that if you play a musical instrument you are more likely to do well in math. Why is it that so many people involved in the computer sciences are very often amateur or part-time professional musicians? Many believe it is this suggested music-math phenomenon that is the answer.

In a study involving 113 ninth grade music students, their Iowa Test of Basic Skills (ITBS) math scores are compared according to whether they received private music lessons or did not receive lessons. Comparisons are based also on the selection of instrument (e.g., keyboard or other instrument). Cheek and Smith (1998) base the significance of this study on the concept that children who exercise their cortical neurons by music are strengthening the neural circuits used for math, along with improving spatial reasoning skills.

45 males and 68 females are included in the analysis. There was no significance found between ITBS math scores of females and males, ruling gender out of the equation as a factor. Of the 45 males, 13 received private music lessons and of the 68 females, 23

received private lessons. These 36 private music students ITBS math scores were then compared to the 77 students who did not receive private lessons and no significant difference in the two sets of scores was recorded. However, 20 of the 36 private lesson music students studied for two or more years and a comparison of their scores to the 77 students did show a significant difference in favor of the 20 students. The authors used a *t* test to determine statistical significance and reported the result $t = 5.72, p < .001$.

This study supported the assumption that music training enhances math achievement, provided that the training is for an extended period of time and provided that the lessons are individual private lessons.

In a similar study reported in their article the "Possible Effects of Early Childhood Music on Mathematical Achievement," authors Goeghegan and Mitchelmore (1996) considered how music might effect the positive mathematical development in young children. The authors believe the arts have a stronger influence through cross-disciplinary and integrated practices than through segregated subject oriented programs.

A group of pre-school students are selected from like socio-economic status (SES) middle class parents who are actively involved in their child's education. The experimental group consists of 39 students with a comparison group made up of 40 children. The experimental group receives a treatment consisting of 10 months' tuition in music with the control group receiving no music instruction. At the end of 10 months, both groups are post tested and scores then compared. The experimental treatment was an in-house music program designed for pre-school students that included Kodály techniques. The children participate in one session a week for an hour; the comparison group receives no musical treatment. Math scores are measured using the Test of Early

Mathematics Ability – 2 (TEMA-2). The two-sample t-test results indicate that the experimental group (mean=20.0) scored higher than the comparison group (mean 16.6) on the TEMA-2 and was found to be significant at $p < .02$.

Qualitative data obtained suggests that musical experiences in the home contribute to group differences. Goeghegan and Mitchelmore (1996) explore this premise by dividing the experimental group into two groups, children with music at home and those without music. They find no difference between the original comparison group and the sub-divided experimental group with no music at home in the TEMA-2 scores. However, the sub-divided experimental group with music at home scored higher in math achievement than both the sub-divided experimental group with no music at home, and the original comparison group.

Instrumental Music and Brain Research

Researchers have begun to examine music participation and its impact on the brain and learning during the last decade. The previous studies cited on music and academic achievement suggest that some type of interaction is occurring concerning the brain and music.

In a recent article in the Music Educators Journal, Hodges (2000), reports that current neuro-musical information has taken a detailed look at these phenomena and proposes five concepts:

- 1) the human brain has the ability to respond to and participate in music. Music is one of the hallmarks of being human, the musical brain is a birthright for all human beings;
- 2) the musical brain operates at birth and persists

through life. Neuroscientific research supports an emphasis on lifelong learning in music; 3) early and ongoing musical training affects the organization of the musical brain. Fajta and Besson demonstrated that musically trained subjects have a stronger and faster brain response to musical tasks than do untrained subjects. The primary auditory cortex in the left hemispheres of musically trained subjects is larger than that of untrained subjects; 4) the musical brain consists of extensive neural systems involving widely distributed, but locally specialized regions of the brain. Musical processing is spread throughout the brain and 5) the musical brain is highly resilient. Individuals with IQ's of 65-70, considered cognitively impaired, often have remarkable musical abilities (Hodges, 2000, p.19).

It is believed by some researchers, that simply listening to music can stimulate neural development, a phenomenon labeled "The Mozart Effect" (Campbell, 1992). Plato believed that music helped to create order and harmony in the mind and should be one of the primary subjects that all children learn.

In her article, "Does Music Make You Smarter?," Frances Rauscher (1995) states, "music can enhance spatial reasoning – the brains ability to perceive the world accurately, to form mental images of physical objects and to recognize variations of objects" (p. 8). These spatial reasoning abilities are, at least in part, what determines success in the fields of mathematics, science and engineering.

In a position paper presented to the Annual Meeting of the American Psychological Association, Rauscher and Others (1994) extended the findings of an earlier study that suggests that the music training of three year olds enhances long-term nonverbal cognitive abilities.

These researchers propose that musical activity and other higher cognitive functions share inherent patterns of neural firing. They predict that the music-spatial causal relationship occurs because of the nurturing of pattern development by groups of neurons brought about by musical operations, such as performing on a musical instrument.

The position paper reports research with 22 preschool children (age 3 years 0 months – 4 years 9 months) from Los Angeles County who were provided with 8 months of keyboard and singing lessons to determine the effect of early music training on spatial abilities. The experimental group received weekly 10-15 minute private keyboard lessons and daily 30-minute group singing sessions. The researchers test five spatial reasoning tasks: object assembly, geometric design, block design, animal pegs and absurdities. Three comparisons are explored: first, the scores of children who received music with those who did not; second, the scores of the music group before lessons, at 4 months, and at 8 months; and third, the scores of the no music group at 4 month intervals throughout the duration of the study.

Analysis of Variance (ANOVA) is used to determine that the music group's scores on the object assembly task are significantly higher than the "no music" group. Object assembly is the only task that requires the child to form mental images and orient physical objects to reproduce the image. The other four tasks provide the child with a

solid object or drawing to match or copy. Success on the object assembly is directed by cortical pattern development facilitated by the music lessons. "As with musical performance, task performance requires forming an ideal mental representation of something which is eventually realized" (Rauscher and Others, 1994, p. 19)

Music training can improve the spatial reasoning of three year olds. Observations led to a prediction that music may be a useful tool for understanding higher brain functions. "Musical activities help systematize the cortical firing patterns so they can be maintained for other pattern development duties, in particular, the right hemisphere function of spatial task performance" (Rauscher and Others, 1994, p. 21). Similar studies in the future have the potential to energize the role of music education in the public schools as an important curricular component (Snyder, 1995).

Gender and Academic Achievement

Gender has long been a controversial variable in research completed in the educational or social science fields. Much has been written about the differences between the genders concerning academic achievement. Most research proposes the possibility of a genetic discrepancy, along with a social bias that presumes a male dominance. Research continues on this hotly debated topic. Whatever the outcome, it is important to note the possibility of gender's influence on academic achievement. When measuring the impact of a specific treatment on academic achievement, gender must be considered as a possible impact variable.

The research of both Anello (1972) and Dreyden (1992) reported significant findings concerning gender differences. Anello (1972), notes that high school females involved in instrumental music are more successful academically than both males and

females not involved in instrumental music. Dreyden (1992) argues that there is an association between the gender of instrumental music students and reading and vocabulary achievement.

As inferred in those findings, this research design will control for the variable gender. If gender does play a part in academic achievement then it needs to be controlled for in this research design. Since the purpose of this research is to look at the relationship between academic achievement and instrumental music and suggest a possible causal association, those variables that may directly impact academic achievement, such as gender, must be statistically controlled to validate the findings.

Using a longitudinal study design with national standardized data, Han and Hoover (1994) reexamined the gender difference evidence of students who participated in the Iowa Test of Basic Skills (ITBS), Iowa Test of Educational Development (ITED) and Tests of Achievement and Proficiency (TAP) from 1963 to 1992. They found that the average between males and females in achievement is relatively small in most subjects. However, they note that females tend to score slightly higher in reading, language skills and mathematics computation up to the age of fifteen, whereas the tendency was for males to surpass females in mathematics. Further evidence is found in the upper grade levels (10 – 12) that females tend to score higher in verbal tests. Han & Hoover (1994) concur that male performance tends to be more variable across all the grade levels.

In a study conducted by the Educational Testing Service (ETS) as reported by Nancy Cole (1997), gender differences in achievement are reported to be small for a national representative sample of 12th graders for most subjects. The mathematics

advantage for males was found to be small. The slight advantage females showed in language acquisition remained consistent and unchanged.

The ETS study pointed out two important caveats: first, that gender differences appear for specific skills within an academic discipline, even if there is no difference for the discipline as a whole.

When you break the academic disciplines into component skills, a different picture of gender differences emerges.

For example, some sub skills within math are stronger for females and others for males. Similarly, females are not better in all aspects of language skills (Cole, 1997, p. 13).

The second finding is that gender differences change as students grow older and move to higher grades, this latter finding is in concurrence with Han & Hoover (1994).

A major finding by the ETS study is that there are larger gender differences for students who self-selected to take higher stakes tests than for students that were drawn from general national samples, an important consideration when examining data drawn from national or regional standardized tests.

Standardized test scores of 3,002 students (1,360 males and 1,642 females) were studied by Becker and Forsyth (1990) to determine the gender differences in academic achievement in vocabulary, reading, language usage, mathematics problem solving and using sources of information over a ten year period in grades 3 through 12. The researchers obtained the data from the Iowa Statewide Testing Programs for each year from 1978-79 through the year 1987-1988. Comparisons are made with the means and standard deviations for the ITBS grade equivalent scores and ITED standard scores

calculated separately for both males and females. The researchers examined the data across the following percentiles, 90th, 75th, 50th, 25th, and 10th.

What Becker and Forsyth (1990) noted was that males tend to score better at the higher percentile ranks than females in both vocabulary and mathematics. Females performed better in the lower percentiles for the content areas examined. This research affirms previous research findings that indicate that females in this design outscore males across all percentile rankings and grades for language usage.

Edward Fierros (1999) in his article, "Examining Gender Differences in Mathematics Achievement on the Third International Mathematics and Science Study," studies the issues related to gender differences in math achievement in an international milieu. The study analyzes the data by gender for low, middle and high performers. He found that 8th grade math achievement has few significant differences in mean achievement by gender. However, differences that do exist tend to favor males. Few differences are found in mathematics performance by ability level between 8th grade males and females. Performance is analyzed by ability level, instead of across the entire ability range. Fierros (1999) notes that the larger gender differences tend to develop by 12th grade in mathematics literacy (the real life everyday application of mathematics to problems).

In a study that compares student performance on the math subtest of the Scholastic Aptitude Test of students in the United States and the People's Republic of China, large differences are reported between United States males and females. Little difference is found between Chinese males and females (Byrnes, Hong, and Xing, 1997). The author's explanation for this is the highly selective nature for participation in

education in the People's Republic of China. Students in China eligible to take these tests have already survived a certain "weeding out" process, resulting in the most select students taking the exam. In America, a gender difference that largely favors males is noticeable because of a more eclectic testing population. This study affirms findings of similar studies by reporting that the more selective the test, the greater the gender difference between males and females in mathematics.

The research suggests that one of the reasons for these differences is the design of the assessment, the form of the test and/or method of testing. In a study of 15 and 16 year old Irish school students, gender differences are examined in achievement for three subjects, Irish, English and mathematics. This was completed by Niall Bolger (1984), as assessed by multiple-choice tests and written examinations. Bolger noted that males performed significantly better than females on multiple choice tests compared to their performance on written examinations.

The last study cited, along with some of the previous findings, suggest slight advantages for the each gender in a specific area or subject. In general, even though most of the research provides varied findings, implications are that males achieve better in mathematics while females achieve better in language arts related subjects at all age levels. The reasons for these differences continue to interest researchers. While these differences have dissipated recently, they persist at some level.

I. Q. and Academic Achievement

Previous research concerning music and its relationship to academic subjects has suspected I. Q. as a possible impact variable. Webb (1984) examined the relationship between musical aptitude and intelligence and noted a small positive correlation among

third graders between the two factors. However, not a strong enough correlation can be found to indicate that I.Q. alone can predict a student's musical proclivity. Phillips (1976) found just the opposite to be true in his study of two junior high school classes. He concluded that children who are musical are far more likely to be intelligent than those who are not musical.

The findings that have the most profound effect on the current research project are those of Anello (1972). Anello's study to determine if there is a significant difference in certain academic subjects between students enrolled in instrumental music and students who are not enrolled, found that instrumental students' GPAs are higher in Math, English and Social Studies than non-instrumental students. The ANOVAS performed in this research design are significant at the .01 level. When Anello performed an ANCOVA with the same data and variables, but controlling for I.Q., there was no significant differences between the two groups. Since Anello's research design so closely matches this design, it is important to factor how I.Q. may impact the statistical treatment of the study and include it as a variable to be controlled.

Literature abounds on the reliability of I.Q. scores to successfully predict a student's academic success. A major research project by Haertel and Walberg (1980) is a meta-analysis describing 20 theorists' concepts of intelligence and an analysis of empirical correlations from both elementary and secondary levels. For the purpose of this research project, an examination of the empirical findings by these authors bears significance.

Haertel and Walberg (1980) studied 396 correlations between intellectual ability as measured by a variety of I.Q. tests and academic achievement. The correlations are

used as "data points" in the statistical summaries. Means of the coefficients and standard deviation of the coefficients are reported. Of 396 correlations, 333 correlations are between group ability tests and academic achievement tests, and 63 are between group ability tests and GPAs.

The authors distinguish three grade ranges: grades 1-4, 5-8, and 9-12. Results of this meta-analysis indicate a tendency for the correlations to be higher in the middle grade range for grades 5-8. Of the two types of achievement measures, correlations with test scores are much higher than correlations with GPA's.

The results also indicate that correlations involving verbal ability are highest ($\mu = .721$), followed by total ability ($\mu = .699$), nonverbal ability ($\mu = .638$), and quantitative ability ($\mu = .599$). This pattern probably reflects the verbal saturation of most academic achievement tests and instructional tasks (Haertel & Walberg, 1980, p. K-23).

The Haertel and Walberg study of correlations (1980) between ability and achievement conclude that I.Q. testing does, in fact, reliably predict a student's educational inclination to successfully achieve in the academic paradigm. What is more, it tends to suggest that this relationship peaks for students in the middle school years, the age level for the sample in this research project.

Janis Fisher (1995), in her article "Relationship of Intelligence Quotients to Academic Achievement in the Elementary Grades," seeks significant correlations between academic achievement in spelling, math, English, social studies and science and intelligence among elementary school students. Using a group of 159 students in 3rd, 4th

and 5th grade from an elementary school in Ohio, she compares test and final grades with students' intelligence scores obtained from intelligence testing to determine its effect on academic achievement.

Grades are obtained from student files and converted to numeric equals (i.e., A=4, B=3, etc.). Verbal and non-verbal intelligence scores are determined by the Otis-Lennon School Ability Test (a paper and pencil multiple choice test) that is administered to students at the end of grade 2. Positive correlations are found between intelligence scores and the following subject areas: science, where $r = .51$, English, where $r = .50$, reading, where $r = .49$, math, where $r = .47$, social studies, where $r = .44$, and spelling, where $r = .30$. All the correlations are significant at the .01 level with the exception of spelling (Fisher, 1995).

In a related study, the researchers administered an assortment of intelligence measuring instruments to a group of 50 kindergarten and first grade students to determine the reliability and validity of these instruments in their effect on academic performance. The study investigates the reliability of the Kaufman Brief Intelligence Test (K-BIT), the Wechsler Preschool and Primary scale of Intelligence Revised (WPPSI-R) and the Draw-a-Person: Quantitative Scoring System (DAP:QSS), as predictor instruments for academic achievement as measured by the Kaufman Assessment Battery for Children (K-ABC) achievement subtests. The researchers examined how similarly the children performed on all the testing instruments, the relationship among the measures of intelligence as compared to academic achievement and what is the best combination of testing measures to predict academic achievement. (Lassiter & Bardos, 1995).

Samples of students are taken from three classrooms of regular education students of a northern Colorado school district. The children range in age from five to seven. A majority are female and the group is diverse in makeup reflecting an accurate percentage of the racial makeup of the community. Means, standard deviations, and Pearson product moment correlation coefficients are obtained from all of the testing data for comparison.

The author's results report that all measures provide similar scores. Their research did suggest, however, using a multiple regression analysis, that a combination of these instruments subtests yield an interesting result:

An *R*-square of .71 was obtained using the following combination of measures in the order they entered the prediction equation: WPPSI-R Similarities, DAP:QSS Total Score, K-BIT Composite Score and the WPPSI-R Vocabulary Subtest (Lassiter & Bardos, 1995, p. 176).

In summary, all brief measures explored by the researchers relate significantly to academic achievement. The previous battery cites a suggested screening for more accurate predictions.

In a study that viewed predictive validity of Wechsler Intelligence Scale for Children-Revised I.Q.s (WISC-R) and Estimated Learning Potential (ELP), Thomas Oakland (1980), selected 467 middle and lower class students from grades 1 through 8 from three racial-ethnic groups, consisting of Anglo, African and Mexican American for inclusion in the study.

ELP is a suggested method of accurately predicting the academic achievement for children from minority groups, as suggested by Mercer and Lewis (1978). The ELP I.Q.

score is derived by combining the WISC-R I.Q., along with data from the System of Multicultural Pluralistic Assessment's (SOMPA) developed by Mercer and Lewis (1978). The SOMPA assesses the student's social and cultural background by studying family size, family structure, socioeconomic status and urban acculturation, and assigning each variable a score. These derived scores, in combination with the WISC-R I.Q. score, are subjected to a formula that determines the students ELP I.Q. score (Oakland, 1980).

With respect to I.Q. and achievement, the total group approximated a normal sample. The I.Q. on achievement correlations for both reading and math were .70 for the total group. The ELP for the total group was reported in the high .40s. Oakland surmises that:

The concurrent prediction of reading and math achievement clearly is accomplished more accurately with I.Q.s than ELPs. ELP-achievement correlations never exceed those between I.Q.-achievement. Among the 24 pairs of correlations, 13 I.Q.-achievement correlations are significantly higher than those for ELP-achievement; the remaining 11 pairs are not statistically different (Oakland, 1980, p. 3).

Oakland (1980) concludes that compared to the standard WISC-R I.Q. scores, the ELP adjusted I.Q. tended to either decrease or not improve the test's reliability to predict achievement. Overall, the WISC-R better predicted academic achievement across cultural, racial and socioeconomic boundaries.

This study, as well as the other studies cited in this section, are included to support the argument that standardized I.Q. testing is a valid and reliable method for predicting a student's future successful academic achievement. These studies corroborate what seems to be general knowledge in the field of education; students who tend to have higher I.Q. scores are more likely to do better academically than those students whose scores are below the normal range.

Socioeconomic Status and Academic Achievement

The literature is replete with studies on socioeconomic status (SES) and academic achievement, all with conflicting results affected by geographical location. Since this research design draws its sample from a large middle class suburban community, designated a D, E New Jersey district factor group, it is relevant to distinguish SES as an impact variable on the original problem: Does formal instrumental music instruction, and the number of years of instruction, have an impact on an eighth grade middle school student's academic achievement?

In the research cited concerning music and academic achievement, only three took into account SES. Dreyden (1992) found an association between an instrumental music students SES and achievement as it related to total score measured by the Comprehensive Test of Basic Skills fourth edition, level 14. The study done by Willie Hill (1987) showed no relationship between level of participation in instrumental music and SES. Goeghegan and Mitchelmore (1996) drew their sample from a group of pre-school students whose parents were from a middle class socioeconomic status, effectively controlling for SES in the selected sample. These studies, along with a general

sociological assumption, support the need to control for SES in the research design proposed in this study.

A Louisiana study investigating the relationship between African American high school students' academic achievement and the socioeconomic status of their family and friends reports that these factors have a considerable impact upon the individual student's academic achievement. Surveys, test scores and data obtained from the school attended, all indicate that poverty and social status, along with their friend's family social status, impact negatively on the student's academic achievement (Caldas & Bankstrom, 1997).

Using a sampling of first year university male undergraduates, Kennett and Grant (1975) studied I.Q. sub-tests for verbal meaning and expression and noted a significant correlation between the students fathers' occupation (used to define SES) and achievement on these batteries. The authors' statistical procedures demonstrate a significant difference in favor of the students from an upper SES environment.

Shakiba-Nejad and Yellin (1981), using a sample of 148 fourth, fifth, and sixth grade students, selected 76 children representing Anglo, African and Native American students for a concentrated study on the possible effects of SES on academic achievement. The students are rated as either lower or middle class. The authors use the California Achievement Test (CAT) to measure academic achievement and subject the data to a variety of statistical treatments. The study reports, "students described as lower SES had significantly lower achievement levels" (Shakiba-Nejad & Yellin, 1981, p. 5). The study surmised that lower SES students consistently had poorer attendance records, indicating a contributing factor for low academic achievement levels.

In the paper, "The Effects of Low Socioeconomic Environment on a Student's Academic Achievement," Kruse (1996) concluded that there are significant differences between a sample of low-income students and non-low income students. Her sample includes a group of sixth grade science students from the Travis Middle School in Temple, Texas. For the purpose of her study, SES is defined as students who qualified for free or reduced lunch, a common qualifier with respect to this variable.

Kruse (1996) uses four categories to run t-tests on the data: a low-income mid-term grade, a low-income final grade, a non-low income mid term grade, and a non-low income final grade. Mean scores are calculated and show that low-income students have a mid-term grade mean of 80.11 and a final mean of 76.70. Students categorized as non-low income show a mid-term mean of 86.72 and a final mean of 88.17 (Kruse, 1996).

The t-tests that the author ran on the data show a level of significance for the grades at the mid term semester with $t = -2.61$ and p equal to or less than 0.011, and $t = -4.00$ with p equal to 0.000 for the final semester. Kruse rejects the null hypothesis based on these findings and deduces that the higher average percentages are found with the non-low income students.

In this study, an interesting difference in mid-term grades in relation to the final grades between the two groups is discovered. The low-income final grade is lower than the mid term grade, whereas the non-low income final grade is higher than the mid-term grade. The cause of this phenomenon is not known, however, it may be that attendance rate is significant factor in this difference.

Karl White (1979) in his article, "The Relation Between Socioeconomic Status and Academic Achievement," performs a meta-analysis using data from numerous

studies that incorporate SES as a main variable of effect in relation to academic achievement to further clarify the role of this variable in academic research. It is White's contention that SES does not have as great an impact on research designs as might be thought.

Of the 248 studies identified for inclusion in this study, only 101 are actually used, harvesting a total of 636 correlation coefficients for the meta-analysis. White attempted to:

(a) establish the strength of the relation that can be expected between typically used measures of SES and academic achievement and (b) to determine how much of the variance in the magnitude of previously reported correlations between SES and academic achievement can be accounted for by systematic differences among the studies (White, 1979, p. 466).

White notes that the correlation coefficients for all the studies form a skewed frequency distribution with a mean of .351, a median of .251 and a standard deviation of .225. Out of 101 studies, the best estimate of the correlation coefficient between SES and academic achievement was .251. White deduces that this data indicates a weaker correlation between SES and academic achievement than most researchers had previously assumed.

The meta-analysis reveals that the size of the correlation between SES and academic achievement is directly related to the unit of analysis to compute the correlation. White reports that research using aggregated data (schools, school districts)

tend to compute higher correlation data than research that uses individuals as the unit of analysis. Research that uses individuals as the unit of analysis shows that SES accounts for less than 5% of the variance in a student's academic achievement.

White adds that in cases where an aggregated unit of analysis is appropriate, SES and academic achievement are strongly correlated. In cases where schools or aggregated groups are used by the researcher as the unit of analysis "SES is usually correlated strongly enough with academic achievement measures to be useful as a covariate, predictor, or stratifying variable" (White, 1979, p. 475).

CHAPTER III

Methodology

The purpose of this research design is to detect the possible effect a public school instrumental music instruction program has on an eighth grade student's academic achievement to determine if a causal relationship can be inferred. Twelve hypotheses are formulated for study in this research design based upon the following problem and its subsequent sub-problems. The problem statement is: Does formal instrumental music instruction, and the number of years of instruction, have an impact on an eighth grade middle school student's academic achievement? The relevant sub-problems that are included in the design are, 1) Does formal instrumental music instruction, when controlling for socioeconomic status, have an impact on an eighth grade middle school student's academic achievement? 2) Does formal instrumental music instruction, when controlling for gender, have an impact on an eighth grade middle school student's academic achievement? 3) Does formal instrumental music instruction, when controlling for I.Q., have an impact on an eighth grade middle school student's academic achievement? and 4) Does formal instrumental music instruction, when controlling for gender, socioeconomic status, and I.Q. as multiple variables, have an impact on an eighth grade middle school student's academic achievement?

Sample Description

The students for this research design were selected from two middle schools located in the Union Township Public School District of New Jersey. The Union Township Public School District is a K-12 school district of 8100 students characterized

as an urban/suburban middle class community of approximately fifty thousand residents. The annual operating school budget is sixty-two million dollars.

The sample of students for this study was selected from each middle school's eighth grade class who were enrolled during the 1998-1999 academic year, approximately 620 students. The students were divided into two groups, 1) students enrolled in the instrumental music program for the 1998-1999 academic year were the experimental group, and 2) students not enrolled in instrumental music for the 1998-1999 academic year were the control group. Students identified by district coding as Special Education students were removed from the total pool before either the experimental group or control group were chosen. There were 72 special education students total between the two schools removed from the total pool of 620 leaving a remaining population of 548 students.

Instrumental music students were identified anonymously by class lists drawn from the school district database by each school's guidance counselor. There are a total of 93 students enrolled in instrumental music for the 1998-1999 academic school year, 40 students at Middle School Number 1 (M.S. #1) and 53 at Middle School Number 2 (M.S. #2). The breakdown by school and gender for the instrumental music students in M.S. #1 is 14 males and 26 females and for M.S. #2 is 21 males and 32 females.

An equal percentage of students for the control group were drawn from each school to facilitate a proportionate balance of subjects between the two middle schools. Total student enrollment in the eighth grade for M.S. #1 after the removal of special education students and instrumental music students is 181 and the total eighth grade enrollment for M.S. #2 after the removal of special education students and instrumental

music students is 274. M.S. #1 is comprised of 104 males and 77 females and M.S. #2 is comprised of 134 males and 140 females. The control group was systematically chosen from the remaining population of students at each middle school taking into consideration gender and selecting an equally proportionate number of students from each school to make up the control group.

Student identification and sorting was done solely by the use of district assigned student identification numbers. Once the total population was defined for the purpose of this study, the researcher reassigned identification numbers in numerical order for each student to facilitate continued anonymity and manipulation of the data. During the process of collecting and sorting data, it was discovered that eight of the students who had been randomly selected for the control group had previously been enrolled in instrumental music during a previous school year. These students were removed from the control group. The breakdown for the remaining data pool is 93 instrumental students (experimental group), 35 males and 58 females, and 85 non-instrumental music students (control group), 32 males and 53 females. The total data pool including both the experimental group and the control group is 178 students.

Instrumentation

All the data obtained for the purpose of this study was done using a series of data queries performed on the district wide student database, Starbase. The district employs a commercial database system called Starbase designed specifically for the district to record and archive student records (i.e., testing results, grades, medical information, parent information, etc.).

The instrumentation used to collect student academic data was the California Achievement Test (CAT) which is given each year to students in grades six, seven and eight for the purposes of identifying students with basic skills needs and placement into advanced sections of a particular discipline. Normal Curve Equivalent scores were collected for each student in mathematics, reading and language arts sections of the CAT assessment. This is a norm-referenced assessment in which student performance is measured against one another to determine the student's relative standing in relation to that particular population of student (Sprinthall, 1997)

Academic data was also obtained from the Grade Eight Proficiency Assessment (GEPA), which is administered in March of each academic year by the State of New Jersey. Total scores were collected for each student on the two main batteries of the GEPA in Mathematic and Language Arts. The GEPA does not include reading as a separate battery but includes it as one of seven sub-batteries in the Language Arts total score.

The GEPA is a standards based assessment or criterion-referenced test in which student performance is based on pre-determined standards. This assessment is not based on student's relative performance within a population but on a student's absolute performance concerning mastery of the material being assessed (Sprinthall, 1997). The CAT informs the researcher on how well students perform in relation to their peers, and the GEPA informs the researcher on how well the students have met pre-determined standards.

I.Q.s for each student were obtained from the Cognitive Abilities Test (Cog AT), which is administered by the school district to all students in fifth and ninth grade. For

the purpose of this study, data was obtained from the fifth grade CogAT Standard Age Score for each student in the data pool.

The following demographic information germane to this research design was also obtained from the school district's student database: participation status in instrumental music (determined by class lists from each school for band and orchestra), gender, and student SES (determined by free and reduced lunch student lists).

Data Collection Procedures

A letter of request (see Appendix A) was sent to the Superintendent of Schools for the Union Township School District to obtain, anonymously, the student data needed for this study. A letter of approval (see Appendix B) was returned upon the accepted cooperation of each specific schools' Principal and Guidance Counselor.

All data obtained for this study was done with the cooperation of each school's Principal and Guidance Counselor and the district wide Test Coordinator. Student data was obtained using the district wide student record database, Starbase, and done so anonymously. All student data was identified using district assigned student identification numbers and at no time were student names used or identified in the process.

Academic Data obtained on each student in the data pool from the district wide database, Starbase, were reading, mathematic and language arts normal curve equivalent scores from the April, 1999 California Achievement Tests; mathematics and language arts total scores from the March, 1999 State of New Jersey's Grade Eight Proficiency Assessments; and standard age I. Q. scores from the September, 1995 Cognitive Abilities Test.

Demographic information for each student was obtained through advanced data queries on the district wide database, Starbase, to determine gender, participation status in instrumental music and participation status in the free and reduced lunch program.

Data Analysis

A varied approach to statistical analysis was employed using the statistical software package SPSS 8.0. For Hypotheses numbers 1 and 8, an independent t-test was employed to determine mean differences on both CAT and GEPA achievement scores between instrumental music students and non-instrumental music students. On Hypotheses numbers 2 and 9 an Analysis of Variance (ANOVA) was used to determine mean differences on both CAT and GEPA achievement scores dependent upon the number of years a student studied instrumental music. A Tukey's HSD post hoc test was administered to determine, if any, the differences among the various sample means.

For Hypotheses four through six and nine through twelve a series of Multiple Linear Regression Models were employed using both CAT and GEPA achievement scores and individual student status pertaining to instrumental music, gender and socioeconomic status. In all Models, I through V, reading and/or language arts and mathematics achievement were the dependent measures.

The independent variables for each Model were as follows: Model I – instrumental music and socioeconomic status, Model II – instrumental music status and gender, Model III – instrumental music status and I. Q., Model IV – instrumental music status, I.Q., socioeconomic status and gender, and Model V – instrumental music status, socioeconomic status and gender.

Restatement of Hypotheses

Using a variety of statistical designs as previously outlined, the following hypotheses are tested:

- HO₁ - There is no significant difference in reading achievement between eighth grade instrumental music students and eighth grade non-instrumental music students.
- HO₂ - The number of years of instrumental music study has no significant impact on an eighth grade student's reading achievement.
- HO₃ - Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Socioeconomic Status (SES) is controlled.
- HO₄ - Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Gender is controlled.
- HO₅ - Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Intelligence Quotient (I.Q.) is controlled.
- HO₆ - Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variables of Socioeconomic Status (SES), Gender and Intelligence Quotient (I.Q.) are controlled.
- HO₇ - There is no significant difference in mathematics achievement between eighth grade instrumental music students and eighth grade non-instrumental music students.

- HO₈ - The number of years of instrumental music study has no significant impact on an eighth grade student's mathematics achievement.
- HO₉ - Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Socioeconomic Status (SES) is controlled.
- HO₁₀ - Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Gender is controlled.
- HO₁₁ - Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Intelligence Quotient (I.Q.) is controlled.
- HO₁₂ - Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variables of Socioeconomic Status (SES), Gender and Intelligence Quotient (I.Q.) are controlled.

The criteria for the rejection or acceptance of each hypothesis is determined by computing the appropriate statistical value and determining its significance at the .05 level.

CHAPTER IV

Analysis of the Data

The purpose of this research design is to detect the possible effect a public school instrumental music instruction program has on an eighth grade student's academic achievement to determine if a causal relationship can be inferred. This chapter will report the results of the data analysis carried out using the statistical software package SPSS 8.0.

Twelve hypotheses are tested based upon the following problem and its sub-problems: Does formal instrumental music instruction, and the number of years of instruction, have an impact on an eighth grade middle school student's academic achievement? The relevant sub-problems that are included in the design are, 1) Does formal instrumental music instruction, when controlling for socioeconomic status, have an impact on an eighth grade middle school student's academic achievement? 2) Does formal instrumental music instruction, when controlling for gender, have an impact on an eighth grade middle school student's academic achievement? 3) Does formal instrumental music instruction, when controlling for I.Q., have an impact on an eighth grade middle school student's academic achievement? and 4) Does formal instrumental music instruction, when controlling for gender, socioeconomic status, and I.Q. as multiple variables, have an impact on an eighth grade middle school student's academic achievement?

This chapter is organized around each of the hypotheses and the subsequent statistical tests carried out on each hypothesis. For Hypotheses numbers 1 and 8, an independent t-test is employed to determine mean differences on both CAT and GEPA

achievement scores between instrumental music students and non-instrumental music students. On Hypotheses numbers 2 and 9 an Analysis of Variance (ANOVA) is used to determine mean differences on both CAT and GEPA achievement scores dependent upon the number of years of a student's instrumental music study. A Tukey's HSD post hoc test is administered to determine significant differences between the groups various sample means.

For Hypotheses four through six and nine through twelve a series of Multiple Linear Regression Models are employed using both the CAT and GEPA achievement scores as dependent measures and individual student status pertaining to instrumental music, gender, I.Q. and socioeconomic status. In all Models, I through V, reading and/or language arts and mathematics achievement are the dependent measures.

The independent variables for each Model are as follows: Model I – instrumental music and socioeconomic status, Model II – instrumental music status and gender, Model III – instrumental music status and I. Q., Model IV – instrumental music status, I.Q., socioeconomic status and gender, and Model V – instrumental music status, socioeconomic status and gender.

Each hypothesis is restated and listed separately followed by the results from the statistical treatment of the data related to that specific hypothesis. A determination as to the rejection or acceptance of each hypothesis is included based on a pre-determined significance level of $p < .05$. Descriptive statistical information for both Instrumental Music Students and Non-Instrumental Music students and results from correlations performed on the independent and dependent variables are included in Appendix C.

At the conclusion of the chapter, a summary as to the rejection or acceptance of each hypothesis is listed. In the interest of brevity, from this point on in the chapter instrumental music students are referred to as music students and non-instrumental music students are referred to as non-music students. An in depth discussion about the results reported in this chapter will take place in chapter five.

Hypothesis Testing

Hypothesis One.

There is no significant difference in reading achievement between eighth grade instrumental music students and eighth grade non-instrumental music students.

A total of 176 student's CAT Normal Curve Equivalent (NCE) reading achievement scores are analyzed for a comparison of mean differences using an independent sample t-test. The mean score for non-music students ($n = 83$) is 57.98, with a standard deviation of 15.06, and the mean score for music students ($n = 93$) is 68.42, with a standard deviation of 15.57. The overall difference in mean scores is 10.44 favoring music students and the effect size is .69 (determined by dividing the overall mean difference {10.44} by the standard deviation of the non-music students {15.06}). Table 1 shows the results where the CAT-NCE reading achievement scores (CAT.R) is the dependent variable and where instrumental music status (imusic) is the independent variable. Results indicate a t-value of -4.511 significant at $p < .000$ favoring students enrolled in instrumental music.

Table 1

Independent t-test Of Mean Comparison For Student Music Status On CAT-NCEReading Achievement

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
CAT.R Equal variances assumed	1.844	.201	-4.511	174	.000	-10.44	2.31	-15.01	-5.87
Equal variances not assumed			-4.520	172.855	.000	-10.44	2.31	-15.00	-5.88

The results of this data analysis confirm that there is a significant difference in reading achievement between music students and non-music students favoring the music students when measured with CAT-NCE reading achievement score.

When the GEPA language arts total scores are used as the dependent variable a total of 175 student scores are analyzed for mean difference. The mean score for non-music students ($n = 84$) is 216.14, with a standard deviation of 18.68, and the mean score for music students ($n = 91$) is 231.18, with a standard deviation of 17.13. The overall difference in mean scores is 15.04 favoring music students and the effect size is .80 (determined by dividing the overall mean difference {15.03} by the standard deviation of the non-music students {18.68}). Table 2 shows the results where the GEPA language arts total score (GEPA.LA) is the dependent variable and where instrumental music status (imusic) is the independent variable. Results indicate a t-value of -5.553 significant at $p < .000$ favoring students enrolled in instrumental music.

Table 2

Independent t-test Of Mean Comparison For Student Music Status On GEPA Language Arts Achievement

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
GEPA.L. Equal variances assumed	.145	.703	-5.553	173	.000	-15.03	2.71	-20.36	-9.69
Equal variances not assumed			-5.533	168.336	.000	-15.03	2.72	-20.40	-9.67

The results of this data analysis confirm that there is a significant difference in language arts achievement between music students and non-music students favoring the music students when measured with GEPA language arts total score. It should again be noted here that the GEPA assessment fails to test reading as a separate test battery but includes it as one of seven language arts test batteries. Along with other test variances between the CAT and GEPA this could possibly explain the higher t value for the GEPA language arts total score compared to the CAT-NCE reading achievement score.

Based upon the results of both independent t-tests, hypothesis one (H_{O1}) is rejected. There is a significant difference in reading achievement between eighth grade music students and eighth grade non-music students. The results indicate that music students achieve higher scores in reading than do non-music students.

Hypothesis Two.

The number of years of instrumental music study has no significant impact on an eighth grade student's reading achievement.

A total of 176 students CAT-NCE reading achievement scores are compared using an Analysis of Variance (ANOVA) to test for mean difference between the groups of students based upon the number of years the students were enrolled in instrumental music. Non-music students received a value of 0 for never having been enrolled in instrumental music during middle school. Instrumental music students received a value of between 1 and 3 for the number of years they were enrolled in instrumental music during middle school.

Mean CAT-NCE reading achievement scores for 83 non-music students with 0 years of music experience ($n = 83$) is 57.98, for music students with 1 year of experience ($n = 6$) is 59.83, for music students with 2 years of experience ($n = 9$) is 69.00, and for music students with 3 years of experience ($n = 78$) it is 69.01. Important to note here is the fact that the two largest groups are the non-music students ($n = 83$) and music students with three years of experience ($n = 78$). The two other groups, music students with 1 year of experience ($n = 6$) and music students with 2 years of experience ($n = 9$) are significantly smaller, so the calculated means for each of these samples are more likely to be unreliable than for the two larger groups, making mean comparisons with these groups questionable.

Table 3 shows the results of a Oneway ANOVA where the CAT-NCE reading achievement score is the dependent variable and instrumental music experience (mus.exp) is the independent variable. Results indicate an F value of 7.455 significant at $p < .000$, a significance does indeed exist between the groups when comparing CAT-NCE reading scores indicating that the number of years of instrumental music study does indeed impact CAT-NCE reading scores.

Table 3

ANOVA Of Instrumental Music Experience And CAT-NCE Reading Achievement

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5256.222	3	1752.074	7.455	.000
Within Groups	40423.772	172	235.022		
Total	45679.994	175			

A Tukey's post-hoc test is performed to determine which of the differences between the various music experience groups (0, 1, 2, 3) is significant, Table 4 displays those results.

Table 4

Tukey's Post Hoc Test For Instrumental Music Experience And CAT-NCE Reading Achievement ANOVA

(I) MUS.EXP	(J) MUS.EXP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	1	-1.86	6.481	.992	-18.51	14.79
	2	-11.02	6.380	.170	-24.85	2.80
	3	-11.04*	2.418	.000	-17.25	-4.83
1	0	1.86	6.481	.992	-14.79	18.51
	2	-9.17	8.080	.688	-29.92	11.59
	3	-8.18	6.495	.491	-25.87	7.51
2	0	11.02	6.380	.170	-2.80	24.85
	1	9.17	8.080	.688	-11.59	29.92
	3	-1.28E-02	5.387	1.000	-13.88	13.85
3	0	11.04*	2.418	.000	4.83	17.25
	1	9.18	6.495	.491	-7.51	25.87
	2	1.28E-02	5.387	1.000	-13.85	13.85

Note. *The mean difference is significant at the .05 level.

Dependent Variable: CAT.R

The results for the Tukey post hoc test indicate that students with 3 years of instrumental music experience achieve higher CAT-NCE reading achievement scores with a mean difference of 11.04 significant at $p < .000$. Students with two years of

instrumental music experience also achieve higher CAT-NCE reading achievement scores with a mean difference of 11.02 but are not found to be significant because of the small sample size ($n = 9$). And students with one year of instrumental music experience achieve a slightly higher CAT-NCE reading achievement score with a mean difference of 1.86 also found not to be significantly different.

Since the mean difference for music students with 1 year of experience is relatively small in comparison to music students with 2 and 3 years of experience the results indicate that music students with 1 year of experience achieve only a slightly higher score for reading achievement as non-music students as measured by the CAT-NCE reading achievement scores indicating that there is no real significant difference between these two groups. However, the small sample size of music students with one year of experience ($n = 6$), make these results questionable.

The results of the Tukey's post hoc test imply that the longer a student is enrolled in a formal instrumental music instruction program the more likely it is that his/her reading achievement score as measured by the CAT-NCE reading achievement score is going to be higher than a student not enrolled in an instrumental music instruction program.

Clearly, students enrolled in an instrumental music program for 3 years obtain significantly higher reading achievement scores than students with no instrumental music experience as measured by the CAT-NCE reading achievement scores. However, the comparison of the mean differences with one year and two years of instrumental music experience to the groups with three years of instrumental music experience and no music

experience is questionable due to the large sample sizes of these two latter groups and the extremely small sample sizes of the former two groups.

A total of 175 students GEPA language arts total scores are compared using an Analysis of Variance (ANOVA) to test for mean difference between the groups of students based upon the number of years the students were enrolled in instrumental music.

Mean GEPA language arts total scores for 84 non-music students with 0 years of experience ($n = 84$) is 216.14, five music students with 1 year of experience ($n = 5$) is 228.60, nine music students with 2 years of experience ($n = 9$) is 229.00, and for 77 music students with 3 years of experience ($n = 77$) it is 231.60. As with the ANOVA performed on the CAT-NCE reading achievement scores the disparity in group (sample) size may impact the calculated means for the smaller groups (samples) making them less stable and comparisons with the larger groups (samples) questionable.

Table 5 shows the results of a Oneway ANOVA where the GEPA language arts total score is the dependent variable and instrumental music experience (mus.exp) is the independent variable. Results indicate an F value of 10.267 significant at $p < .000$, a significance does indeed exist between the groups when comparing GEPA language arts scores, indicating that the number of years of instrumental music study impacts the GEPA language arts total score.

Table 5

ANOVA Of Instrumental Music Experience And GEPA Language Arts Achievement

GEPA.LA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9960.715	3	3320.238	10.267	.000
Within Groups	55300.005	171	323.392		
Total	65260.720	174			

A Tukey's post hoc test is performed on the results for this ANOVA to determine which of the differences between the various music experience groups (0, 1, 2, 3) is significant, Table 6 displays those results.

Table 6

Tukey's Post Hoc Test For Instrumental Music Experience And GEPA Language Arts Achievement ANOVA

(I) MUS.EXP	(J) MUS.EXP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	1	-12.46	8.278	.435	-33.72	8.81
	2	-12.86	6.307	.174	-29.06	3.35
	3	-15.45*	2.837	.000	-22.74	-8.17
1	0	12.46	8.278	.435	-8.81	33.72
	2	-.40	10.030	1.000	-26.17	25.37
	3	-3.00	8.299	.984	-24.32	18.32
2	0	12.86	6.307	.174	-3.35	29.06
	1	.40	10.030	1.000	-25.37	26.17
	3	-2.60	6.335	.977	-18.87	13.68
3	0	15.45*	2.837	.000	8.17	22.74
	1	3.00	8.299	.984	-18.32	24.32
	2	2.60	6.335	.977	-13.68	18.87

Note. *The mean difference is significant at the .05 level.

Dependent Variable: GEPA.LA

The results for the Tukey post hoc test indicate that students with 3 years of instrumental music experience achieve higher GEPA language arts total scores with a mean difference of 15.45 significant at $p < .000$. Students with two years of instrumental music experience also achieve higher GEPA language arts total scores with a mean difference of 12.86 but are not found to be significant because of the small sample size ($n = 9$). And students with one year of instrumental music experience also achieve a higher GEPA language arts total score with a mean difference of 12.46 also found not to be significant due to the small sample size ($n = 6$).

When using the GEPA language arts total score the mean difference between the groups with 1, 2 and 3 years of instrumental music experience is more similar than when the CAT-NCE reading achievement scores are used as the dependent variable. Although the mean difference for music students with 3 years of experience is found to be the only statistically significant group, the mean difference for students with 1 and 2 years of experience are relatively high as compared to the students with no experience. Again, the extremely small sample size of these two groups impact the statistical significance of their mean differences.

The results of the Tukey's post hoc test imply that the longer a student is enrolled in a formal instrumental music instruction program the more likely it is that his/her reading achievement score as measured by the GEPA language arts total score is going to be higher than a student not enrolled in an instrumental music instruction program.

Students enrolled in an instrumental music program for 3 years obtain significantly higher reading achievement scores than students with no instrumental music experience as measured by the GEPA language arts total scores. Results also indicate that students enrolled in an instrumental music program for 1 and 2 years also score higher in reading achievement on the GEPA language arts total score. However, the comparison of the mean differences with one year and two years of instrumental music experience to the groups with three years of instrumental music experience and no music experience is questionable due to the large sample sizes of these two latter groups and the extremely small sample sizes of the former two groups.

Based upon the results of both ANOVA's hypothesis two (H_{O2}) is rejected. The number of years of instrumental music study does have a significant impact upon an

eight grade student's reading achievement. Data also indicates that the more years a student has received instrumental music study the more likely the student will obtain higher achievement scores in reading.

Hypothesis Three.

Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Socioeconomic Status (SES) is controlled.

A multiple regression is used to test the hypothesis on both the CAT-NCE reading achievement score and the GEPA language arts total scores. Two separate regressions are run with Model I where the CAT-NCE reading score (n = 176) and the GEPA language arts total score (n = 175) are the dependent measures for the specific model. The predictor variables are Socio-Economic Status (SES) where n = 178, and Instrumental Music Status (IMUSIC) where n = 178; both predictor variables are dummy coded. SES is dummy coded where 0 represents students not on free and reduced lunch (n = 146) and 1 represents student receiving free and reduced lunch (n = 32). IMUSIC is dummy coded where 0 represents students not enrolled in instrumental music (n = 85) and 1 represents students enrolled in instrumental music (n = 93). Table 7 is the model summary for this regression model using the CAT-NCE reading achievement score as the dependent measure.

Table 7

Multiple Regression Model I Summary For CAT-NCE Reading Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.472 ^a	.223	.214	14.33

Note. Predictors: (Constant), ses, imusic

The multiple correlation coefficient for Model I with the CAT-NCE reading achievement as the dependent measure is $R = .472$ indicating an average correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .223, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.223} by 100). This model indicates that both IMUSIC and SES explain 22.3% of the variance for the CAT-NCE reading achievement scores.

Table 8 indicates that both predictor variables are significant in this regression model. IMUSIC yielded a beta of .252 and a t-score of 3.682 significant at $p < .000$ favoring music students over non-music students. SES yielded a beta of -.351 and a t-score of -5.123 significant at $p < .000$ favoring students not enrolled in the free and reduced lunch program. Taken together, both predictor variables account for 22.3 % of the variance in this model. The output in Table 8 indicates that SES has more of an impact on the overall variance than IMUSIC. Since the beta for SES is -.351 and the t score is -5.123 and the beta for IMUSIC is .252 with a t score of 3.682, SES has slightly more of an effect on the variance when the dependent variable is the CAT-NCE reading achievement score.

Table 8

Predictor Variables In The Model I Multiple Regression For CAT-NCE ReadingAchievement

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	61.860	1.746		35.434	.000
	imusic	8.135	2.210	.252	3.682	.000
	ses	-14.652	2.860	-.351	-5.123	.000

Note. Dependent Variable: CAT.R

In order to determine the significance of this model an ANOVA yielded an F ratio of 24.774 significant at $p < .000$ (see Table 9). Since the F value is found to be significant for the multiple regression Model I on CAT-NCE reading achievement scores it indicates that both predictor variables, IMUSIC and SES, have an effect on an eighth grade student's reading achievement when the CAT-NCE reading achievement score is the dependent measure. In this model SES accounts for more of the variance than IMUSIC indicating that it contributes more in the overall effect.

Table 9

Model I ANOVA For CAT-NCE Reading Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10170.328	2	5085.163	24.774	.000 ^a
	Residual	35509.668	173	205.258		
	Total	45679.994	175			

Note. Predictors: (Constant), ses, imusic
Dependent Variable: CAT.R

Table 10 is the model summary for this regression model using the GEPA language arts total score as the dependent measure.

Table 10

Multiple Regression Model I Summary For GEPA Language Arts Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.505 ^a	.255	.247	16.81

Note. Predictors: (Constant), ses, imusic

The multiple correlation coefficient for Model I with the GEPA language arts total score as the dependent measure is $R = .505$ indicating an above average correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .255, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.255} by 100). This model indicates that both IMUSIC and SES explain 25.5% of the variance for the GEPA language arts total scores.

Table 11 indicates that both predictor variables are significant in this regression model. IMUSIC yielded a beta of .318 and a t-score of 4.729 significant at $p < .000$ favoring music students over non-music students. SES yielded a beta of -.330 and a t-score of -4.904 significant at $p < .000$ favoring students not enrolled in the free and reduced lunch program. Taken together, both predictor variables account for 25.5 % of the variance in this model. The output in Table 11 indicates that SES has just slightly more of an impact on the overall variance than IMUSIC. Since the beta for SES is -.330 with a t score of -4.904 and the beta for IMUSIC is .318 with a t score of 4.729, there is no substantive difference in effect for both SES and IMUSIC on the variance when the dependent measure is the GEPA language arts total score. When using the GEPA language arts total score as the dependent measure both SES and IMUSIC contribute, in

effect, equally to the variance, whereas when the CAT-NCE reading achievement score is the dependent measure, SES has a slightly larger contribution to the variance than IMUSIC.

Table 11

Predictor Variables In The Model I Multiple Regression For GEPA language Arts Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	220.518	2.039		108.125	.000
	imusic	12.310	2.603	.318	4.729	.000
	ses	-16.705	3.406	-.330	-4.904	.000

Note. Dependent Variable: GEPA.LA

In order to determine the significance of this model an ANOVA yielded an F ratio of 29.493 significant at $p < .000$ (see Table 12). Since the F value is found to be significant for the multiple regression Model I on GEPA language arts total scores it indicates that both predictor variables, IMUSIC and SES, have an effect on an eighth grade student's reading achievement when the GEPA language arts total score is the dependent measure.

Table 12

Model I ANOVA For GEPA Language Arts Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16665.463	2	8332.731	29.493	.000 ^a
	Residual	48595.257	172	282.531		
	Total	65260.720	174			

Note. Predictors: (Constant), ses, imusic
Dependent Variable: GEPA.LA

Based upon the results of both Model I multiple regressions hypothesis three (H0₃) is rejected. Even when controls are entered for socioeconomic status (SES), participation in instrumental music has an independent impact in effect on an eighth grade middle school student's reading achievement. Students involved in instrumental music and/or non-enrollment in a free and reduced lunch program achieve higher reading scores.

Hypothesis Four.

Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Gender is controlled.

A multiple regression is used to test the hypothesis on both the CAT-NCE reading achievement score and the GEPA language arts total score. Two separate regressions are run with Model II where the CAT-NCE reading score (n = 176) and the GEPA language arts total score (n = 176) are the dependent measures for the specific model. The predictor variables are gender (GENDER) where n = 178, 67 male and 111 female, and Instrumental Music Status (IMUSIC) where n = 178; both predictor variables are dummy coded. GENDER is dummy coded where 0 represents male (n = 67) and 1 represents female students (n = 111). IMUSIC is dummy coded where 0 represents students not enrolled in instrumental music (n = 85) and 1 represents students enrolled in instrumental music (n = 93). Table 13 is the model summary for this regression model using the CAT-NCE reading achievement score as the dependent measure.

Table 13

Multiple Regression Model II Summary For CAT-NCE Reading Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.327 ^a	.107	.097	15.35

Note. Predictors: (Constant), gender, imusic

The multiple correlation coefficient for Model II with the CAT-NCE reading achievement score as the dependent measure is $R = .327$ indicating an average correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .107, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.107} by 100). This model indicates that both IMUSIC and GENDER explain 10.7% of the variance for the CAT-NCE reading achievement scores, a small percentage of the variance.

Table 14 indicates that only 1 predictor variable is significant in this regression model. IMUSIC yielded a beta of .323 and a t-score of 4.502, significant at $p < .000$ favoring music students over non-music students. GENDER yielded a beta of -.050 and a t-score of -.690 which is not found to be significant. Taken together, both predictor variables account for 10.7 % of the variance in this model with IMUSIC contributing a majority if not all of the variance. The impact of participating in an instrumental music program on reading achievement is six times as great as the effect of gender.

Table 14

Predictor Variables In The Model II Multiple Regression For CAT-NCE ReadingAchievement

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	59.010	2.255		26.172	.000
	imusic	10.439	2.318	.323	4.502	.000
	gender	-1.650	2.391	-.050	-.890	.491

Note. Dependent Variable: CAT.R

In order to determine the significance of this model an ANOVA yielded an F ratio of 10.383 significant at $p < .000$ (see Table 15). Since the F value is found to be significant for the multiple regression Model II on CAT-NCE reading achievement scores it indicates that both predictor variables, IMUSIC and GENDER, have an effect on an eighth grade student's reading achievement when the CAT-NCE reading achievement score is the dependent measure. Because both the beta and t score for GENDER are extremely small and not significant respectively, it indicates that IMUSIC accounts for a majority if not all of the impact on reading achievement in this regression model.

Table 15

Model II ANOVA For CAT-NCE Reading Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4895.725	2	2447.862	10.383	.000 ^a
	Residual	40784.270	173	235.747		
	Total	45679.994	175			

Note. Predictors: (Constant), gender, imusic
Dependent Variable: CAT.R

Table 16 is the model summary for this regression model using the GEPA language arts total score as the dependent measure.

Table 16

Multiple Regression Model II Summary For GEPA Language Arts Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.397 ^a	.158	.148	17.88

Note. Predictors: (Constant), gender, imusic

The multiple correlation coefficient for Model II with the GEPA language arts total score as the dependent measure is $R = .397$ indicating an average correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .158, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.158} by 100). This model indicates that both IMUSIC and GENDER explain 15.8% of the variance for the GEPA language arts total score, a slightly higher percentage of the variance than when the CAT-NCE reading achievement score is the dependent measure.

Table 17 indicates that only one predictor variable is significant in this regression model. IMUSIC yielded a beta of .388 and a t-score of 5.549, significant at $p < .000$ favoring music students over non-music students. GENDER yielded a beta of .081 and a t-score of 1.157, which is found not to be significant. Taken together, both predictor variables account for 15.8 % of the variance in this model with IMUSIC contributing a majority if not all of the variance due to the fact that the beta and t score are much larger than the same values for GENDER.

TABLE 17

Predictor Variables In The Model II Multiple Regression For GEPA language Arts Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	214.147	2.604		82.223	.000
	imusic	15.009	2.705	.388	5.549	.000
	gender	3.225	2.788	.081	1.157	.249

Note. Dependent Variable: GEPA.LA

In order to determine the significance of this model an ANOVA yielded an F ratio of 16.114 significant at $p < .000$ (see Table 18). Since the F value is found to be significant for the multiple regression Model II using the GEPA language arts total score it indicates that both predictor variables, IMUSIC and GENDER, have an effect on an eighth grade student's reading achievement when the GEPA language arts total score is the dependent measure. Because both the beta and t score for GENDER are small and not significant respectively, it indicates that IMUSIC accounts for a majority if not all of the impact on reading achievement in this regression model.

Table 18

Model II ANOVA For GEPA Language Arts Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10298.661	2	5149.330	16.114	.000 ^a
	Residual	54962.059	172	319.547		
	Total	65260.720	174			

Note. Predictors: (Constant), gender, imusic
Dependent Variable: GEPA.LA

Based upon the results of both Model II multiple regressions hypothesis four (H0₄) is rejected. Even when controls are entered for GENDER, participation in instrumental music has an independent impact in effect on an eighth grade middle school student's reading achievement. These results indicate that students involved in instrumental music achieve higher reading scores and that gender has little or no significant impact on attenuating the relationship between instrumental music instruction and reading achievement

Hypothesis Five.

Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variable of Intelligent Quotient (I.Q.) is controlled.

A multiple regression is used to test the hypothesis on both the CAT-NCE reading achievement score and the GEPA language arts total score. Two separate regressions are run with Model III where the CAT-NCE reading score (n = 176) and the GEPA language arts total score (n = 176) are the dependent measures for the specific model. The predictor variables are intelligent quotient standard age scores (I.Q.) where n = 134, and Instrumental Music Status (IMUSIC) where n = 178. IMUSIC is dummy coded where 0 represents students not enrolled in instrumental music (n = 85) and 1 represents students enrolled in instrumental music (n= 93). Table 19 is the model summary for this regression model using the CAT-NCE reading achievement score as the dependent measure.

Table 19

Multiple Regression Model III Summary For CAT-NCE Reading Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.665 ^a	.442	.434	12.19

Note. Predictors: (Constant), IQ, imusic

The multiple correlation coefficient for Model III with the CAT-NCE reading achievement as the dependent measure is $R = .665$ indicating a strong correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .442, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.442} by 100). This model indicates that both IMUSIC and I.Q. explain 44.2% of the variance for the CAT-NCE reading achievement scores, a large percentage of the variance.

Table 20 indicates that only 1 predictor variable is significant in this regression model. I.Q. yielded a beta of .653 and a t-score of 9.501, significant at $p < .000$ favoring students with a high I.Q. IMUSIC yielded a beta of .038 and a t-score of .555 which is not found to be significant. Taken together, both predictor variables account for 44.2 % of the variance in this model with I.Q. contributing a majority if not all of the variance. The impact of a high I.Q. on reading achievement is nearly 17 times as great as the effect of instrumental music participation status.

Table 20

Predictor Variables In The Model III Multiple Regression For CAT-NCE ReadingAchievement

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	-38.896	10.859		-3.649	.000
	imusic	1.249	2.251	.038	.555	.580
	IQ	.964	.101	.653	9.501	.000

Note. Dependent Variable: CAT.R

In order to determine the significance of this model an ANOVA yielded an F ratio of 51.543 significant at $p < .000$ (see Table 21). Since the F value is found to be significant for the multiple regression Model III on CAT-NCE reading achievement scores it indicates that both predictor variables, IMUSIC and I.Q., have an effect on an eighth grade student's reading achievement when the CAT-NCE reading achievement score is the dependent measure. Because both the beta and t score for IMUSIC are extremely small and not significant respectively, it indicates that I.Q. accounts for a majority if not all of the impact on reading achievement in this regression model.

Table 21

Model III ANOVA For CAT-NCE Reading Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15317.110	2	7658.555	51.543	.000 ^a
	Residual	19316.333	130	148.587		
	Total	34633.444	132			

Note. Predictors: (Constant), IQ, imusic
Dependent Variable: CAT.R

When dealing with multiple regression, proper selection of the predictor variables is critical to determining the multiple coefficient of determination - R Square. Predictor variables should be highly correlated to the dependent variable but not to each other in order to capitalize on the effect of the multiple coefficient of determination - R square (Hinkle, Wiersma & Jurs, 1998). Since this regression model indicates a large influence for one variable, I.Q., over another, IMUSIC, on the overall variance, it is important to determine the correlation between these two variables.

The Pearson product-moment correlation coefficient for the independent variables IMUSIC and I.Q. is .306 (see Table 22). Table 22 indicates that this correlation is significant at $p < .01$. There is a positive relationship between eighth grade students enrolled in instrumental music and intelligent quotients. Instrumental music students tend to have higher I.Q. scores than do non-instrumental music students. This relationship could have an effect on a regression model that uses both I.Q. and instrumental music status (IMUSIC) as predictor variables.

Table 22

Pearson Product-Moment Correlation Coefficient For The Variables I.Q. And IMUSIC

		IQ	imusic
IQ	Pearson Correlation	1.000	.306**
	Sig. (2-tailed)	.	.000
	N	134	134
imusic	Pearson Correlation	.306**	1.000
	Sig. (2-tailed)	.000	.
	N	134	178

Note. **Correlation is significant at the 0.01 level

Table 23 is the model summary for this regression model using the GEPA language arts total score as the dependent measure.

Table 23

Multiple Regression Model III Summary For GEPA Language Arts Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.582 ^a	.339	.329	14.28

Note. Predictors: (Constant), IQ, imusic

The multiple correlation coefficient for Model III with the GEPA language arts total score as the dependent measure is $R = .582$ indicating another strong correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .339, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.339} by 100). This model indicates that both IMUSIC and I.Q. explain 33.9% of the variance for the GEPA language arts total score, a smaller percentage of the variance than when the CAT-NCE reading achievement score is the dependent measure.

Table 24 indicates that both predictor variables are significant in this regression model. IMUSIC yielded a beta of .208 and a t-score of 2.767, significant at $p < .006$ favoring music students over non-music students. I.Q. yielded a beta of .483 and a t-score of 6.408, significant at $p < .000$ favoring students with high I.Q.'s. Taken together, both predictor variables account for 33.9% of the variance in this model. Although both predictor variables are determined to be significant in this regression model, I.Q. contributes more than twice the variance than does IMUSIC, although IMUSIC contributes to the overall effect. The output in Table 24 indicates that I.Q. and IMUSIC

are significant predictor variables on the dependent variable GEPA language arts score, whereas when the CAT-NCE reading achievement score is the dependent variable I.Q. accounts for a majority if not all of the variance. This could be due to the different testing criteria for each of the dependent variables.

Table 24

Predictor Variables In The Model III Multiple Regression For GEPA Language Arts

Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	138.615	12.672		10.939	.000
	imusic	7.320	2.646	.208	2.767	.006
	IQ	.774	.121	.483	6.406	.000

Note. Dependent Variable: GEPA.LA

In order to determine the significance of this model an ANOVA yielded an F ratio of 33.077 significant at $p < .000$ (see Table 25). Since the F value is found to be significant for the multiple regression Model III using the GEPA language arts total score it indicates that both predictor variables, IMUSIC and I.Q., have an effect on an eighth grade student's reading achievement when the GEPA language arts total score is the dependent measure.

Table 25

Model III ANOVA For GEPA Language Arts Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13483.380	2	6741.690	33.077	.000 ^a
	Residual	26282.885	129	203.821		
	Total	39776.265	131			

Note. Predictors: (Constant), IQ, imusic
Dependent Variable: GEPA.LA

Based upon the mixed results of the data analysis there are two findings for hypothesis five (H0₅). When the CAT-NCE reading achievement score is the measurement tool we accept the null hypothesis because the variable IMUSIC is not found to be significant in the Model III multiple regression. When controls are entered for I.Q., participation in instrumental music has no significant independent impact in effect on an eighth grade middle school student's reading achievement when the CAT – NCE reading achievement score is used as the dependent measure.

When the GEPA language arts total score is used as the measurement tool we reject the null hypothesis because the variable IMUSIC is found to be significant using the Model III multiple regression. Even when controls are entered for I.Q., participation in instrumental music has an independent impact in effect on an eighth grade middle school student's reading achievement when the GEPA language arts total score is used as the dependent measure.

Hypothesis Six.

Participation in an instrumental music program has no impact on the reading achievement of an eighth grade middle school student when the variables of Socioeconomic Status (SES), Gender and Intelligence Quotient (I.Q.) are controlled.

A multiple regression is used to test the hypothesis on both the CAT-NCE reading achievement score and the GEPA language arts total score. Two separate regressions are run with Model IV where the CAT-NCE reading score (n = 176) and the GEPA language arts total score (n = 176) are the dependent measures for the specific model. The predictor variables are intelligent quotient standard age scores (I.Q.) where n = 134, socioeconomic status (SES) where n = 178, gender (GENDER) where n = 178, 67 males and 111

females, and Instrumental Music Status (IMUSIC) where $n = 178$. SES is dummy coded where 0 represents students not enrolled in a free and reduced lunch program ($n = 146$) and 1 represents students enrolled in a free and reduced lunch program ($n = 32$); GENDER is dummy coded where 0 represents males ($n = 67$) and 1 represents females ($n = 111$); and IMUSIC is dummy coded where 0 represents students not enrolled in instrumental music ($n = 85$) and 1 represents students enrolled in instrumental music ($n = 93$). Table 26 is the model summary for this regression model using the CAT-NCE reading achievement score as the dependent measure.

Table 26

Multiple Regression Model IV Summary For CAT-NCE Reading Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.678 ^a	.459	.442	12.10

Note. Predictors: (Constant), gender, imusic, ses, IQ

The multiple correlation coefficient for Model IV with the CAT-NCE reading achievement as the dependent measure is $R = .678$ indicating a strong correlation between the four predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .459, indicating the percentage of the variance for the four predictor variables (calculated by multiplying the value of R Square {.459} by 100). This model indicates that IMUSIC, SES, GENDER and I.Q. explain 45.9% of the variance for the CAT-NCE reading achievement scores, a large percentage of the variance.

Table 27 indicates that only 1 predictor variable is significant in this regression model. I.Q. yielded a beta of .632 and a t-score of 8.785, significant at $p < .000$ favoring

students with a high I.Q. IMUSIC yielded a beta of .016 and a t score of .232 which is not found to be significant, SES yielded a beta of -.125 and a t score of -1.813 which is not found to be significant and GENDER yielded a beta of .053 and a t score of .792 which is also not found to be significant. Taken together, all predictor variables account for 45.9 % of the variance in this model with I.Q. contributing a majority of the effect because the beta and t score is much larger than the same values for IMUSIC, SES and GENDER.

Table 27

Predictor Variables In The Model IV Multiple Regression For CAT-NCE Reading Achievement

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1					
	(Constant)	-35.639	11.738		
	imusic	.525	2.262	.016	.817
	IQ	.933	.106	.832	.000
	ses	-8.386	3.622	-.125	.072
	gender	1.778	2.244	.053	.430

Note. Dependent Variable: CAT.R

In order to determine the significance of this model an ANOVA yielded an F ratio of 27.186 significant at $p < .000$ (see Table 28). Since the F value is found to be significant for the multiple regression Model IV on CAT-NCE reading achievement scores it indicates that all the predictor variables, IMUSIC, SES, GENDER and I.Q., have an effect on an eighth grade student's reading achievement when the CAT-NCE reading achievement score is the dependent measure. Because the betas and t scores for IMUSIC, SES and GENDER are extremely small and not significant respectively, it indicates that I.Q. accounts for a majority if not all of the impact on reading achievement in this

regression model, although, SES does seem to contribute a slight effect to the overall variance favoring students not enrolled in a free and reduced lunch program. It is important to note that the variable IMUSIC yielded the lowest beta indicating it is the smallest contributor to the overall variance in this regression model.

Table 28

Model IV ANOVA For CAT-NCE Reading Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15808.192	4	3977.048	27.186	.000 ^a
	Residual	18725.252	128	146.291		
	Total	34633.444	132			

Note. Predictors: (Constant), gender, imusic, ses, IQ
Dependent Variable: CAT.R

Table 29 is the model summary for this regression model using the GEPA language arts total score as the dependent measure.

Table 29

Multiple Regression Model IV Summary For GEPA Language Arts Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.647 ^a	.418	.400	13.50

Note. Predictors: (Constant), gender, ses, imusic, IQ

The multiple correlation coefficient for Model IV with the GEPA language arts total score as the dependent measure is $R = .647$ indicating another strong correlation between the four predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .418, indicating the percentage of the variance for the four predictor variables (calculated by multiplying the value of R Square {.418} by 100). This model indicates that IMUSIC, SES, GENDER and I.Q. explain 41.8% of the

variance for the GEPA language arts total score, a smaller percentage of the variance than when the CAT-NCE reading achievement score is the dependent measure.

Table 30 indicates that all four predictor variables are significant in this regression model. IMUSIC yielded a beta of .156 and a t score of 2.151, significant at $p < .033$ favoring music students over non-music students. SES yielded a beta of -.228 and a t score of -3.178, significant at $p < .002$ in favor of students not enrolled in a free and reduced lunch program. GENDER yielded a beta of .176 and a t score of 2.552, significant at .012 in favor of female students. I.Q. yielded a beta of .466 and a t-score of 6.273, significant at $p < .000$ favoring students with high I.Q.'s. Taken together, all four predictor variables account for 41.8% of the variance in this model.

Although all four predictor variables are determined to be significant in this regression model, I.Q. has more than twice the effect than any of the other predictor variables. SES is the next predictor with the most impact followed by GENDER and then IMUSIC. Again, it is interesting to note that IMUSIC contributes the least amount of effect on the variance in this regression model although it does contribute some effect. The output in Table 30 indicates that I.Q., SES, GENDER and IMUSIC are significant predictor variables on the dependent variable GEPA language arts score, whereas when the CAT-NCE reading achievement score is the dependent variable I.Q. accounts for a majority if not all of the variance. This could be due to the different testing criteria for each of the dependent variables.

Table 30

Predictor Variables In The Model IV Multiple Regression For GEPA Language ArtsTotal Score.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	139.862	13.067		10.704	.000
	imusic	5.477	2.547	.156	2.151	.033
	IQ	.747	.119	.466	6.273	.000
	ses	-12.848	4.043	-.228	-3.178	.002
	gender	6.371	2.497	.176	2.552	.012

Note. Dependent Variable: GEPA.LA

In order to determine the significance of this model an ANOVA yielded an F ratio of 22.828 significant at $p < .000$ (see Table 31). Since the F value is found to be significant for the multiple regression Model IV using the GEPA language arts total score it indicates that all four predictor variables, IMUSIC, SES, GENDER and I.Q., have an effect on an eighth grade student's reading achievement when the GEPA language arts total score is the dependent measure.

Table 31

Model IV ANOVA For GEPA Language Arts Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16637.123	4	4159.281	22.828	.000*
	Residual	23139.142	127	182.198		
	Total	39776.265	131			

Note. Predictors: (Constant), gender, ses, imusic, IQ
Dependent Variable: GEPA.LA

Based upon the mixed results of the data analysis there are two findings for hypothesis six (H0₆). When the CAT-NCE reading achievement score is the measurement tool we accept the null hypothesis because the variable IMUSIC is not found to be significant in the Model IV multiple regression. Participation in instrumental music does not significantly impact reading achievement when controlling for standard age score intelligent quotient (I.Q.), socioeconomic status (SES) and gender (GENDER). Results indicate that on the CAT-NCE reading achievement scores I.Q. is determined to be the predictor variable with the most effect with little or no impact from the variables IMUSIC, SES and GENDER.

When the GEPA language arts total score is used as the measurement tool we reject the null hypothesis because the variable IMUSIC is found to be significant using the Model IV multiple regression. Participating in instrumental music does significantly impact reading achievement when controlling for standard age score intelligent quotient (I.Q.), socioeconomic status (SES) and gender (GENDER). I.Q. still remains the most powerful predictor but the variables IMUSIC, SES and GENDER contribute significantly to the overall variance. This mixed result in Model IV multiple regression model indicates that even though I.Q. appears to have the most effect on reading achievement, instrumental music status, socioeconomic status and gender also have an impact.

Since the purpose of this research design is to examine the effect of enrollment in an instrumental music program on a student's academic achievement it is prudent to consider an alternative regression model to determine if IMUSIC may contribute more to the dependent measures in the absence of I.Q. Because I.Q. is such a powerful contributor in the Model IV regressions, and could possibly be weakening the impact of the other

predictor variables on the dependent measures, another multiple regression model is employed that excludes I.Q. as a contributing variable.

Two separate regressions are run with a Model V regression where the CAT-NCE reading achievement score ($n = 176$) and the GEPA language arts total score ($n = 176$) are the dependent measures for the specific model. The predictor variables are Socioeconomic Status (SES), Instrumental Music Status (IMUSIC) and Gender (GENDER). The sample sizes and dummy coding remain the same for Model V as in Model IV. The intelligent quotient standard age score (I.Q.) has been removed from this regression model.

Table 32 is the model summary for this regression model using the CAT-NCE reading achievement score as the dependent measure.

Table 32

Multiple Regression Model V Summary For CAT-NCE Reading Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.473 ^a	.223	.210	14.36

Note. Predictors: (Constant), gender, imusic, ses

The multiple correlation coefficient for Model V with the CAT-NCE reading achievement as the dependent measure is $R = .473$ indicating an above average correlation between the three predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .223, indicating the percentage of the variance for the three predictor variables (calculated by multiplying the value of R Square $\{.223\}$ by 100). This model indicates that IMUSIC, SES, and GENDER explain 22.3%

of the variance for the CAT-NCE reading achievement scores, a noticeable percentage of the variance.

Table 33 indicates that only 2 predictor variables are significant in this regression model. IMUSIC yielded a beta of .252 and a t score of 3.677 significant at $p < .000$, SES yielded a beta of -.349 and a t score of -5.075 significant at $p < .000$, and GENDER yielded a beta of -.029 and a t score of -.424 which is not found to be significant. Taken together, all predictor variables account for 22.3 % of the variance in this model with SES and IMUSIC contributing a majority if not all of the variance because the beta and t score is much larger than the same values for GENDER. This regression indicates that SES has more of an impact than IMUSIC but that both contribute an overall effect on the variance.

Table 33

Predictor Variables In the Model V Multiple Regression For CAT-NCE Reading

Achievement

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	62.435	2.214		28.197	.000
	Imusic	8.144	2.215	.252	3.677	.000
	ses	-14.577	2.872	-.349	-5.075	.000
	gender	-.950	2.240	-.029	-.424	.672

Note. Dependent Variable: CAT.R

In order to determine the significance of this model an ANOVA yielded an F ratio of 16.498 significant at $p < .000$ (see Table 34). Since the F value is found to be significant for the multiple regression Model V on CAT-NCE reading achievement scores it indicates that all the predictor variables, IMUSIC, SES, and GENDER, have an

effect on an eighth grade student's reading achievement when the CAT-NCE reading achievement score is the dependent measure. Because the beta and t score for GENDER is extremely small and not significant respectively, it indicates that SES and IMUSIC account for a majority if not all of the impact on reading achievement in this regression model.

Table 34

Model V ANOVA For CAT-NCE Reading Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10207.443	3	3402.481	16.498	.000 ^a
	Residual	35472.551	172	206.236		
	Total	45679.994	175			

Note. Predictors: (Constant), gender, imusic, ses
Dependent Variable: CAT.R

Table 35 is the model summary for this regression model using the GEPA language arts total score as the dependent measure.

Table 35

Multiple Regression Model V Summary For GEPA Language Arts Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.515 ^a	.265	.252	16.75

Note. Predictors: (Constant), gender, imusic, ses

The multiple correlation coefficient for Model V with the GEPA language arts total score as the dependent measure is $R = .515$ indicating a strong correlation between the three predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .265, indicating the percentage of the variance for the three predictor variables (calculated by multiplying the value of R Square {.265} by 100).

This model indicates that IMUSIC, SES, and GENDER explain 26.5% of the variance for the GEPA language arts total score, a marginal 4.2 % increase in the percentage of the variance than when the CAT-NCE reading achievement score is the dependent measure.

Table 36 indicates that only two predictor variables are significant in this regression model. IMUSIC yielded a beta of .317 and a t score of 4.717, significant at $p < .000$ favoring music students over non-music students. SES yielded a beta of -.336 and a t score of -4.998, significant at $p < .000$ in favor of students not enrolled in a free and reduced lunch program. GENDER yielded a beta of .099 and a t score of 1.508, which is found not to be significant in this model. Taken together, all three predictor variables account for 26.5% of the variance in this model. SES is determined to be a slightly higher predictor variable than IMUSIC but since the difference is marginal they contribute just about the same in effect. GENDER contributes very little if anything to the overall variance. The output in Table 36 indicates that SES and IMUSIC are significant predictor variables on the dependent variable GEPA language arts score the same as for the CAT-NCE reading achievement score.

Table 36

Predictor Variables In The Model V Multiple Regression For GEPA Language Arts Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	218.150	2.588		84.948	.000
	imusic	12.235	2.584	.317	4.717	.000
	ses	-16.987	3.399	-.336	-4.998	.000
	gender	3.945	2.616	.099	1.508	.133

Note. Dependent Variable: GEPA.LA

In order to determine the significance of this model an ANOVA yielded an F ratio of 20.566 significant at $p < .000$ (see Table 37). Since the F value is found to be significant for the multiple regression Model V using the GEPA language arts total score it indicates that all three predictor variables, IMUSIC, SES, GENDER, have an effect on an eighth grade student's reading achievement when the GEPA language arts total score is the dependent measure.

Table 37

Model V ANOVA For GEPA Language Arts Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17303.289	3	5767.763	20.566	.000 ^a
	Residual	47957.431	171	280.453		
	Total	65260.720	174			

Note. Predictors: (Constant), gender, imusic, ses
Dependent Variable: GEPA.LA

Based upon the results of both Model V multiple regressions even when controls are entered for socioeconomic status (SES) and GENDER, participation in instrumental music has an independent impact in effect on an eighth grade middle school student's reading achievement.

The results from the Model V multiple regression model imply that IMUSIC and SES do contribute to the variance in student reading achievement when the variable I.Q. is excluded from the model. GENDER, as in Model IV, does not seem to contribute any effect on the dependent measures worth noting. Between 22% and 27% of the impact on reading achievement can be contributed to IMUSIC and SES when I.Q. is excluded.

Hypothesis Seven.

There is no significant difference in mathematics achievement between eighth grade instrumental music students and eighth grade non-instrumental music students.

A total of 170 student's CAT Normal Curve Equivalent (NCE) mathematics scores are analyzed for a comparison of mean differences using an independent sample t-test. The mean score for non-music students ($n = 80$) is 60.08, with a standard deviation of 19.12, and the mean score for music students ($n = 90$) is 68.57, with a standard deviation of 15.90. The overall difference in mean scores is 8.49 favoring music students and the effect size is .44 (determined by dividing the overall mean difference {8.49} by the standard deviation of the non-music students {19.12}). Table 38 shows the results where the CAT-NCE mathematics score (CAT.M) is the dependent variable and where instrumental music status (imusic) is the independent variable. Results indicate a t-value of -3.160 significant at $p < .002$ favoring students enrolled in instrumental music.

Table 38

Independent t-test Of Mean Comparison For Student Music Status On CAT-NCE

Mathematics Achievement

	Levene's Test for quality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
CAT.M Equal variances assumed	.936	.335	-3.160	168	.002	-8.49	2.69	-13.80	-3.19
Equal variances not assumed			-3.126	154.239	.002	-8.49	2.72	-13.86	-3.13

The results of this data analysis confirm that there is a significant difference in mathematics achievement between music students and non-music students favoring the music students when measured with CAT-NCE mathematics achievement scores.

When the GEPA mathematics total score is used as the dependent variable a total of 175 student scores are analyzed for mean difference. The mean score for non-music students ($n = 83$) is 208.40, with a standard deviation of 29.02, and the mean score for music students ($n = 91$) is 226.46, with a standard deviation of 29.15. The overall difference in mean scores is 18.06 favoring the music students and the effect size is .62 (determined by dividing the overall mean difference {18.06} by the standard deviation of the non-music students {29.02}). Table 39 shows the results where the GEPA mathematics total score (GEPA.M) is the dependent variable and where instrumental music status (imusic) is the independent variable. Results indicate a t-value of -4.092 significant at $p < .000$ favoring students enrolled in instrumental music.

Table 39

Independent t-test Of Mean Comparison For Student Music Status On GEPA

Mathematics Achievement

	Levene's Test for quality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
GEPA.M Equal variances assumed	.029	.865	-4.092	172	.000	-18.06	4.41	-26.78	-9.35
Equal variances not assumed			-4.092	170.673	.000	-18.06	4.41	-26.78	-9.35

The results of this data analysis confirm that there is a significant difference in mathematics achievement between music students and non-music students favoring the music students when measured with GEPA mathematics total score.

Based upon the results of both independent t-tests, hypothesis seven (H_{O7}) is rejected. There is a significant difference in mathematics achievement between eighth grade music students and eighth grade non-music students. The results indicate that music students achieve higher scores in mathematics than do non-music students.

Hypothesis Eight.

The number of years of instrumental music study has no significant impact on an eighth grade student's mathematics achievement.

A total of 170 students CAT-NCE mathematics scores are compared using an Analysis of Variance (ANOVA) to test for mean difference between the groups of students based upon the number of years the student were enrolled in instrumental music. Non-music students received a value of 0 for never having been enrolled in instrumental music during middle school. Instrumental music students received a value of between 1 and 3 for the number of years they were enrolled in instrumental music during middle school.

Mean CAT-NCE mathematics scores for 80 non-music students with 0 years of music experience ($n = 80$) is 60.08, for music students with 1 year of experience ($n = 6$) is 57.50, for music students with 2 years of experience ($n = 9$) is 71.78, and for music students with 3 years of experience ($n = 75$) it is 69.07. Again, it is important to note that the two largest groups are the non-music students ($n = 83$) and music students with three years of experience ($n = 78$). The two other groups, music students with 1 year of

experience ($n = 6$) and music students with 2 years of experience ($n = 9$) are significantly smaller, so the calculated means for each of these samples are more likely to be unreliable than for the two larger groups, making mean comparisons with these groups questionable.

Table 40 shows the results of a Oneway ANOVA where the CAT-NCE mathematics score is the dependent variable and instrumental music experience (mus.exp) is the independent variable. Results indicate an F value of 4.271 significant at $p < .006$, a significance does indeed exist between the groups when comparing CAT-NCE mathematics scores indicating that the number of years of instrumental music study does impact CAT-NCE mathematics scores.

Table 40

ANOVA Of Instrumental Music Experience And CAT-NCE Mathematics Achievement

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3900.381	3	1300.127	4.271	.006
Within Groups	50531.272	166	304.405		
Total	54431.653	169			

A Tukey's post-hoc test is performed to determine which of the differences between the various music experience groups (0, 1, 2, 3) are significant, Table 41 displays those results.

Table 41

Tukey's Post Hoc Test For Instrumental Music Experience And CAT-NCE Mathematics Achievement ANOVA

(I) MUS.EXP	(J) MUS.EXP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	1	2.58	7.385	.985	-16.40	21.55
	2	-11.70	6.134	.225	-27.46	4.06
	3	-8.99*	2.804	.007	-16.20	-1.79
1	0	-2.58	7.385	.985	-21.55	16.40
	2	-14.28	9.195	.406	-37.90	9.35
	3	-11.57	7.402	.400	-30.58	7.45
2	0	11.70	6.134	.225	-4.06	27.46
	1	14.28	9.195	.406	-9.35	37.90
	3	2.71	6.155	.971	-13.10	18.52
3	0	8.99*	2.804	.007	1.79	16.20
	1	11.57	7.402	.400	-7.45	30.58
	2	-2.71	6.155	.971	-18.52	13.10

Note. *The mean difference is significant at the .05 level.
Dependent Variable: CAT.M

The results for the Tukey's post hoc test indicate that students with 3 years of instrumental music experience achieve higher CAT-NCE mathematics scores with a mean difference of 8.99 significant at $p < .007$. Students with 2 years of experience achieve a higher mean difference of 11.70 overall, but are not found to be significant because of the small sample size ($n = 9$). And students with one year of instrumental music experience achieve a slightly higher CAT-NCE mathematics achievement score with a mean difference of 2.58 also found not to be significant.

Since the mean difference for music students with 1 year of experience is relatively small in comparison to music students with 2 and 3 years of experience the results indicate that music students with 1 year of experience achieve a slightly higher score for mathematics achievement than non-music students as measured by the CAT-

NCE mathematics achievement scores indicating that there is no real significant difference between these two groups. However, the small sample size of music students with 1 year of experience ($n = 6$) makes these results questionable.

Students with 2 years of experience show the highest mean difference in mathematics achievement, which implies that the exceedingly small sample size for this group has an impact on the mean comparisons. Music students with 3 years of experience is the only group to show a mean difference that is significant at 8.99 and based on the size of the sample this result is reliable.

The results of the Tukey post hoc test imply that students enrolled in a formal instrumental music instruction program for 3 years have higher mathematics achievement scores as measured by the CAT-NCE mathematics achievement score than do students who have never been enrolled in instrumental music. The results for students with 1 and 2 years of music experience also indicate the same effect but due to the small sample size for each group and the skewed relationships with the mean comparisons these results are not reliable.

A total of 174 students GEPA mathematics total scores are compared using an Analysis of Variance (ANOVA) to test for mean difference between the groups of students based upon the number of years the student were enrolled in instrumental music.

Mean GEPA mathematics total scores for 83 non-music students with 0 years of experience ($n = 83$) is 208.40, five music students with 1 year of experience ($n = 5$) is 206.60, nine music students with 2 years of experience ($n = 9$) is 226.78, and for 77 music students with 3 years of experience ($n = 77$) it is 227.71. As with the ANOVA performed on the CAT-NCE mathematics achievement scores the disparity in group

(sample) size may impact the calculated means for the smaller groups (samples) making them less stable and comparisons with the larger groups (samples) questionable.

Table 42 shows the results of a Oneway ANOVA where the GEPA mathematics score is the dependent variable and instrumental music experience (mus.exp) is the independent variable. Results indicate an F value of 6.423 significant at $p < .000$, a significance does indeed exist between the groups when comparing GEPA mathematics scores, indicating that the number of years of instrumental music study does impact GEPA mathematics scores.

Table 42

ANOVA Of Instrumental Music Experience And GEPA Mathematics Achievement

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	16258.461	3	5419.487	6.423	.000
Within Groups	143436.349	170	843.743		
Total	159694.810	173			

A Tukey's post hoc test is performed on the results for this ANOVA to determine which of the differences between the various music experience groups (0, 1, 2, 3) are significant, Table 43 displays those results.

Table 43

Tukey's Post Hoc Test For Instrumental Music Experience And GEPA MathematicsAchievement ANOVA

(I) MUS.EXP	(J) MUS.EXP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	1	1.80	13.376	.999	-32.57	36.16
	2	-18.38	10.194	.272	-44.57	7.81
	3	-19.32*	4.596	.000	-31.12	-7.51
1	0	-1.80	13.376	.999	-36.16	32.57
	2	-20.18	16.202	.598	-61.80	21.45
	3	-21.11	13.405	.393	-55.55	13.32
2	0	18.38	10.194	.272	-7.81	44.57
	1	20.18	16.202	.598	-21.45	61.80
	3	-.94	10.233	1.000	-27.22	25.35
3	0	19.32*	4.596	.000	7.51	31.12
	1	21.11	13.405	.393	-13.32	55.55
	2	.94	10.233	1.000	-25.35	27.22

Note. *The mean difference is significant at the .05 level.

Dependent Variable: GEPA.M

The results for the Tukey post hoc test indicate that students with 3 years of instrumental music experience achieve higher GEPA mathematics total scores with a mean difference of 19.32 significant at $p < .000$. Students with two years of instrumental music experience also achieve higher GEPA mathematics total scores with a mean difference of 18.38 but are not found to be significant because of the small sample size ($n = 9$). And students with one year of instrumental music experience achieve a slightly higher GEPA mathematics total score with a mean difference of 1.80 also found not to be significantly different.

Since the mean difference for music students with 1 year of experience is relatively small in comparison to music students with 2 and 3 years of experience the

results indicate that music students with 1 year of experience achieve only a slightly higher score for mathematics achievement as non-music students as measured by the GEPA mathematics total scores indicating that there is no real significant difference between these two groups. However, the small sample size of music students with one year of experience ($n = 6$) makes these results questionable.

The results of the Tukey's post hoc test imply that the longer a student is enrolled in a formal instrumental music instruction program the more likely it is that his/her mathematics achievement score as measured by the GEPA mathematics total score is going to be higher than a student not enrolled in an instrumental music instruction program.

Students enrolled in an instrumental music program for 3 years obtain significantly higher mathematics achievement scores than students with no instrumental music experience as measured by the GEPA mathematics total scores. However, the comparison of the mean differences with one year and two years of instrumental music experience to the groups with three years of instrumental music experience and no music experience is questionable due to the large sample sizes of these two latter groups and the extremely small sample sizes of the former two groups.

Based upon the results of both ANOVA's hypothesis eight (H_{08}) is rejected. The number of years of instrumental music study does have a significant impact upon and eighth grade student's mathematics achievement. Data also indicates that the more years a student has received instrumental music study the more likely the student will obtain higher achievement scores in mathematics.

Hypothesis Nine.

Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Socioeconomic Status (SES) is controlled.

A multiple regression is used to test the hypothesis on both the CAT-NCE mathematics achievement score and the GEPA mathematics total scores. Two separate regressions are run with Model I where the CAT-NCE mathematics score ($n = 170$) and the GEPA mathematics total score ($n = 174$) are the dependent measures for the specific model. The predictor variables are Socio-Economic Status (SES) where $n = 178$, and Instrumental Music Status (IMUSIC) where $n = 178$; both predictor variables are dummy coded. SES is dummy coded where 0 represents students not on free and reduced lunch ($n = 146$) and 1 represents student receiving free and reduced lunch ($n = 32$). IMUSIC is dummy coded where 0 represents students not enrolled in instrumental music ($n = 85$) and 1 represents students enrolled in instrumental music ($n = 93$). Table 44 is the model summary for this regression model using the CAT-NCE mathematics achievement score as the dependent measure.

Table 44

Multiple Regression Model I Summary For CAT-NCE Mathematics Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.471 ^a	.222	.213	15.92

Note. Predictors: (Constant), ses, imusic

The multiple correlation coefficient for Model I with the CAT-NCE mathematics achievement as the dependent measure is $R = .471$ indicating an average correlation

between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .222, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.222} by 100). This model indicates that both IMUSIC and SES explain 22.2% of the variance for the CAT-NCE mathematics achievement scores.

Table 45 indicates that both predictor variables are significant in this regression model. IMUSIC yielded a beta of .148 and a t-score of 2.121 significant at $p < .035$ favoring music students over non-music students. SES yielded a beta of -.417 and a t-score of -5.970 significant at $p < .000$ favoring students not enrolled in the free and reduced lunch program. Taken together, both predictor variables account for 22.2 % of the variance in this model. The output in Table 45 indicates that SES has more of an impact on the overall variance than IMUSIC. Since the beta for SES is -.417 and the t score is -5.970 and the beta for IMUSIC is .148 with a t score of 2.121, SES has nearly three times the effect than IMUSIC on the variance when the dependent variable is the CAT-NCE mathematics achievement score.

Table 45

Predictor Variables In The Model I Multiple Regression For CAT-NCE Mathematics Achievement

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1						
	(Constant)	65.213	1.977		32.980	.000
	imusic	5.311	2.504	.148	2.121	.035
	ses	-19.573	3.279	-.417	-5.970	.000

Note. Dependent Variable: CAT.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 23.843 significant at $p < .000$ (see Table 46). Since the F value is found to be significant for the multiple regression Model I on CAT-NCE mathematics achievement scores it indicates that both predictor variables, IMUSIC and SES, have an effect on an eighth grade student's mathematics achievement when the CAT-NCE mathematics achievement score is the dependent variable. In this model, SES accounts for nearly three times the effect than IMUSIC indicating that it contributes more to the overall variance.

Table 46

Model I ANOVA For CAT-NCE Mathematics Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12090.306	2	6045.153	23.843	.000 ^a
	Residual	42341.347	167	253.541		
	Total	54431.653	169			

Note. Predictors: (Constant), ses, imusic
Dependent Variable: CAT.M

Table 47 is the model summary for this regression model using the GEPA mathematics total score as the dependent measure.

Table 47

Multiple Regression Model I Summary For GEPA Mathematics Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.446 ^a	.199	.190	27.35

Note. Predictors: (Constant), ses, imusic

The multiple correlation coefficient for Model I with the GEPA mathematics total score as the dependent measure is $R = .446$ indicating an average correlation between the

two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .199, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.199} by 100). This model indicates that both IMUSIC and SES explain 19.9% of the variance for the GEPA mathematics total score.

Table 48 indicates that both predictor variables are significant in this regression model. IMUSIC yielded a beta of .224 and a t-score of 3.195 significant at $p < .002$ favoring music students over non-music students. SES yielded a beta of -.340 and a t-score of -4.852 significant at $p < .000$ favoring students not enrolled in the free and reduced lunch program. Taken together, both predictor variables account for 19.9% of the variance in this model. The output in Table 48 indicates that SES has a greater impact on reading achievement than IMUSIC. Since the beta for SES is -.340 with a t score of -4.852 and the beta for IMUSIC is .224 with a t score of 3.195, SES has more of an effect than IMUSIC when the dependent measure is the GEPA mathematics total score. This is also true when the CAT-NCE mathematics achievement score is the dependent measure although the difference is larger in favor of SES.

Table 48

Predictor Variables In The Model I Multiple Regression For GEPA Mathematics Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	215.537	3.343		64.469	.000
	imusic	13.589	4.253	.224	3.195	.002
	ses	-26.933	5.551	-.340	-4.852	.000

Note. Dependent Variable: GEPA.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 21.239 significant at $p < .000$ (see Table 49). Since the F value is found to be significant for the multiple regression Model I on GEPA mathematics total scores it indicates that both predictor variables, IMUSIC and SES, have an effect on an eighth grade student's mathematics achievement when the GEPA mathematics total score is the dependent measure.

Table 49

Model I ANOVA For GEPA Mathematics Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31775.995	2	15887.997	21.239	.000 ^a
	Residual	127918.815	171	748.063		
	Total	159694.810	173			

Note. Predictors: (Constant), ses, imusic
Dependent Variable: GEPA.M

Based upon the results of both Model I multiple regressions hypothesis nine (H_0_9) is rejected. Even when controls are entered for socioeconomic status (SES), participation in instrumental music has an independent impact in effect on an eighth grade middle school student's mathematics achievement. This model reveals that although IMUSIC adds to the overall outcome, SES contributes more to the overall effect. Results indicate that students involved in instrumental music and/or non-enrollment in a free and reduced lunch program achieve higher mathematics scores.

Hypothesis Ten.

Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Gender is controlled.

A multiple regression is used to test the hypothesis on both the CAT-NCE mathematics achievement score and the GEPA mathematics total score. Two separate regressions are run with Model II where the CAT-NCE mathematics achievement score ($n = 170$) and the GEPA mathematics total score ($n = 174$) are the dependent measures for the specific model. The predictor variables are gender (GENDER) where $n = 178$, 67 male and 111 female, and Instrumental Music Status (IMUSIC) where $n = 178$; both predictor variables are dummy coded. GENDER is dummy coded where 0 represents male ($n = 67$) and 1 represents female students ($n = 111$). IMUSIC is dummy coded where 0 represents students not enrolled in instrumental music ($n = 85$) and 1 represents students enrolled in instrumental music ($n = 93$). Table 50 is the model summary for this regression model using the CAT-NCE mathematics achievement score as the dependent measure.

Table 50

Multiple Regression Model II Summary For CAT-NCE Mathematics Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.324 ^a	.105	.094	17.08

Note. Predictors: (Constant), gender, imusic

The multiple correlation coefficient for Model II with the CAT-NCE mathematics achievement score as the dependent measure is $R = .324$ indicating an average correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .105, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square $\{.105\}$ by 100).

This model indicates that both IMUSIC and GENDER explain 10.5% of the variance for the CAT-NCE mathematics achievement scores, a small percentage of the variance.

Table 51 indicates that both predictor variables are significant in this regression model. IMUSIC yielded a beta of .239 and a t-score of 3.262, significant at $p < .001$ favoring music students over non-music students, GENDER yielded a beta of -.221 and a t-score of -3.022, significant at $p < .003$. Taken together, both predictor variables account for 10.5 % of the variance in this model with IMUSIC and GENDER contributing approximately the same impact with betas of .239 and -.221 respectively.

Table 51

Predictor Variables In The Model II Multiple Regression For CAT-NCE Mathematics Achievement

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	65.199	2.553		25.534	.000
	imusic	8.560	2.624	.239	3.262	.001
	gender	-8.198	2.712	-.221	-3.022	.003

Note. Dependent Variable: CAT.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 9.803 significant at $p < .000$ (see Table 52). Since the F value is found to be significant for the multiple regression Model II on CAT-NCE mathematics achievement scores it indicates that both predictor variables, IMUSIC and GENDER, have an effect on an eighth grade student's mathematics achievement when the CAT-NCE mathematics achievement score is the dependent measure. The beta scores for this model indicate that

both variables, IMUSIC and GENDER, have approximately the same effect on the overall variance.

Table 52

Model II ANOVA For CAT-NCE Mathematics Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5718.757	2	2859.379	9.803	.000 ^a
	Residual	48712.896	167	291.694		
	Total	54431.653	169			

Note. Predictors: (Constant), gender, imusic
Dependent Variable: CAT.M

Table 53 is the model summary for this regression model using the GEPA mathematics total score as the dependent measure.

Table 53

Multiple Regression Model II Summary For GEPA Mathematics Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.329 ^a	.108	.098	28.86

Note. Predictors: (Constant), gender, imusic

The multiple correlation coefficient for Model II with the GEPA mathematics total score as the dependent measure is $R = .329$ indicating an average correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .108, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.108} by 100). This model indicates that both IMUSIC and GENDER explain 10.8% of the variance for the GEPA mathematics total score, a slightly higher percentage of the variance than when the CAT-NCE mathematics achievement score is the dependent measure.

Table 54 indicates that only one predictor variable is significant in this regression model. IMUSIC yielded a beta of .300 and a t-score of 4.147, significant at $p < .000$ favoring music students over non-music students. GENDER yielded a beta of $-.139$ and a t-score of -1.931 , which is found to be almost significant based on $p < .055$. Taken together, both predictor variables account for 10.8 % of the variance in this model with IMUSIC having the greater impact than GENDER.

Table 54

Predictor Variables In the Model II Multiple Regression For GEPA Mathematics Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	213.747	4.209		50.788	.000
	imusic	18.168	4.381	.300	4.147	.000
	gender	-8.706	4.509	-.139	-1.931	.055

Note. Dependent Variable: GEPA.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 10.367 significant at $p < .000$ (see Table 55). Since the F value is found to be significant for the multiple regression Model II using the GEPA mathematics total score it indicates that both predictor variables, IMUSIC and GENDER, have an effect on an eighth grade student's mathematics achievement when the GEPA mathematics total score is the dependent measure.

Because the calculated t score for GENDER fails to achieve significance in this model, it indicates that IMUSIC accounts for a majority of the impact on mathematics

achievement in this regression model, although GENDER does contribute marginally to the effect based upon its near significance, $p < .055$.

Table 55

Model II ANOVA For GEPA Mathematics Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17288.679	2	8634.339	10.387	.000 ^a
	Residual	142428.131	171	832.901		
	Total	159716.810	173			

Note. Predictors: (Constant), gender, imusic
Dependent Variable: GEPAM

Based upon the results of both Model II multiple regressions hypothesis 10 (H_{010}) is rejected. Even when controls are entered for GENDER, participation in instrumental music has an independent impact in effect on an eighth grade middle school student's mathematics achievement.

However, results indicate an inconsistency with the predictor variables amount of effect. When the dependent measure is the CAT-NCE mathematics achievement score both IMUSIC and GENDER contribute equally to the overall effect. When the dependent measure is the GEPA mathematics total score the variable contributing a majority of overall effect is IMUSIC. In both regressions, results indicate that males have an advantage over females in mathematics achievement even though in the second regression this effect is found to be small. Since IMUSIC contributes significantly in both regressions, the conclusion is that IMUSIC has the stronger effect.

Hypothesis Eleven.

Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variable of Intelligence Quotient (I.Q.) is controlled.

A multiple regression is used to test the hypothesis on both the CAT-NCE mathematics achievement score and the GEPA mathematics total score. Two separate regressions are run with Model III where the CAT-NCE mathematics achievement score ($n = 170$) and the GEPA mathematics total score ($n = 174$) are the dependent measures for the specific model. The predictor variables are intelligent quotient standard age scores (I.Q.) where $n = 134$, and Instrumental Music Status (IMUSIC) where $n = 178$. IMUSIC is dummy coded where 0 represents students not enrolled in instrumental music ($n = 85$) and 1 represents students enrolled in instrumental music ($n = 93$). Table 56 is the model summary for this regression model using the CAT-NCE mathematics achievement score as the dependent measure.

Table 56

Multiple Regression Model III Summary For CAT-NCE Mathematics Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.729 ^a	.531	.524	10.97

Note. Predictors: (Constant), IQ, imusic

The multiple correlation coefficient for Model III with the CAT-NCE mathematics achievement as the dependent measure is $R = .729$ indicating a strong correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .531, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.531} by 100). This model indicates that both IMUSIC and I.Q. explain 53.1% of the variance for the CAT-NCE mathematics achievement scores, a large percentage of the variance.

Table 57 indicates that only 1 predictor variable is significant in this regression model. I.Q. yielded a beta of .729 and a t-score of 11.264, significant at $p < .000$ favoring students with a high I.Q. IMUSIC yielded a beta of .001 and a t-score of .009 which is not found to be significant. Taken together, both predictor variables account for 53.1 % of the variance in this model with I.Q. contributing a majority if not all of the effect because the beta and t score are much larger than the same values for IMUSIC.

Again, as was noted in hypothesis five (H_{05}), the correlation between IMUSIC and I.Q. is .306 significant at $p < .01$ (refer to Table 22). Since the correlation between these two variables is significant the effect of multicollinearity between IMUSIC and I.Q. comes into question. This possible interaction could possibly have an effect on the overall impact of these two variables in this regression model.

Table 57

Predictor Variables In the Model III Multiple Regression For CAT-NCE Mathematics Achievement

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-47.755	9.898		-4.825	.000
	imusic	1.791E-02	2.083	.001	.009	.993
	IQ	1.061	.094	.729	11.264	.000

Note. Dependent Variable: CAT.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 70.267 significant at $p < .000$ (see Table 58). Since the F value is found to be significant for the multiple regression Model III on CAT-NCE mathematics achievement scores it indicates that both predictor variables, IMUSIC and I.Q., have an effect on an

eighth grade student's mathematics achievement when the CAT-NCE mathematics achievement score is the dependent variable. Because both the beta and t score for IMUSIC are extremely small and not significant respectively, it indicates that I.Q. accounts for a majority if not all of the impact on mathematics achievement in this regression model.

Table 58

Model III ANOVA For CAT-NCE Mathematics Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19908.308	2	8454.154	70.287	.000 ^a
	Residual	14919.048	124	120.315		
	Total	31827.354	126			

Note. Predictors: (Constant), IQ, imusic
Dependent Variable: CAT.M

Table 59 is the model summary for this regression model using the GEPA mathematics total scores as the dependent measure.

Table 59

Multiple Regression Model III Summary For GEPA Mathematics Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.822 ^a	.676	.671	16.13

Note. Predictors: (Constant), IQ, imusic

The multiple correlation coefficient for Model III with the GEPA mathematics total score as the dependent measure is $R = .822$ indicating another strong correlation between the two predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .676, indicating the percentage of the variance for the two predictor variables (calculated by multiplying the value of R Square {.676} by 100).

This model indicates that both IMUSIC and I.Q. explain 67.6% of the variance for the GEPA mathematics total score, a higher percentage of the variance than when the CAT-NCE mathematics achievement score is the dependent measure.

Table 60 indicates that only 1 variable is significant in this regression model. I.Q. yielded a beta of .819 and a t-score of 15.522, significant at $p < .000$ favoring students with high I.Q.'s. IMUSIC yielded a beta of .011 and a t-score of .216 which is found not to be significant. Taken together, both predictor variables account for 67.6% of the variance in this model. Although both predictor variables contribute to the overall variance in this regression model, I.Q. contributes a majority of the effect and IMUSIC has virtually no impact.

Table 60

Predictor Variables In the Model III Multiple Regression For GEPA Mathematics Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8.677	14.484		-.599	.550
	Imusic	.647	2.993	.011	.216	.829
	IQ	2.137	.138	.819	15.522	.000

Note. Dependent Variable: GEPA.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 133.539 significant at $p < .000$ (see Table 61). Since the F value is found to be significant for the multiple regression Model III using the GEPA mathematics total score it indicates that both predictor variables, IMUSIC and I.Q., have an effect on an eighth grade student's mathematics achievement when the GEPA mathematics total score is the dependent measure.

Table 61

Model III ANOVA For GEPA Mathematics Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69457.878	2	34728.939	133.539	.000 ^a
	Residual	33288.504	128	260.066		
	Total	102746.382	130			

Note. Predictors: (Constant), IQ, imusic
Dependent Variable: GEPA.M

Based upon the results of both Model III multiple regressions hypothesis eleven (H_{011}) is not rejected because the variable IMUSIC is not found to be significant in this model regression. When controls are entered for intelligent quotient (I.Q.), participation in instrumental music has no significant independent impact in effect on an eighth grade middle school student's mathematics achievement.

Results indicate that on both CAT-NCE mathematics achievement score and the GEPA mathematics total score, students with a high I.Q. achieve higher mathematics scores with very little if no impact from instrumental music status (IMUSIC). These results also imply that when using mathematics achievement scores as the dependent variable, I.Q. has more of an overall effect on the variance than it did when using reading/language arts achievement scores as the dependent measures. In both cases, I.Q. is the predictor that is the greatest contributor to the overall effect on achievement with IMUSIC contributing little or no impact to the overall effect for both of these dependent measures. However, since the correlation between IMUSIC and I.Q. is found to be significant, the possibility that multicollinearity effects the regression model cannot be ruled out.

Hypothesis Twelve.

Participation in an instrumental music program has no impact on the mathematics achievement of an eighth grade middle school student when the variables of Socioeconomic Status (SES), Gender and Intelligence Quotient are controlled.

A multiple regression is used to test the hypothesis on both the CAT-NCE mathematics achievement score and the GEPA mathematics total score. Two separate regressions are run with Model IV where the CAT-NCE reading score (n = 176) and the GEPA mathematics total score (n = 176) are the dependent measures for the specific model. The predictor variables are intelligent quotient standard age scores (I.Q.) where n = 134, socioeconomic status (SES) where n = 178, gender (GENDER) where n = 178, 67 males and 111 females, and Instrumental Music Status (IMUSIC) where n = 178. SES is dummy coded where 0 represents students not enrolled in a free and reduced lunch program (n = 146) and 1 represents students enrolled in a free and reduced lunch program (n = 32); GENDER is dummy coded where 0 represents males (n = 67) and 1 represents females (n = 111); and IMUSIC is dummy coded where 0 represents students not enrolled instrumental music (n = 85) and 1 represents students enrolled in instrumental music (n = 93). Table 62 is the model summary for this regression model using the CAT-NCE mathematics achievement score as the dependent measure.

Table 62

Multiple Regression Model IV Summary For CAT-NCE Mathematics Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.772*	.596	.583	10.26

Note. Predictors: (Constant), ses, gender, imusic, IQ

The multiple correlation coefficient for Model IV with the CAT-NCE mathematics achievement as the dependent measure is $R = .772$ indicating a strong correlation between the four predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .596, indicating the percentage of the variance for the four predictor variables (calculated by multiplying the value of R Square { .596 } by 100). This model indicates that IMUSIC, SES, GENDER and I.Q. explain 59.6% of the variance for the CAT-NCE mathematics achievement scores, a large percentage of the variance.

Table 63 indicates that 2 predictor variables are significant in this regression model. I.Q. yielded a beta of .657 and a t-score of 10.393, significant at $p < .000$ favoring students with a high I.Q. and SES yielded a beta of -.254 and a t score of -4.188, significant at $p < .000$. IMUSIC yielded a beta of -.040 and a t score of -.647 which is not found to be significant, and GENDER yielded a beta of -.090 and a t score of -1.530 which is also not found to be significant. Taken together, all predictor variables account for 59.6 % of the variance in this model with I.Q. and SES contributing a majority if not all of the effect because the beta and t score for each is much larger than the same values for IMUSIC and GENDER. A significant finding in this model is with the value of the IMUSIC variable. It is found to be not only of no significance in the

overall model, but the negative value indicates that with mathematics achievement, students who are not enrolled in instrumental music score better than students enrolled in instrumental music.

Table 63

Predictor Variables In The Model IV Multiple Regression For CAT-NCE Mathematics Achievement

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-32.430	10.149		-3.195	.002
	Imusic	-1.284	1.986	-.040	-.647	.519
	IQ	.956	.092	.657	10.393	.000
	gender	-3.000	1.961	-.090	-1.530	.129
	ses	-13.243	3.162	-.254	-4.188	.000

Note. Dependent Variable: CAT.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 45.068 significant at $p < .000$ (see Table 64). Since the F value is found to be significant for the multiple regression Model IV on CAT-NCE mathematics achievement scores it indicates that all the predictor variables, IMUSIC, SES, GENDER and I.Q. have an effect on an eighth grade student's mathematics achievement when the CAT-NCE mathematics achievement score is the dependent measure. Because the betas and t scores for IMUSIC and GENDER are extremely small and not significant respectively, it indicates that I.Q. and SES account for a majority if not all of the impact on mathematics achievement in this regression model with I.Q. contributing the largest effect.

It is important to note that the variable IMUSIC yielded not only the lowest beta, indicating it is the smallest contributor to the overall variance in this regression model, but it also favored students not enrolled in instrumental music.

Table 64

Model IV ANOVA For CAT-NCE Mathematics Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18981.533	4	4745.383	45.068	.000 ^a
	Residual	12845.821	122	105.294		
	Total	31827.354	126			

Note. Predictors: (Constant), ses, gender, imusic, IQ
Dependent Variable: CAT.M

Table 65 is the model summary for this regression model using the GEPA mathematics total score as the dependent measure.

Table 65

Multiple Regression Model IV Summary For GEPA Mathematics Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.832 ^a	.692	.682	15.86

Note. Predictors: (Constant), ses, gender, imusic, IQ

The multiple correlation coefficient for Model IV with the GEPA mathematics total score as the dependent measure is $R = .832$ indicating another strong correlation between the four predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .692, indicating the percentage of the variance for the four predictor variables (calculated by multiplying the value of R Square {.692} by 100). This model indicates that IMUSIC, SES, GENDER and I.Q. explain 69.2% of the

variance for the GEPA mathematics total score, a larger percentage of the variance than when the CAT-NCE mathematics achievement score is the dependent measure.

Table 66 indicates that two predictor variables are significant in this regression model. I.Q. yielded a beta of .784 and a t-score of 14.490, significant at $p < .000$ favoring students with high I.Q.'s. SES yielded a beta of -.132 and a t score of -2.508, significant at $p < .013$ in favor of students not enrolled in a free and reduced lunch program. IMUSIC yielded a beta of -.012 and a t score of -.224, which is found not to be significant. GENDER yielded a beta of -.023 and a t score of -.449, which is also found not to be significant. Taken together, all four predictor variables account for 69.2% of the variance in this model. I.Q. contributes a majority of the effect more than any of the other predictor variables. SES is the next predictor with the most impact on the dependent measure, favoring students not in a free and reduced lunch program. Again, in this regression it is important to note that the variable IMUSIC yielded not only the lowest beta, indicating it is the smallest contributor to the overall variance in this regression model, but it again favored students not enrolled in instrumental music. The output in Table 66 indicates that I.Q. and SES are the variables with the most impact in this model with I.Q. having the largest overall effect.

Table 66

Predictor Variables In The Model IV Multiple Regression For GEPA Mathematics Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.927	15.531		.253	.801
	imusic	-.673	2.999	-.012	-.224	.823
	IQ	2.046	.141	.764	14.490	.000
	gender	-1.317	2.935	-.023	-.449	.654
	ses	-11.857	4.787	-.132	-2.508	.013

Note. Dependent Variable: GEPA.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 70.678 significant at $p < .000$ (see Table 67). Since the F value is found to be significant for the multiple regression Model IV using the GEPA mathematics total score it indicates that all four predictor variables, IMUSIC, SES, GENDER and I.Q., have an effect on an eighth grade student's mathematics achievement when the GEPA mathematics total score is the dependent measure. Because the betas and t scores for IMUSIC and GENDER are extremely small and not significant respectively, it indicates that I.Q. and SES accounts for a majority if not all of the impact on mathematics achievement in this regression model although I.Q. contributes the most to the overall effect. It is important to note that the variable IMUSIC yielded not only the lowest beta, indicating it is the smallest contributor to the overall effect in this regression model, but it also favored students not enrolled in instrumental music.

Table 67

Model IV ANOVA For GEPA Mathematics Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	71071.011	4	17767.753	70.678	.000 ^a
	Residual	31675.371	126	251.392		
	Total	102746.382	130			

Note. Predictors: (Constant), ses, gender, imusic, IQ
Dependent Variable: GEPA.M

Based upon the results of both Model IV multiple regressions hypothesis twelve (H_{012}) is not rejected because the variable IMUSIC is not found to be significant in this regression model. When controls are entered for socioeconomic status (SES), Gender and intelligence quotient (I.Q.) participation in instrumental music has no significant independent impact in effect on an eighth grade middle school student's mathematics achievement.

Results indicate that on CAT-NCE mathematics achievement scores I.Q. and SES are determined to be the predictors with the most effect with little or no impact from the variables IMUSIC and GENDER; and on the GEPA mathematics total score students I.Q. still remains the most powerful predictor with the variable SES contributing to the overall model.

Since the purpose of this research design is to examine the effect of enrollment in an instrumental music program has on a student's academic achievement it is prudent to consider an alternative regression model to determine if IMUSIC may contribute more to the dependent measures even though when using mathematics achievement as the dependent measure it is found that IMUSIC status tends to favor students not enrolled in instrumental music.

Because I.Q. is such a powerful contributor in the Model IV regressions, and could possibly be weakening the impact of the other predictor variables on the dependent measures, another multiple regression model is employed that excludes I.Q. as a contributing variable. This Model is also employed with hypothesis six and is also being employed here to remain consistent to the overall research design and data analysis.

Two separate regressions are run with a Model V regression where the CAT-NCE mathematics achievement score ($n = 176$) and the GEPA mathematics total score ($n = 176$) are the dependent measures for the specific model. The predictor variables are Socioeconomic Status (SES), Instrumental Music Status (IMUSIC) and Gender (GENDER). The sample sizes and dummy coding remain the same for Model V as in Model IV. The intelligent quotient standard age score (I.Q.) has been removed from this regression model.

Table 68 is the model summary for this regression model using the CAT-NCE mathematics achievement score as the dependent measure.

Table 68

Multiple Regression Model V Summary For CAT-NCE Mathematics Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.509 ^a	.259	.246	15.58

Note. Predictors: (Constant), gender, imusic, ses

The multiple correlation coefficient for Model V with the CAT-NCE mathematics achievement as the dependent measure is $R = .509$ indicating an above average correlation between the three predictor variables and the dependent measure. The multiple coefficient of determination, R Square, is .259, indicating the percentage of the variance for the three predictor variables (calculated by multiplying the value of R Square

{.259} by 100). This model indicates that IMUSIC, SES, and GENDER explain 25.9% of the variance for the CAT-NCE mathematics achievement scores, a noticeable percentage of the variance.

Table 69 indicates that all three predictor variables are significant in this regression model. IMUSIC yielded a beta of .153 and a t score of 2.235 significant at $p < .027$, SES yielded a beta of -.403 and a t score of -5.879 significant at $p < .000$, and GENDER yielded a beta of -.193 and a t score of -2.886 significant at $p < .004$. Taken together, all predictor variables account for 25.9 % of the variance in this model. This regression indicates that SES has more of an effect than IMUSIC and GENDER but that all contribute to the overall variance.

Table 69

Predictor Variables In The Model V Multiple Regression For CAT-NCE Mathematics Achievement

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	69.515	2.443		28.456	.000
	Imusic	5.478	2.452	.153	2.235	.027
	ses	-18.913	3.217	-.403	-5.879	.000
	gender	-7.161	2.481	-.193	-2.886	.004

Note. Dependent Variable: CAT.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 19.369 significant at $p < .000$ (see Table 70). Since the F value is found to be significant for the multiple regression Model V on CAT-NCE mathematics achievement scores it indicates that all the predictor variables, IMUSIC, SES, and GENDER, have an

effect on an eighth grade student's mathematics achievement when the CAT-NCE mathematics achievement score is the dependent measure. SES accounts for a majority of the effect on mathematics achievement in this regression model with GENDER having the second most effect and favoring males. But unlike the Model IV regression model on mathematics achievement, IMUSIC not only imparts some effect on the overall variance but it favors students enrolled in instrumental music.

Table 70

Model V ANOVA For CAT-NCE Mathematics Achievement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14113.006	3	4704.335	19.369	.000 ^a
	Residual	40318.647	166	242.883		
	Total	54431.653	169			

Note. Predictors: (Constant), gender, imusic, ses
Dependent Variable: CAT.M

Table 71 is the model summary for this regression model using the GEPA mathematics total score as the dependent measure.

Table 71

Multiple Regression Model V Summary For GEPA Mathematics Total Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.462 ^a	.213	.200	27.18

Note. Predictors: (Constant), gender, imusic, ses

The multiple correlation coefficient for Model V with the GEPA mathematics total score as the dependent measure is $R = .462$ indicating an above average correlation between the three predictor variables and the dependent measure. The multiple

coefficient of determination, R Square, is .213, indicating the percentage of the variance for the three predictor variables (calculated by multiplying the value of R Square {.213} by 100). This model indicates that IMUSIC, SES, and GENDER explain 21.3% of the variance for the GEPA mathematics total score, a smaller percentage of the variance than when the CAT-NCE mathematics achievement score is the dependent measure.

Table 72 indicates that only two predictor variables are significant in this regression model. IMUSIC yielded a beta of .227 and a t score of 3.258, significant at $p < .001$ favoring music students over non-music students. SES yielded a beta of -.333 and a t score of -4.770, significant at $p < .000$ in favor of students not enrolled in a free and reduced lunch program. GENDER yielded a beta of -.120 and a t score of -1.767, which is found not to be significant in this model. Taken together, all three predictor variables account for 21.3% of the variance in this model. SES is determined to be a higher predictor variable than IMUSIC with GENDER contributing very little if anything to the overall effect. The output in Table 72 indicates that SES and IMUSIC have more of an equal impact on the dependent variable GEPA mathematics total score than they do for the CAT-NCE mathematics achievement score where SES has three times the impact than IMUSIC.

Table 72

Predictor Variables In The Model V Multiple Regression For GEPA Mathematics Total Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	220.005	4.175		52.690	.000
	imusic	13.773	4.228	.227	3.258	.001
	ses	-26.362	5.526	-.333	-4.770	.000
	gender	-7.519	4.255	-.120	-1.767	.079

Note. Dependent Variable: GEPA.M

In order to determine the significance of this model an ANOVA yielded an F ratio of 15.376 significant at $p < .000$ (see Table 73). Since the F value is found to be significant for the multiple regression Model V using the GEPA mathematics total score it indicates that all three predictor variables, IMUSIC, SES, GENDER, have an effect on an eighth grade student's mathematics achievement when the GEPA mathematics total score is the dependent measure. However, this regression implies that both IMUSIC and SES impact the variance more with little or no effect being contributed by GENDER.

Based upon the results of both Model V multiple regressions even when controls are entered for socioeconomic status (SES) and GENDER, participation in instrumental music has an independent impact in effect on an eighth grade middle school student's mathematics achievement.

Table 73

Model V ANOVA For GEPA Mathematics Total Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34083.498	3	11361.166	15.376	.000 ^a
	Residual	125611.312	170	738.890		
	Total	159694.810	173			

Note. Predictors: (Constant), gender, imusic, ses
Dependent Variable: GEPA.M

The results from the Model V multiple regression model indicate that IMUSIC and SES have an effect on an eighth grade student's mathematics achievement when the variable I.Q. is excluded from the model. GENDER contributes to the overall effect when the CAT-NCE mathematics achievement score is the dependent measure but not when the GEPA mathematics total score is the dependent measure. Between 21% and 26% of the effect on mathematics achievement can be contributed mostly to IMUSIC and SES when I.Q. is exclude from the regression model.

Summary

To close this chapter, a brief summary concerning the status for each hypothesis is listed. Conclusions and recommendations based upon the results of the data analysis from this chapter and the rejection or acceptance of each hypothesis will be discussed in Chapter Five. The data analysis as outlined in this chapter brought about the following results concerning the status for each hypothesis tested.

Hypothesis One (H_{01}) is rejected. There is a significant difference in reading achievement between eighth grade instrumental music students and eighth grade non-instrumental music students as measured on both the CAT-NCE reading achievement scores and the GEPA language arts total scores.

Hypothesis Two (H_{0_2}) is rejected. The number of years of instrumental music study has a significant impact on an eighth grade student's reading achievement as measured on both the CAT-NCE reading achievement score and the GEPA language arts total score.

Hypothesis Three (H_{0_3}) is rejected. Participation in an instrumental music program has an impact on the reading achievement of an eighth grade middle school student when the variable of Socioeconomic Status is controlled as measured on both the CAT-NCE reading achievement score and the GEPA language arts total score.

Hypothesis Four (H_{0_4}) is rejected. Participation in an instrumental music program has an impact on the reading achievement of an eighth grade middle school student when the variable of Gender is controlled as measured on both the CAT-NCE reading achievement score and the GEPA language arts total score.

Hypothesis Five (H_{0_5}) is not rejected when the CAT-NCE reading achievement total score is used as the measurement tool. Participation in an instrumental music program has no significant impact on the reading achievement of an eighth grade middle school student when the variable of I.Q. is controlled as measured on the CAT-NCE reading achievement score.

Hypothesis Five (H_{0_5}) is rejected when the GEPA language arts total score is used as the measurement tool. Participation in an instrumental music program has an impact on the reading achievement of an eighth grade middle school student when the variable of I.Q. is controlled as measured on the GEPA language arts total score.

Hypothesis Six (H_{0_6}) is not rejected when the CAT-NCE reading achievement score is the measurement tool. Participation in an instrumental music program has no

significant impact on the reading achievement of an eighth grade middle school student when the variables of Socioeconomic Status, Gender and I.Q. are controlled as measured on the CAT-NCE reading achievement score.

Hypothesis Six ($H0_6$) is rejected when the GEPA language arts total score is the measurement tool. Participation in an instrumental music program has an impact on the reading achievement of an eighth grade middle school student when the variables of Socioeconomic Status, Gender and I.Q. are controlled as measured on the GEPA language arts total score.

Hypothesis Seven ($H0_7$) is rejected. There is a significant difference in mathematics achievement between eighth grade instrumental music students and eighth grade non-instrumental music students as measured on both the CAT-NCE mathematics achievement scores and the GEPA mathematics total scores.

Hypothesis Eight ($H0_8$) is rejected. The number of years of instrumental music study has a significant impact on an eighth grade student's mathematics achievement as measured on both the CAT-NCE mathematics achievement score and the GEPA mathematics total score.

Hypothesis Nine ($H0_9$) is rejected. Participation in an instrumental music program has an impact on the mathematics achievement of an eighth grade middle school student when the when the variable of Socioeconomic Status is controlled as measured on both the CAT-NCE mathematics achievement score and the GEPA mathematics total score.

Hypothesis Ten ($H0_{10}$) is rejected. Participation in an instrumental music program has an impact on the mathematics achievement of an eighth grade middle school

student when the variable of Gender is controlled as measured on both the CAT-NCE mathematics achievement score and the GEPA mathematics total score.

Hypothesis Eleven (H_{011}) is not rejected. Participation in an instrumental music program has no significant impact on the mathematics achievement of an eighth grade middle school student when the variable of I.Q. is controlled as measured on both the CAT-NCE mathematics achievement score and the GEPA mathematics total score.

Hypothesis Twelve (H_{012}) is not rejected. Participation in an instrumental music program has no significant impact on the mathematics achievement of an eighth grade middle school student when the variable of Socioeconomic Status, Gender and I.Q. are controlled as measured on both the CAT-NCE mathematics achievement score and the GEPA mathematics total score.

Eight of the hypotheses formulated for this study are rejected based upon the results of the data analysis carried out for each hypothesis, H_{01} , H_{02} , H_{03} , H_{04} , H_{07} , H_{08} , H_{09} , H_{010} . Two of the hypotheses, H_{05} and H_{06} , demonstrate mixed results based upon the measurement tool being used. Hypothesis eleven (H_{011}) and Hypothesis twelve (H_{012}) are not rejected for both measurement assessments.

The impact of each specific hypothesis conclusion on the initial research problem (Does formal instrumental music instruction, and the number of years of instruction, have an impact on an eighth grade middle school student's academic achievement?) is wide-ranging and will be discussed in the following chapter, Chapter 5.

CHAPTER V

Discussion, Conclusions and Recommendations

The purpose of this study is to explore the existence and nature of the relationship between instrumental music instruction and academic achievement. The problem statement is: Does formal instrumental music instruction, and the number of years of instruction, have an impact on an eighth grade middle school student's academic achievement? Based upon previous research, the variables of gender, I. Q. and socioeconomic status have been controlled for in this research design to precisely measure their impact on academic achievement and instrumental music's residual effect. The researcher's intent for doing this is to be able to draw a more precise conclusion to the problem and support the possible existence of a causal relationship between academic excellence and instrumental music instruction.

The research design looks at the post facto academic and demographic data of 178 students enrolled in the eighth grade during the 1998 – 1999 academic year. The sample is from two middle schools located in a suburban middle class community with a New Jersey district factor group rating of D, E. Data obtained from the California Achievement Test Normal Curve Equivalent Scores, the Grade Eight Proficiency Assessment Total Scores and the Cognitive Abilities Test Standard Age Scores are compared and analyzed with the statistical package SPSS 8.0 for 93 grade eight instrumental music students and 85 grade eight non-instrumental music students for achievement differences in reading and/or language arts and mathematics. The statistical data outlined in the previous chapter indicates a mixed response to the hypotheses generated from the original research problem, Does formal instrumental music

instruction, and the number of years of instruction, have an impact on an eighth grade middle school student's academic achievement?

This chapter is divided into three parts. Part 1 is a discussion of the statistical data analysis outlined in Chapter 4 as it relates and/or compares to previous research cited in Chapter 2. Part 2 is a list of conclusions based upon the analysis of the statistical data. Part 3 is the recommendations for future research based upon what is and is not inferred by the analysis of the data. In the interest of brevity, from this point on in the chapter instrumental music students will be referred to as music students and non-instrumental music students will be referred to as non-music students.

Discussion

Hypotheses number one and seven compared mean differences in achievement between music and non-music students in reading and/or language arts and mathematics, respectively. Results from the independent sample t-tests indicate a significant difference between music students and non-music students in reading and/or language arts and mathematics achievement favoring music students. The differences revealed through the data analysis are that a music student achieves higher scores in both of these academic areas.

On the CAT-NCE scores, the larger mean difference occurs in reading (10.44 points higher than non-music students) as opposed to mathematics (8.49 points higher than non-music students). On the GEPA scores, the larger mean difference occurs in mathematics (18.08 points higher than non-music students) as opposed to reading and/or language arts (15.04 points higher than non-music students).

The differences in scoring between the CAT and the GEPA could be attributable to the fact that on the CAT, only reading scores are analyzed whereas on the GEPA, language arts scores are comprised of a series of sub-batteries with reading being just one of the sub-batteries. Important to note is that significant differences occur between music and non-music students with music students achieving higher scores overall in all subject areas analyzed.

These findings partially support Corral (1998) and Friedman (1959) who found significant differences between music and non-music students in reading and language arts but not in mathematics. Trent (1996), who found differences in a high school student's achievement in mathematics and language arts in favor of students enrolled in instrumental music, and Hill (1987), who proposed a positive correlation between music students and superior academic achievement in reading, language arts and mathematics is also supported by the data analyzed for hypotheses numbers one and seven.

Eighth grade music students do achieve higher scores in reading and/or language arts and mathematics than do eighth grade non-music students when both the CAT and GEPA assessments are used as measurement tools. This finding supports a positive relationship between participation in music education and superior academic achievement.

Hypotheses two and eight look at the longitudinal effect of instrumental music involvement on reading and/or language arts and mathematics achievement based upon the number of years a student is enrolled in instrumental music. Because this study involves middle school students only, the period of time each individual student has been enrolled in instrumental music cannot be accounted for entirely. Since the district being

studied begins the instrumental music program in third grade it is quite possible that the music students involved could have been enrolled for a longer period than the three years maximum allowed for in this design.

Non-music students assigned a value of "0" for instrumental music experience could quite possibly have been enrolled in either 3rd, 4th or 5th grade instrumental music programs. The design of this study did not allow for this possibility because of the nature of data retrieval and the focus on the middle school level specifically. As a result, this condition warrants a limitation not originally foreseen by the researcher.

The data analysis revealed a significant difference in academic achievement between music students and non-music students based on the number of years a student is enrolled in instrumental music. According to the post-hoc tests performed on the ANOVAS for both hypotheses, two and eight, students with three years of instrumental music experience scored significantly higher on the CAT and GEPA reading and/or language arts and mathematics batteries than students with zero years of experience.

Because of the extremely small sample sizes of students with one year of music experience ($n = 6$) and music students with two years of experience ($n = 9$), the results of the Tukey's post-hoc tests comparing mean differences with these groups are tenuous at best. Because of the small sample sizes of each of these groups, calculation of the mean differences is limited. Comparison of these mean differences to the larger groups (music students with three years of experience, $n = 78$; and non-music students with zero years of experience, $n = 83$) is unreliable (Hinkle, Wiersma, & Jurs, 1998). However, the results for these two groups still demonstrate an overall tendency consistent to the mean comparisons of the two larger groups.

Music students with two years of experience exhibit a higher mean difference than non-music students (zero years of experience) on the CAT and GEPA reading and/or language arts and mathematics batteries. For reading and/or language arts, music students with two years of experience score 11.02 points higher than non-music students on the CAT and 12.86 points higher on the GEPA. In mathematics, these same students score 8.99 points higher on the CAT and 19.32 points higher on the GEPA.

Music students with one year of experience demonstrate the smallest mean difference in scores except on the GEPA language arts total scores (12.46 points higher than non-music students). On this measurement, music students with one year of experience score nearly as well as students with two or three years of experience, which could be due to the difference in testing criteria. On all other measurements students with one year of experience score only marginally better than students with zero years of experience.

Since the majority of music students from this data pool have three years of experience ($n = 78$), and findings suggest significant differences for students with two years of experience even though the sample size is small, the conclusion is that there is a relationship between the number of years a student is enrolled in an instrumental music program and their academic success.

These results are in agreement with Cheek and Smith's (1998) findings that proved enrollment in instrumental music for two or more years has a positive impact on a student's mathematics achievement. Robitaille and O'Neal (1981) who found that students with two or more years of instrumental music experience score higher on the

CTBS than students with one year of experience or no years of experience is also supported.

The data analysis for hypotheses two and eight has the largest implication on Zanutto's (1997) study that looked at the long term relationship of instrumental music on academic achievement (five years) as measured by the student's grade point averages in mathematics, English, science and social studies. Zanutto concluded that enrollment in instrumental music did have a significant impact on a student's achievement and because the data revealed consistently higher GPA's over a period of time for music students, he concluded that instrumental music had a causal relationship on academic achievement. The findings in the present study support Zanutto's conclusions based on the overall mean difference in reading and/or language arts and mathematics achievement scores of students with two or three years of music experience compared to students with only one or no years of instrumental music instruction. The number of years a student is enrolled in instrumental music does have an overall effect on that student's academic achievement, implying that a causal relationship between instrumental music instruction and positive academic achievement might exist.

Hypotheses numbers one and seven, and two and eight take a more standardized statistical treatment of the data incorporating the use of an independent samples t-test and an ANOVA, respectively. This treatment of the data confirms other studies in that it supports the existence of a relationship between enrollment in an instrumental music program and higher student academic achievement (Friedman, 1959; Robitaille & O'Neal, 1981; Hill, 1987; Dreyden, 1992; Trent, 1996; Zanutto, 1997; Cheek & Smith, 1998; Coral, 1998).

Anello (1972) found that when running a simple ANOVA and comparing academic achievement between music and non-music students the results were significant in favor of music students. When he employed the use of an Analysis of Covariance, (ANCOVA) controlling for I.Q. by assigning it as the covariate, the results were not significant, music students did not achieve higher academic scores than non-music students. Since Anello's use of a different statistical design contradicts the previously cited authors, this research design explores this contradiction by employing a different statistical treatment of the data in an attempt to quantify instrumental music's contribution to academic achievement. In order to do this the statistical procedure of a multiple regression is employed for hypotheses three through six and nine through twelve.

The purpose of this study is to build upon the previous research findings and through the process of statistically treating the data differently support the findings and beliefs of Leng & Shaw (1991), Rauscher (1995) and Miller & Coen (1994) who all believe that instrumental music might possibly play a role in a student's cognitive development.

Nelson and Zaichkowsky (1979) propose the use of multiple regression instead of ANOVA in the statistical treatment of educational research because it is able to provide strength of relationship between the independent and dependent variables and it is capable of handling data that an ANOVA has traditionally found difficult to handle, namely, categorical and continuous data. Since the data collected in this research design is a mixture of categorical (i.e., gender, socioeconomic status, music status) and continuous (i.e., I.Q., reading and mathematics achievement scores) the use of multiple

regression is more advantageous. Because previous research has been tenuous at best in defining the strength of relationship between music status and academic achievement the employment of a multiple regression attempts to confirm and quantify this relationship.

Hypotheses three, four, five, nine, ten and eleven attempt to look at the impact of a student's participation in an instrumental music instruction program on reading and/or language arts and mathematics achievement by controlling for SES, GENDER and I.Q. through the use of a series of multiple regression models. When paired with these variables in a multiple regression design (model) the amount of impact instrumental music has on achievement can be quantified.

When instrumental music status (IMUSIC) and socioeconomic status (SES) are combined in a regression analysis the combined effect of both of these variables explains 22.3% of the variance for the CAT-NCE reading scores and 25.5% of the variance for the GEPA language arts scores, both found to be significant. When the CAT score is the dependent measure SES has more of an impact but for the GEPA score both variables contribute equally.

The combined effect of IMUSIC and SES on a student's mathematics achievement explains 22.2% of the variance for the CAT-NCE mathematics scores and 19.9% of the variance for the GEPA mathematics scores. SES has the strongest effect on both dependent measures but IMUSIC is still found to have a significant impact. When both these predictor variables are combined they have a significant effect on an eighth grade students reading and or language arts achievement and mathematics achievement.

In both reading and mathematics, SES demonstrates the strongest impact on achievement overall favoring students that come from a higher economic stratum and

supporting the research of Kennett & Grant (1975), Shakiba-Nejad & Yeldin (1981), Kruse (1996) and Caldas & Bankstrom (1997). It is important to note that the data pool contained 32 students enrolled in a free and reduced lunch program and 146 students not enrolled. Of the 32 students enrolled in the free and reduced lunch program, only 10 were music students

Even when controls are entered for SES, the regression indicates that participation in an instrumental music program has an independent impact in effect on an eighth grade student's reading and mathematics achievement.

When instrumental music status (IMUSIC) and gender (GENDER) are combined in a regression analysis the combined effect of both of these variables explains 10.7% of the variance for the CAT-NCE reading scores and 15.8% of the variance for the GEPA language arts scores, both found to be significant. For both cases, GENDER is not found to contribute significantly to the overall effect. What little effect it does have favors females and supports the research of Han and Hoover (1994), Becker and Forsyth (1990) and Cole (1997). However, on both dependent measures, IMUSIC has the largest effect.

The combined effect of IMUSIC and GENDER on a student's mathematics achievement explains 10.5% of the variance for the CAT-NCE mathematics scores and 10.8% of the variance for the GEPA mathematics scores. IMUSIC has the strongest effect on both dependent measures but GENDER does seem to contribute more to the overall effect for mathematics than it did for reading although the results are mixed. On the CAT math scores GENDER is found to contribute significantly favoring males. On the GEPA math scores GENDER is not found to be significant but it does contribute more than it did for the GEPA reading, favoring males. These findings support Cole

(1997), who proposed that males score higher on mathematics assessments than do females.

In both reading and mathematics, IMUSIC demonstrates the strongest impact on achievement favoring instrumental music students. Although this regression is found to be significant it is important to note that the total overall effect of the predictors explains roughly 10% of the variance for mathematics and between 10 to 15 % of the variance for reading. Nevertheless, when controls are entered for GENDER, the regression indicates that participation in an instrumental music program has an independent impact in effect on an eighth grade student's reading and mathematics achievement.

When instrumental music status (IMUSIC) and intelligence quotient (I.Q.) are combined in a regression analysis the combined effect of both of these variables explains 44.2% of the variance for the CAT-NCE reading scores and 33.9% of the variance for the GEPA language arts scores, both found to be significant. In both cases, I.Q. is found to contribute the greatest impact to the overall regression with IMUSIC only contributing significantly to the GEPA scores.

The combined effect of IMUSIC and I.Q. on a student's mathematics achievement explains 53.1% of the variance for the CAT-NCE mathematics scores and 67.6% of the variance for the GEPA mathematics scores. I.Q. has the strongest effect on both dependent measures with IMUSIC not contributing significantly to either score.

For both reading and mathematics the overall effect on both dependent measures from the regression model is quite high, between 34 to 68%. Because I.Q. contributes the greatest effect overall, the conclusion is that I.Q. has the greatest impact on both reading

and mathematics achievement supporting Haertel and Walberg (1980), Fisher (1995) and Lassiter and Bardos (1995).

Because other studies have linked I.Q. with music, specifically Phillips (1976) and Webb (1984), and that this relationship could have an effect on the regressions coefficient of determination $\{r^2\}$ (Hinkle, Wiersma, & Jurs, 1998), the researcher determined the Pearson product-moment correlation coefficient for IMUSIC and I.Q. to be .306, significant at $p < .01$. Since this correlation is found to be significant it could have an effect on this regression model and other regression models that test the effects of I.Q. with IMUSIC on a dependent measure.

Nonetheless, in the regression model for both reading and mathematics, I.Q. demonstrates the strongest contribution to the overall variance, favoring students with above average I.Q.s. When controls are entered for I.Q., the regressions indicate that participation in an instrumental music program has no independent impact in effect on an eighth grade student's reading and mathematics achievement unless the GEPA language arts scores are used solely as the dependent measure. In part, this finding agrees with Anello's (1972) findings that proposed when the variable for I.Q. is controlled for in the design, there is no real difference in achievement between an instrumental music student and a non-instrumental music student.

When instrumental music status (IMUSIC), socioeconomic status (SES), gender (GENDER) and intelligence quotient (I.Q.) are combined in a regression analysis the combined effect of all of these variables explains 45.9% of the variance for the CAT-NCE reading scores and 41.8% of the variance for the GEPA language arts scores, both found to be significant. With the CAT scores, I.Q. is found to have the most significant

impact and with the GEPA scores, although all the variables contribute to the overall impact, I.Q. had the largest impact and IMUSIC the least.

The combined effect of IMUSIC, SES, GENDER and I.Q. on a student's mathematics achievement explains 58.3% of the variance in the CAT-NCE mathematics scores and 69.2% of the variance in the GEPA mathematics scores. I.Q. has the strongest impact on both dependent measures although SES is found to be a significant contributor also. Both IMUSIC and GENDER are not found to be significant contributors.

When controls are entered for SES, GENDER and I.Q., the regressions indicate that participation in an instrumental music program has no independent impact on an eighth grade student's reading and mathematics achievement except on the GEPA language arts scores. These findings are similar to the IMUSIC – I.Q. regression model. Again, important to note is the correlation between IMUSIC and I.Q. which could possibly be affecting the overall impact of instrumental music participation.

Because the statistical tests for hypotheses five, six, eleven and twelve overwhelmingly found that I.Q. had an extremely strong impact on the dependent measures, and because the correlation between I.Q. and IMUSIC is found to be significant, the researcher employed a fifth multiple regression model excluding I.Q. from the design.

When instrumental music status (IMUSIC), socioeconomic status (SES) and gender (GENDER) are combined in a regression analysis the combined effect of all of these variables explains 22.3% of the variance in the CAT-NCE reading scores and 25.2% of the variance in the GEPA language arts scores, both found to be significant. With the CAT scores, SES and IMUSIC are found to be the strongest predictors with

GENDER having no real impact. SES is again found to have a slightly stronger impact than IMUSIC. With the GEPA scores, SES and IMUSIC are found to have a similar impact with GENDER having the least impact.

The combined effect of IMUSIC, SES and GENDER on a student's mathematics achievement explains 25.9% of the variance for the CAT-NCE mathematics scores and 21.3% of the variance for the GEPA mathematics scores. SES has the strongest effect on both dependent measures with IMUSIC contributing a significant impact on both dependent measures and GENDER only having a significant effect on CAT math scores in favor of males.

When controls are entered for SES and GENDER, the regressions indicate that participation in an instrumental music program has an independent impact on an eighth grade student's reading and mathematics achievement. The exclusion of I.Q. from this model indicates that when included in a regression model, its overall effect diminishes the impact of the other variables in that model.

It is important to note, however, that when I.Q. is combined with SES, IMUSIC and GENDER, the combined variables explain 41 to 69% of the variance in math and reading achievement scores. Whereas when I.Q. is excluded from the combination of variables SES, IMUSIC and GENDER, only between 21 to 26% of the variance in math and reading achievement scores are explained, still significantly notable, but not as large an impact on the variance as when I.Q. is added.

Obviously, I.Q. has a significant impact upon reading and mathematics achievement that cannot be refuted in this research project or in past studies carried out by the likes of Haertel & Walberg (1980), Fisher (1995) and Lassiter & Bardos (1995),

and in no way is it this researcher's desire to do so here. However, the significant correlation between instrumental music participation and I.Q., along with a series of regression analysis that quantify instrumental music participation's impact on academic achievement, provides more than enough substantive information to answer the research problem posed in Chapter 1.

Conclusions

Does formal instrumental music instruction, and the number of years of instruction, have an impact on an eighth grade middle school student's academic achievement?

Based on the evidence in this research study the simple answer is yes. Statistical tests that look at the relationship between music and non-music students (independent t-tests and ANOVAS) all conclude that music students achieve higher scores on standardized mathematics and reading assessments than do non-music students. The results from this study are congruent with the results of Friedman (1959), Hill (1987), Dreyden (1992), Goeghegan & Mitchlemore (1996), Holmes (1997), and Corral (1998).

Robitaille & O'Neal (1981), Zanutto (1997) and Cheek & Smith (1998) all looked at instrumental music's impact over a period of time and concluded that students involved in instrumental music for two or more years achieve better academically than students enrolled for fewer years or not enrolled altogether. The findings in this research project support those conclusions, although, a true sense of "years of experience" can not be ascertained due to the possible impact from the discrepancies in sample size. However, this study found conclusively that students enrolled in instrumental music for

three years scored significantly higher on the standardized mathematics and reading achievement assessments than those students who were never enrolled.

In order to determine a quantitative value for participation in an instrumental music program on academic achievement, and a true sense of impact, a series of multiple regression analyses were employed. The rationale for employing this statistical procedure was borne from the findings of Anello (1972), who concluded that when controlling for I.Q. there is no impact on academic achievement between instrumental music students and non-instrumental music students. The results were mixed, reminiscent of Trent's 1996 study that reported different findings dependent upon the standardized assessment tool being employed. Overall, participation in an instrumental music program can account for an independent impact of between 10% to 16% of the variance in an eighth grade middle school student's reading and mathematics achievement. Findings and conclusions for each of the sub-problems will clarify this conclusion.

Does formal instrumental music instruction, when controlling for socioeconomic status, have an impact on an eighth grade middle school student's academic achievement?

Yes. Participation in an instrumental music program has an independent impact on an eighth grade middle school student's academic achievement even when controls are entered for socioeconomic status. Although SES was determined to have the largest impact, instrumental music participation still had a strong effect and together these variables explained between 20% to 26% of the variance in reading and mathematics achievement scores.

Does formal instrumental music instruction, when controlling for gender, have an impact on an eighth grade middle school student's academic achievement?

Yes. Participation in an instrumental music program has an independent impact on an eighth grade middle school student's academic achievement even when controls are entered for gender. In fact, gender is found to contribute very little if anything to the overall effect. However, together these variables explained between 10% to 16% of the variance in reading and mathematics achievement scores with instrumental music participation contributing a majority if not all of the overall impact.

Does formal instrumental music instruction, when controlling for I.Q., have an impact on an eighth grade middle school student's academic achievement?

Yes. Participation in an instrumental music program has an independent impact on an eighth grade middle school student's academic achievement when controls are entered for intelligence quotient (I.Q.). Although I.Q. is determined to have the largest impact overall on all dependent measures, instrumental music participation contributed a significant effect on the GEPA language arts total scores. Instrumental music participation and I.Q. explain 33.9% of the variance when the GEPA language arts total scores are the dependent measure. Overall, these variables explained between 34% to 68% of the variance in reading and mathematics achievement scores with I.Q. contributing a majority of the impact with little or no effect from instrumental music participation status except on the GEPA language arts total scores, partially supporting Anello (1972).

Because of these results, the researcher determined that a significant correlation exists between I.Q. and instrumental music participation status supporting the previous

studies of Phillips (1976) and Webb (1984). This correlation quite possibly influences the regression model by negating instrumental music participation status' influence on the overall effect of the design.

Does formal instrumental music instruction, when controlling for gender, socioeconomic status, and I.Q. as multiple variables, have an impact on an eighth grade middle school student's academic achievement?

Yes. Participation in an instrumental music program has an independent impact on an eighth grade middle school student's academic achievement when controls are entered for socioeconomic status (SES), gender and intelligence quotient (I.Q.). Although I.Q. is determined to have the largest impact of all the variables, instrumental music participation contributes a significant effect when the GEPA language arts total scores are the dependent measure. Combined with the other variables, SES, gender and I.Q., participation in instrumental music explained 41.8 % of the variance on the GEPA language arts total scores. Overall, these variables accounted for an effect of between 41% to 69% on reading and mathematics achievement scores with I.Q. contributing a majority of the impact with little or no effect from instrumental music participation status except on the GEPA language arts total scores.

When I.Q. is excluded from the design, it is found that both the variables for instrumental music participation and socioeconomic status explained between 21% to 26% of the variance in reading and mathematics achievement scores.

Although this research project found that I.Q. is the variable with the strongest impact upon an eighth grade student's academic achievement, quantitative results supplied by the statistical designs employed in this research project support a primary

conclusion that socioeconomic status and participation in an instrumental music program have an overall positive effect on a student's reading and mathematics achievement.

Findings from this data analysis also support a secondary conclusion that participation in an instrumental music program has its largest impact on a student's reading and/or language arts achievement supporting the conclusions of Pelletier (1963), Dreyden (1992) and Hill (1987).

Since all four problem statements can be answered in the affirmative, and because eight of the 12 null hypotheses were rejected and two demonstrated mixed results, a preponderance of the evidence supports the conclusion that participation in an instrumental music program has a significant impact on a student achieving better academically than a student who does not participate in an instrumental music program regardless of Intelligence Quotient, Gender and/or Socioeconomic Status.

The true independent effect and impact participation in instrumental music has upon a student's academic achievement may be overshadowed by the significant overall role of I.Q. The simple correlation between I.Q. and students enrolled in instrumental music discovered by Phillips (1976) and Webb (1984) and now supported by this research project conclusively ascertain that students who participate in a formal instrumental music program are more likely to have an above average I.Q. than students who do not participate in a formal instrumental music program. Since most standardized assessment tools that test a student's reading and mathematics achievement tend to give an advantage to students with an above average I. Q. (Haertel & Walberg, 1980) it stands to reason that instrumental music students will score higher than non-instrumental music students.

Since the purpose of this study is to build upon the previous research findings of Leng & Shaw (1991), Rauscher (1995) and Miller & Coen (1994) who all believed that instrumental music might possibly play a role in a student's cognitive development, a causal inference between instrumental music participation and academic achievement can be proposed.

Although this study goes one step further to quantify the results of participation in an instrumental music program on higher academic achievement and does so successfully, the relationship between I.Q. and instrumental music participation cannot be ignored and needs to be explored more fully. Participation in an instrumental music program does have a positive effect on a student's academic achievement and it is this researchers contention, based upon the results reported from this project and past research findings, that instrumental music participation might very well play a role in improving a student's intelligence quotient.

Recommendations

- 1) Webb (1984) looked at the relationship between musical aptitude and intelligence and concluded that a correlation exists between the two. Children, who are intelligent, tend to be musically inclined. Certainly, the research of Phillips (1976) and Frances Rauscher's work with pre-school children (Viadero, 1998) suggest that further study be done on the relationship between intelligence and instrumental music study.

Based upon the analysis of the data in this research design conclusions suggest that this relationship may be one where a student's intelligence quotient might be enhanced by participation in an instrumental music program. To further clarify this

relationship it is recommended that studies to explore the impact of instrumental music on intelligence quotient be performed. Since students are generally tested for I.Q. three times in their academic career, once in the primary grades, once in the middle school years and once in the high school years, a longitudinal research design should be developed that compares standardized assessments and grade point averages between instrumental music students and non-instrumental music students to see what differences, if any, exist.

It is Weinberger's (1998) belief that learning and performing music assists in exercising the brain, exercising it in ways that increase brain capacity and function. This research project, along with the previously cited examples, gives credibility to this opinion.

- 2) It is recommended that further studies be done, experimental in nature, that utilize a control group that receives no instrumental music instruction and an experimental group that receives instrumental music instruction, where pre and post test scores in mathematics and reading can be compared, preferably done with children from the primary grades. The experimental studies of Rauscher and others (1994) and Gordon (1979) give credibility to this type of a design for exploring instrumental music's impact on academic achievement.

Both studies incorporated control groups that received no treatment and found that these groups did not perform up to the level of the experimental groups. A design that incorporates this methodology into the exploration of instrumental music participation and academic achievement may reveal more conclusive data on the nature of this relationship.

- 3) Dorothy Straub (1994) believes that by participating in an instrumental music program "students gain a sense of discipline, self-esteem, and pride of accomplishment" (p.3). Trent (1996) concluded that it is the instrumental music student's inner desire to strive for excellence in everything that they do that might account for their higher academic achievement.

It is recommended that quantitative studies, similar to this one, be designed to investigate what different attributes contribute to or motivate a student to enroll in a formal instrumental music program. The areas of self-concept, self-discipline and self-esteem are examples of some of the areas for consideration.

- 4) Zanutto's (1997) longitudinal study of instrumental music instruction and Grade Point Average (GPA), through the use of mean comparison testing (t-tests and ANOVAS), suggests that a similar investigation be done incorporating the design analysis from this research project (multiple regression models).

A research project that uses GPA as the dependent measure for all the major academic areas, Science, Mathematics, English, Foreign Language and Social Studies and instrumental music participation status and instrumental music participation experience as the predictor variables would provide more conclusive evidence on the instrumental music/academic achievement relationship.

- 5) Based on the findings of Hill (1987) and Dreyden (1992) whom both controlled for ethnicity and parental educational background in their research designs a replication of this study using both ethnicity and parental educational background as predictor variables is recommended.

Further Recommendations and Considerations

First, this research project implores that all board of education members, school administrators, teachers, and parent community groups take into consideration the beneficial impact an instrumental music program has upon a student population before the program is vanquished from a school district based upon a shortage of financial capital. Although the need to study music and the creation of art is important in and of itself, the results from this research project and numerous others before it indicate that formal public school instrumental music instruction has an impact on the successful academic achievement of a student.

In the article "Music Students and Academic Growth," Steven Morrison (1994) opinions that the value of artistic achievement has a positive influence on both the intellectual and social maturity of a public school student. If the local education constituency is to remove a program based on the lack of funding, it is doing a disservice to all those involved, and based upon what is reported here, borders on the academically criminal.

Second, state boards of education need to adopt universal standards and requirements that mandate district sponsored instrumental music programs for all students in grades 4 through 6. Ponter (1999) reports that the nations with the highest student academic achievement, Japan, Hungary and the Netherlands, put a priority on including music instruction in the curriculum, should not the United States follow suit.

Since these are the years that are the most formidable in determining school success for most students, both cognitively and behaviorally, and based on the conclusions of Straub (1994) and Trent (1996), a student's involvement in a formal

instrumental music program will help to promote brain development, self-control, self-esteem and self-discipline, attributes considered to be invaluable for an individual's overall success in society at large and life in general.

The main motivating factor underlying the purpose of this research project was to provide quantitative proof that participation in an instrumental music education program has a positive impact on student achievement across the academic disciplines. This researcher agrees with the opinion of Kelstrom (1998) that during the present educational climate, one that champions a myopic view of a "back to the basics" mentality, an argument for instrumental music inclusion based on its role for improving overall academic achievement is essential and necessary if these programs are going to continue and be supported.

Having said that, though, it is important to emphasize that the role and function of an instrumental music education program is an important and viable one in and of itself. The benefits to experiencing an art form through active engagement can not necessarily be quantified as easily as it can be with the other disciplines. Music, like language and religion, seems to be species specific. According to Leng and Shaw (1991), all humans are born with some capacity to understand and process music on some level. A public school system that champions a "holistic" education for its constituents would be promoting a disservice to this ideal if it did not support and advocate a music curriculum that included an instrumental music education component.

Music education helps to foster in children the ability to think creatively and critically, evaluate and analyze, and experience another human being's emotional psyche in a way that the other art and literary forms can not provide. This type of aesthetic

experience is more valuable than a thousand lectures given by an expert and more authentic than passively listening to a pre-recorded selection. Experiencing music in this way improves the quality of life for all individuals regardless of their age, culture, social status or position in the occupational world.

Wilson (1998) theorized in his book Consilience that a myriad of social and human elements appeared and matured during man's evolutionary process that are still crucial to the success of the human species on this planet. Wilson believes that the Arts came about as a way for man to express and share his inner thoughts and feelings with the rest of society in an attempt to educate and enlighten others about the human experience in a way not afforded by man's greatest attribute, verbal communication. By communicating in a variety of methods, through the written and spoken word and through the many mediums afforded us by the arts, the human species is given the opportunity to experience all aspects of each others lives that can lead to true understanding and empathy between all human beings. If the nature of the arts grew from this altruistic paradigm to ensure man's eventual evolutionary conclusion, then a place for music and the arts in the current curriculum is indisputable.

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Appendix A

Letter of Request for Data Collection from Designated School District

December 8, 2000

Dr. Theodore Jakubowski, Superintendent
Union Township Board of Education
2369 Morris Avenue
Union, New Jersey 07083

Dear Dr. Jakubowski:

I am in the process of researching my doctoral dissertation at Seton Hall University on the relationship between public school instrumental music education and its impact on middle school reading, mathematics and language arts achievement. This letter serves as my formal request for your approval and support in allowing me to obtain data from both Kawameeh Middle School and Burnet Middle School of the Union Township Public School District.

The information I am requesting pertains to each eighth grade student enrolled during the 1998 1999 academic year in the aforementioned schools. I will need the following data on each student:

- 1 gender
- 2 I. Q. (Quantitative)
- 3 - Ethnicity
- 4 Socio-Economic Status (enrolled in free and reduced lunch program)
- 5 CAT scores in total reading, total language arts and total mathematics
- 6 GEPA scores in total reading, total language and total mathematics
- 7 GPA for the 1999 academic school year
- 8 Instrumental music enrollment status (numbers of years student participated in middle school instrumental music program)

All of the data listed above will be obtained anonymously with the anticipated assistance of each school's guidance counselor. All student data used in this research proposal will remain unnamed and treated with complete confidentiality.

I believe that this study is important to the field and will openly share all of my findings with you and members of the Union Township Educational Community you may choose to identify. Thank you for your anticipated cooperation concerning this matter and I look forward to hearing from you in the near future with your decision. I wish you and the Union Township School District much success in all your future endeavors.

Sincerely,

Gerard Babo
30 Northwood Drive
High Bridge, NJ 08829
(h) 908-638-5898
(w) 973-822-3884 ext. 202

cc: Mr. Gary Malles, Principal, Burnet Middle School
Mr. Harold Bell, Principal, Kawameeh Middle School
Mr. Ronald Rago, Supervisor of Fine and Performing Arts
Miss Renay Josloff, Guidance Counselor, Burnet Middle School
Miss Anne Kelleher, Guidance Counselor, Kawameeh Middle School

Appendix B

Letter of Approval from Superintendent of the Designated District for Data Collection

Township of Union Public Schools
The Presidential Model School District

Theodore A. Jakubowski, Ed.D.
Superintendent of Schools

March 2, 2001

Mr. Gerard Babo
30 Northwood Drive
High Bridge, New Jersey 08829

Please be advised that you are granted my permission to collect dissertation data in selected schools within the Township of Union.

I understand that you have the cooperation of the building principals and that all data will be collected anonymously. Since your topic is of interest to me, please forward me a copy of your dissertation upon its completion.

Good luck,



THEODORE A. JAKUBOWSKI, Ed.D.
Superintendent

Appendix C

Descriptive Statistics and Correlations for all Independent and Dependent Variables

Descriptive Statistics For All Instrumental Music Students

	N	Minimum	Maximum	Mean	Std. Deviation
gender	93	0	1	.62	.49
ses	93	0	1	.11	.31
MUS.EXP	93	1	3	2.77	.55
IQ	78	88	143	110.51	11.61
CAT.R	93	29	99	68.42	15.57
CAT.M	90	1	99	68.57	15.90
GEP.A.M	91	161	280	226.46	29.15
GEP.A.LA	91	178	265	231.18	17.13
Valid N (listwise)	73				

Notes. Gender 0 = male; 1 = female
SES 0 = no food services; 1 = food services

Descriptive Statistics For All Non-Instrumental Music Students

	N	Minimum	Maximum	Mean	Std. Deviation
gender	85	0	1	.62	.49
ses	85	0	1	.26	.44
MUS.EXP	85	0	0	.00	.00
IQ	56	82	125	103.75	8.62
CAT.R	83	22	99	57.98	15.06
CAT.M	80	1	99	60.07	19.12
GEP.A.M	83	155	259	208.40	29.02
GEP.A.LA	84	153	277	216.14	18.68
Valid N (listwise)	51				

Notes. Gender 0 = male; 1 = female
SES 0 = no food services; 1 = food services

Correlations between all independent and dependent variables.

Gender: 0 = male; 1 = female

		gender	CAT.R
gender	Pearson Correlation	1.000	-.051
	Sig. (2-tailed)	.	.505
	N	178	176
CAT.R	Pearson Correlation	-.051	1.000
	Sig. (2-tailed)	.505	.
	N	176	176

		gender	CAT.M
gender	Pearson Correlation	1.000	-.219**
	Sig. (2-tailed)	.	.004
	N	178	170
CAT.M	Pearson Correlation	-.219**	1.000
	Sig. (2-tailed)	.004	.
	N	170	170

**. Correlation is significant at the 0.01 level

		gender	GEPA.LA
gender	Pearson Correlation	1.000	.084
	Sig. (2-tailed)	.	.270
	N	178	175
GEPA.LA	Pearson Correlation	.084	1.000
	Sig. (2-tailed)	.270	.
	N	175	175

		gender	GEPA.M
gender	Pearson Correlation	1.000	-.136
	Sig. (2-tailed)	.	.074
	N	178	174
GEPA.M	Pearson Correlation	-.136	1.000
	Sig. (2-tailed)	.074	.
	N	174	174

Socioeconomic Status: 0 = no food service; 1 = food service

		ses	CAT.R
ses	Pearson Correlation	1.000	-.402**
	Sig. (2-tailed)	.	.000
	N	178	178
CAT.R	Pearson Correlation	-.402**	1.000
	Sig. (2-tailed)	.000	.
	N	176	176

** . Correlation is significant at the 0.01 level

		ses	CAT.M
ses	Pearson Correlation	1.000	-.449**
	Sig. (2-tailed)	.	.000
	N	178	170
CAT.M	Pearson Correlation	-.449**	1.000
	Sig. (2-tailed)	.000	.
	N	170	170

** . Correlation is significant at the 0.01 level

		ses	GEP.A.LA
ses	Pearson Correlation	1.000	-.398**
	Sig. (2-tailed)	.	.000
	N	178	175
GEP.A.LA	Pearson Correlation	-.398**	1.000
	Sig. (2-tailed)	.000	.
	N	175	175

** . Correlation is significant at the 0.01 level (2-tailed).

		ses	GEP.A.M
ses	Pearson Correlation	1.000	-.389**
	Sig. (2-tailed)	.	.000
	N	178	174
GEP.A.M	Pearson Correlation	-.389**	1.000
	Sig. (2-tailed)	.000	.
	N	174	174

** . Correlation is significant at the 0.01 level

Instrumental Music Status: 0 = non-instrumental music student
1 = instrumental music student

		imusic	CAT.R
imusic	Pearson Correlation	1.000	.324**
	Sig. (2-tailed)	.	.000
	N	178	176
CAT.R	Pearson Correlation	.324**	1.000
	Sig. (2-tailed)	.000	.
	N	176	176

** . Correlation is significant at the 0.01 level

		imusic	CAT.M
imusic	Pearson Correlation	1.000	.237**
	Sig. (2-tailed)	.	.002
	N	178	170
CAT.M	Pearson Correlation	.237**	1.000
	Sig. (2-tailed)	.002	.
	N	170	170

** . Correlation is significant at the 0.01 level

		imusic	GEP.A.LA
imusic	Pearson Correlation	1.000	.389**
	Sig. (2-tailed)	.	.000
	N	178	175
GEP.A.LA	Pearson Correlation	.389**	1.000
	Sig. (2-tailed)	.000	.
	N	175	175

** . Correlation is significant at the 0.01 level (2-tailed).

		imusic	GEP.A.M
imusic	Pearson Correlation	1.000	.298**
	Sig. (2-tailed)	.	.000
	N	178	174
GEP.A.M	Pearson Correlation	.298**	1.000
	Sig. (2-tailed)	.000	.
	N	174	174

** . Correlation is significant at the 0.01 level

Intelligence Quotient:

		IQ	CAT.R
IQ	Pearson Correlation	1.000	.664**
	Sig. (2-tailed)	.	.000
	N	134	133
CAT.R	Pearson Correlation	.664**	1.000
	Sig. (2-tailed)	.000	.
	N	133	176

** . Correlation is significant at the 0.01 level

		IQ	CAT.M
IQ	Pearson Correlation	1.000	.729**
	Sig. (2-tailed)	.	.000
	N	134	127
CAT.M	Pearson Correlation	.729**	1.000
	Sig. (2-tailed)	.000	.
	N	127	170

** . Correlation is significant at the 0.01 level

		IQ	GEPA.LA
IQ	Pearson Correlation	1.000	.547**
	Sig. (2-tailed)	.	.000
	N	134	132
GEPA.LA	Pearson Correlation	.547**	1.000
	Sig. (2-tailed)	.000	.
	N	132	175

** . Correlation is significant at the 0.01 level (2-tailed).

		IQ	GEPA.M
IQ	Pearson Correlation	1.000	.822**
	Sig. (2-tailed)	.	.000
	N	134	131
GEPA.M	Pearson Correlation	.822**	1.000
	Sig. (2-tailed)	.000	.
	N	131	174

** . Correlation is significant at the 0.01 level

