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Music Education as a Strategy to Narrow the Achievement Gap: A Causal-comparative Analysis of Band and Choir Enrollment and Academic Achievement of Low Socioeconomic Status Students

William Zwikelmaier
University of Missouri-St. Louis, zwikelmaierw@gmail.com

Music Education as a Strategy to Narrow the Achievement Gap: A Causal-comparative Analysis of Band and Choir Enrollment and Academic Achievement of Low Socioeconomic Status Students

William T. Zwikelmaier

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Advisory Committee

Keith Miller, Ph.D.

Chairperson

Charles Granger, Ph.D.

Helene Sherman, Ed. D.

ABSTRACT

There is a gap in the knowledge pertaining to socioeconomic status as a variable in academic achievement among students those who enroll in band and/or choir in public high schools in America. Research has shown that students who engage in music study consistently show higher levels of academic achievement in other subjects compared to their non-music study peers. It is necessary to study those who typically do not perform at the same academic levels as their peers (low socioeconomic status (SES) students) and determine if the formal study of music alone can serve as a strategy to contribute to closing the achievement gap between low SES music study students and average/above average SES non-music study students.

Building on existing work in understanding causal comparative relationships with music study and achievement, three questions are asked; Do low-SES music students score higher than their low-SES non-music study peers? Do low-SES music students score higher than their average/above average-SES peers? Can music enrollment narrow the achievement gap between low SES students and their peers?

Statistical analysis was completed on a data set containing enrollment and assessment score information for a rural school district. The results indicate no significant direct correlation to higher achievement scores of low-SES music study students and as such no significant narrowing of the gap is seen. The research did confirm previous reports that music study students overall score significantly higher on core subject assessments. On this basis, it is recommended that further research is needed to understand if the reported scores are a result of music's impact on learning or if students

with more potential are attracted to music; as well as the reasons for the research findings.

ACKNOWLEDGEMENT

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I would like to thank my beautiful and intelligent daughters who sacrificed time with their daddy, never made me feel guilty for that sacrifice and provided the necessary balance to my life with their joyous and infectious energy. My pursuit of higher education is, in large part, an attempt to set an example of the importance of lifelong learning and contribution to one's chosen field for those young women.

Most importantly I would like to thank my steady base, my cheerleader, my confidant, my best friend, and the lyrics to my song…my wife. She surrendered many of life's pleasures and took on most of life's dirty work to ensure that I was set up for success in this endeavor. In front of every successful woman is a very lucky man. Thank you for putting me ahead of yourself throughout. I am very much looking forward to walking side-by-side again.

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CHAPTER I

INTRODUCTION

Formal music study, as a component of a fine arts and liberal arts education, has long been at the forefront of the debate over its importance to an academic education, while at the same time an academic achievement gap between economic classes has been widening. In light of the rapidly growing achievement gap, and the fading footprint of music as an integral curricular component, there is evidence to indicate formal music study plays a role in increasing general academic achievement for students, and perhaps in narrowing the achievement gap exhibited in lower socioeconomic students. Formal music study may play a key role in increasing overall academic achievement for those students who are in a lower socioeconomic status (SES) which could validate music as an integral and desirable component of a successful curriculum (Catterall, Chapleau, & Iwanaga, 1999).

Background of the Problem

Participation in music education and its positive relationship with academic achievement has been an anecdotal observation of music educators for decades. This phenomenon has been rigorously studied in a variety of ways. The general consensus of research on this topic is that participation in school music programs reveals a positive correlation to academic achievement as measured by standardized tests. The Journal of Aesthetic Education devoted an entire issue in 2000 to the relationship between the arts and academic achievement entitled “The Arts and Academic Achievement: What the

Evidence Shows". In this issue was a meta-analysis of much of the available research to that point including over 30 studies asking the question of whether or not an arts education has a positive influence on standardized test scores. The results showed that students involved in the arts had statistically significant higher achievement scores on both mathematics and verbal assessments (Winner & Cooper, 2000). Several studies since this 2000 meta-analysis confirmed this result using a variety of variables in an attempt to eliminate possible causes including self-selection bias and demographic and culture differences (Elpus 2013; Fitzpatrick, 2006; Hollenbeck, 2008; Johnson & Memmott 2006; Kinney, 2008; Southgage & Roscigno, 2009). It has since become general working knowledge in the field of music education that music students are typically the highest achievers of the student population.

This connection between music education and academic success is of particular importance in academia today because there exists, in the United States, a significant achievement gap that the United States Department of Education describes as "the difference in academic performance" between different groups of students (SEDL, 2011). This gap is prevalent as it pertains to income and wealth. "Historically, low-income students as a group have performed less well than high-income students on most measures of academic success—including standardized test scores, grades, high school completion rates, and college enrollment and completion rates" (Reardon, 2011 , p.10). There is some evidence to suggest that music can play a role in the remediation of that gap (Hash, 2011; Kinney, 2008; Salazar, 2012).

A 1999 study indicated that low SES senior level high school students who were enrolled in fine arts classes significantly reduced the achievement gap when compared to

higher SES non-fine arts students (Catterall, Chapleau, & Iwanaga, 1999). It has been hypothesized that some of the skills that are learned through music study (e.g., discipline, persistence, patience, and self-motivation) are applied to learning in other subject areas and provide the reasoning for the marked increase in academic achievement among that population (Olson, 2010).

One significant challenge to music's potential positive impact on the achievement gap has been a movement toward accountability in American public education. In the last 30 years there has been an onslaught of reform in public education in the United States that specifically focuses on accountability of education at all levels of government (Hansen, 1993). The momentum for this reform was created by a report authored by the Commission on Higher Education (CHE) entitled "A Nation at Risk" (United States, 1983). The publication claimed that the United States was at a severe risk of slipping from superiority among the world's nations, in large part due to the lack of emphasis and public support for a quality and rigorous education. The ideas sparked by the CHE document eventually grew into policy known as the No Child Left Behind Act (NCLB), in 2001. NCLB legislation was not new to the United States and was, in effect, a reauthorization of a similar piece of legislation from 1965 known as the Elementary and Secondary Education Act (ESEA). NCLB was the result of a movement toward accountability that had "been gathering steam in American Education for over 80 years" (Williams & Dunn, 2008).

The push toward accountability in NCLB required school districts and communities to place more emphasis on testing in intentionally targeted subject areas; music was not included as a targeted area. NCLB required that public schools make

Adequate Yearly Progress (AYP) on an incremental basis until every student had reached a 100% proficiency goal in the targeted academic subjects (Armstrong, 2006). NCLB included annual testing of what it described as 'core subjects'- reading, mathematics and science- but it did not include many other subjects, excluding music and fine arts in its evaluation guidelines (Armstrong, 2006). NCLB had an effect on academia that many considered harmful, as it shifted the focus to testing and accountability, and away from the education of students (Armstrong, 2006). Despite the goals of NCLB, "it has neither significantly increased academic performance nor significantly reduced achievement gaps, even measured by standardized exams. Many schools, particularly those serving low-income students, have become little more than test-preparation programs." (Guisbond, Neill, & Schaeffer, 2012, p.1)

Because the NCLB Act exluded music as a tested subject, districts across the nation began limiting and in some cases eliminating music instruction in favor of NCLB tested subjects. Although NCLB ended in late 2015 with the signing of a new education law by then President Barack Obama, the accountability movement has continued to reduce music instruction in the curriculum despite a vast catalog of research detailing multiple connections between academic achievement and music study. (Elpus 2013; Fitzpatrick, 2006; Hollenbeck, 2008; Johnson & Memmott 2006; Kinney, 2008; Southgage & Roscigno, 2009)

Whereas academia may have recently lost sight of the importance of music study participation in the preparation of young people toward successful futures, due in large part to the impact of the accountability movement, it seems that many Americans have not. A Harris Poll of 2,286 students was conducted in May of 2014 which revealed that

"76% of Americans identified themselves as having participated in music education in school, over half of those saying that it was extremely or very important in providing them with the skills of working toward common goals (54%) and striving for individual excellence in a group setting (52%)" (Corso, 2014). This study also showed that "71% of participants said that music education helps people to be better team players, 67% said it provides disciplined approaches to problem solving, and 66% said it prepares someone to manage the tasks of their job more successfully" (Corso, 2014). This provides context that perhaps a shift towards music instruction is not outside the consensus of the American public which is of particular importance given music's historically researched connection to increased achievement and the strong need for positive interventions to address the achievement gap.

Statement of the Problem

Educational research reports a positive correlation between academic achievement and formal music study; but it may be that this correlation occurs because high achieving students self-select into music study. To cast doubt on the self-selection bias theory, research must be done on students who would historically not score as highly as their peers regardless of elective interest. There is a gap in the knowledge pertaining to socioeconomic status as a variable in academic achievement among those who enroll in band and/or choir in public high schools in America. It is necessary to study those who typically do not perform at the same academic levels as their peers, low SES students. This research can determine if the formal study of music alone can serve as a strategy to

narrow the achievement gap between low SES music study students and average/above average SES non-music study students.

Purpose of the Study

A solid foundation of curriculum that is designed to most effectively increase academic achievement among young people is the underpinning of sound pedagogy. Research literature points to curricular music study as a major variable in reports of higher academic achievement. The question of self-selection into music remains a largely unstudied theory toward explanation of the relationship between music study and academic achievement. The purpose of the study is to explore the correlation between formal music study at a high school level (band or choir) and increased academic achievement among students that have historically underperformed: low socioeconomic status students. This result may challenge the self-selection bias theory and position band or choir enrollment as an integral component of a successful curriculum. Furthermore, music participation may be shown to have a significant effect on the academic achievement gap between low SES students and their average/above average SES peers at the high school level.

Using standardized test scores and enrollment data of public high school students, the researcher will explore if there is a significant difference between the academic achievement of students who enroll in band or choir, and their peers who enroll in neither. If an increase in academic achievement is shown, formal music study may be

validated as a tool for narrowing the achievement gap between low SES student populations and their peers from higher SES levels.

Significance of the Study

The author will contribute to the existing body of literature by focusing on the integral variable of SES to more fully explore the influence of music study on academic achievement. Placing a direct focus on music as a tool in narrowing the SES achievement gap will highlight an education field which has been understudied to date. The proposed research will provide music educators, school administrators, and communities with information that will help them improve the comparatively low academic achievement outcomes of low SES students. With an increase in understanding of how music study effects the sample population in terms of general academic achievement outcomes, educators will be able to alter offerings and requirements of band and choir in their core curriculum for all students, and particularly low SES students, in an impactful way.

Research Questions and Hypotheses

Research Questions

1. Do high school students from a low SES who enroll in band or choir score higher on core subject standardized tests than their low SES peers who do not enroll in formal music education?

2. Do high school students from a low SES who enroll in band or choir score higher on core subject standardized tests than their average/above average SES peers who do not enroll in formal music education?
3. Can enrollment and participation in band or choir at the high school level narrow the achievement gap between low SES students and their average/above average SES peers?

Null Hypotheses

HO1. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average core subject standardized test scores compared to their low SES peers who are not enrolled in formal music education.

HO2. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average core subject standardized test scores compared to their average/above average SES peers who are not enrolled in formal music education.

HO3. The enrollment and participation in band or choir at the high school level does not significantly narrow the achievement gap between low SES students and their average/above average SES peers.

Theoretical Framework

Urie Bronfenbrenner's ecological systems theory of development (Bronfenbrenner, 1979) will be used in this study as a tool to illustrate the contextual relationship between participation in music study and academic achievement.

Bronfenbrenner offered a framework from which educational psychologists may examine student relationships with and within their communities across multiple ecosystems. Bronfenbrenner postulates that the differing settings in which students live and learn have direct and indirect impacts on learning development in the following statement:

"The ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as the process is affected by the relations between these settings and by the larger context in which the settings are embedded." (Bronfenbrenner, 1979, p. 21)

Bronfenbrenner posits five environmental systems in which a student lives and learns, each of which have the capability to impact the outcomes of a learner based on their interactivity. Bronfenbrenner's five systems include the microsystem, mesosystem, exosystem, macrosystem and chronosystem (Bronfenbrenner, 1979). Molar activities, joint activity dyads and reciprocity relationships between levels of all systems were also noted as three key contributors to development by Bronfenbrenner (1979).

Music study, playing its role in the microsystem of student learning as a part of the formal school experience, practices all three contributors to development in the following ways. Molar activities are defined by Bronfenbrenner as activities that involve "a behavior possessing a momentum of its own and perceived as having meaning or intent by the participants in the setting" (Bronfenbrenner, 1979, p. 45). By this definition, the daily rudimentary and advanced skill building exercises that are commonplace in music study are an example of molar activities. Daily skill building exercises are meant to be progressive and purposeful toward the ability to perform, giving them both

independent momentum and intent. This can also be said about skill building activities in core subjects.

Bronfenbrenner describes joint activity dyads as relationships wherein "two participants perceive themselves as doing something together" (Bronfenbrenner, 1979, p. 45). It is readily apparent that in a performing ensemble, as in the high school band and choir involved in this study, there is a clear dyadic relationship between members of the ensemble and the whole of the ensemble when performing. The third contributing factor is reciprocity. Reciprocity results when a single member of a system has to coordinate his/her activities with another (Bronfenbrenner, 1979). Participation in an ensemble has an inherent level of reciprocity involved as coordination of effort is an integral aspect of music ensemble participation.

Participation in high school music is assessed and graded at the microsystem level where personal musical development of the individual student is the key indicator of success (Asmus, 1999). There is, however, a much more ensemble focused aspect to participation in a music performance at the high school level, as well as group interaction between students of varying disciplines within the confines of the microsystem of high school. This interaction would be considered a mesosystem by Bronfenbrenner's definition and plays a key role in understanding how participation in music can impact learning in other areas of a student's ecological system and how a transfer of learning can take place between dyadic relationships within that ecosystem (Bronfenbrenner, 1979).

These baseline correlations to Bronfenbrenner's definitions establish high school music participation as an active and purposeful player in a student's development ecosystem. Bronfenbrenner postulates that interconnections, such as the ones prevalent

within formal high school music study and their core subject counterparts, play a key role in the developmental outcomes of the student (Bronfenbrenner, 1979). This theory puts into context the likely role music plays in the core subject academic achievement outcomes of a student who lives and learns in an environment in which both music study and core subject study are present.

Delimitations

- This study includes data from only one mid-west rural school district and may not be representative of schools of varying sizes, or of schools from other areas of the nation.
- Student ethnicity is not a studied variable due to the low diversity of the sample population.
- The focus of this research is only on academic achievement in grades nine through twelve and does not measure achievement for lower grades even though band and choir are available enrollment options prior to ninth grade.

Limitations

- The State of Missouri has changed the standardized test format and content multiple times throughout the course of the collected data. The assessment scores are not a reliable measure of academic growth from year to year for this reason.
- Some students have moved in and out of the district, thus presenting the opportunity to call into question the consistency of student experience as an outcome factor.

Assumptions

- Enrollment in music assumes study of music. While one could argue that some students who are enrolled do not necessarily reap the rewards of the experience because they do not engage in the required study, the research will assume each enrollee took an active role in the study of music.
- The school district and sample of students participating in this study trend closely with the available research results that students of a low SES typically score lower on standardized achievement tests than their average/above average SES peers.

Definition of Terms

- Achievement: the discussion of which refers to only academic achievement
- Achievement gap: any significant and persistent disparity in academic performance or educational attainment between different groups of students (Partnership, G. S., 2013).
- Socioeconomic status: “the social standing or class of an individual or group, often measured as a combination of education, income and occupation” (Socioeconomic Status, n.d.).
- Core Subjects: Subjects tested annually by the State government.
- Low Socioeconomic Status: students who qualify for free or reduced lunch based on family income.

Conclusion

In this chapter the background of the socioeconomic achievement gap, the accountability movement, the impact on music education, and the potential impact music education has on academic achievement were introduced and analyzed. The need for this study is evidenced by the strong statistical correlation that music education has to academic assessment scores and the wide academic achievement gap between socioeconomic groups. The framework for this study, Bronfenbrenner's Ecological Systems Theory, was presented and the specific connection to the study was outlined. The limitations, delimitations and assumptions of the study were each outlined and a definition of terms were provided to ensure a common vernacular for describing the study and results. In the following chapter, a summation of the available literature concerning the factors that have contributed to a de-emphasis in music, the socioeconomic achievement gap, and the impact of music study on academic achievement will be presented.

CHAPTER II

LITERATURE REVIEW

The Impact of Music on Academic Achievement

Many connections between participation in music study and increases in academic achievement, attendance and even cognition and comprehension skills have been reported (Elpus, 2013; Olson, 2010; Fitzpatrick, 2006; Thomas, 2011).

Similar studies spanning the past two decades also concluded that there is a positive connection between academic achievement and participation in music study (Costa Giomi, 1999; Gadberry, 2010; Southgate & Roscigno, 2009). It is often hypothesized that some of the skills that are learned through music study (i.e. discipline, persistence, patience, self-motivation) are applied to learning in other subject areas and provide the reasoning for the marked increase in academic achievement among that population (Olson, 2010). Other learned skills notable to music study include teamwork, relationship building, expert-level multitasking, advanced communication, as well as some heightened spatial-temporal reasoning skills (Graziano, Peterson, & Shaw, 1999; Hollenbeck, 2008).

Gerard Babo (Babo, 2004) presented research in 2004 that showed a clear relationship between music study and academic achievement. Babo's research sought to extend studies of the previous decade by including variables previously not well acknowledged. Babo included gender, tested IQ and, importantly, socioeconomic status (SES) to help determine if music study was the prime factor in increased achievement.

His conclusion was that, while IQ was the variable with the strongest correlation to higher academic achievement, there was a statistically significant correlation between music study and higher assessment scores, particularly in reading and mathematics (Babo, 2004).

The quality of the music instruction provided also seems to play a role in the academic achievement of students, according to a report by Johnson & Memmott (2006). Students enrolled in instrumental programs classified of a higher caliber, as identified by survey of area music education professors, scored higher on standardized assessments in mathematics and English than those in lower quality instrumental programs. The report also indicated that regardless of the quality of the music program, students enrolled in any formal music program outscored their non-music peers (Johnson & Memmott, 2006). SES was a variable that was accounted for in the Johnson & Memmott (2006) study which found that music students excelled at a higher level academically than their non-music peers regardless of the influence of students' SES. A 1999 study indicated that low SES senior level high school students who were enrolled in fine arts classes nearly closed the achievement gap when compared to higher SES non-fine arts students (Catterall, Chapleau, & Iwanaga, 1999).

The Catterall, Chapleau, & Iwanaga (1999) study also showed the correlative improvement continued over time spent in study, indicating that not only the act of music study but the amount of music study is an important factor in higher academic achievement. 260 students in eighth grade who were highly involved in music study scored higher in mathematics with 20% scoring at the highest level of proficiency on the National Assessment of Educational progress. Whereas only 10% of their non-music

study peers scored at that highest proficiency level. Those same 260 students were evaluated again in their twelfth grade year and the same result was shown only this this time with a larger margin. 33% of music students scored at the top level of proficiency compared to 15% of their non-music study peers scoring in that category (Catterall et al., 1999)

Many studies that found a correlation between music study and core subject academic achievement postulated that music study itself may not prepare students to be successful learners in other disciplines, but that those students who are high academic achievers tend to pursue music study opportunities (Fitzpatrick, 2006; Hash, 2011; Kinney, 2008). Elpus (2013) directly addressed the self-selection theory in his study, stating:

"A more candid appraisal of the current body of research literature might suggest that music is somehow attractive to those students who are already are likely to perform well academically and, as such, may serve as an important artistic outlet with positive developmental benefits for those students who choose to study it. (Elpus, 2013)"

Hash (2011) noted a similar phenomenon when extending his study to the test scores of students prior to selection into beginning band. Hash noted that "Students who enrolled in beginning band tended to be the most academically successful in the class and those who persisted through eighth grade were among the highest achieving students in the entire sample" (Hash, 2011). Fitzpatrick (2006) postulated that:

" This study clearly found that students who participated in high school instrumental music were higher scorers from the beginning of their music study of an instrument, suggesting that the reason for the higher instrumental scores might be a

stronger than average concentration of higher scoring students involved in instrumental music classes."

Fitzpatrick (2006) cautioned against making generalizations based on his data because of the large differences in the samples sizes of his compared populations. Fitzpatrick used SES as a variable in his study and, importantly, noted that "all differences between non-instrumental and instrumental music participants of like SES on every subject and at every level except free/reduced lunch (FRL) sixth grade were determined significant."

Pertinent literature is positioned between an overwhelming support of a positive correlation between music participation and higher academic achievement and the postulation that students destined for a greater level of excellence are simply more attracted to music. It is important to note, as Gouzouasis, Guhn, & Kishor (2007) did, that all of the studies referenced here "clearly and consistently indicate that participation in music courses does not hamper achievement in other domains." While practices resulting from the accountability movement would lend to the idea that class instruction spent focused on music is counterproductive to focusing class time on core tested subjects, it does not appear that in any instance of the reviewed literature it is the case. Each study consistently indicates that music participation positively correlates to a higher level of academic achievement.

Factors contributing to de-emphasis in non-core subjects

Accountability and assessment as approaches to ensure educational excellence are concepts that have been researched and analyzed in education for over 100 years (Hansen, 1993). Educators focused on assessment more heavily in the late 1960s with the "beginning of mandated accountability in federal programs" (Hansen, 1993) This mandate is known as the Elementary and Secondary Education Act of 1965 (ESEA). In the early 1990s the concept of accountability in academia saw an increase with the Improving America's Schools Act (IASA), which significantly revised the ESEA, but that increase quickly faded as the IASA gave control back to the localities wherein many communities chose to waive federal requirements (Strauss, 2013).

In 2001, President George W. Bush reauthorized the ESEA, renaming it the No Child Left Behind Act (NCLB) (Armstrong, 2006). Assessment via standardized testing became an approach that focused on a "one-size-fits-all" model. Student scores were reported in groups, in contrast to education reform efforts that sought to approach students in a more individualistic way (Guisbond, Neill, & Schaeffer, 2012). The NCLB legislation had a significant impact on not only the way students were educated but to what education they were exposed. "In an age of increased accountability and educational standardization accompanied by tighter budgets and fewer funds, core subjects, such as mathematics and reading, receive more funding and instructional time in public schools, while non-core subjects, like music, potentially face reductions or elimination in budgets, programs, and staffing" (Major, 2013). These types of reductions effect students in public schools across the nation.

School districts adhering to the NCLB legislation were required to measure and demonstrate that their students were making Adequate Yearly Progress (AYP) in core subject areas. NCLB excluded instrumental music from the list of core subjects which has led to a lower degree of emphasis on music programs as an integral cog in the academic instruction machine (Major, 2013).

A study done in Texas of 349 public school districts demonstrates the negative impact that emphasis on higher core subject test scores has had on non-core subjects including band, choir, art and theater. This study showed a clear increase in time spent in study of the NCLB core subjects as well as a corresponding decrease in time spent in study of the humanities and fine arts (Heilig, Cole, & Aguilar, 2010). The United States Department of Education describes the phenomenon in this way.:

> "Administrators recognize that more time is needed to teach such critical core subjects such as Algebra I. Class schedules are typically changed in order for teachers to have longer blocks of time to allow for instructor-led as well as applied instructional strategies. Administrators recognize the need to change classroom practices to allow students the opportunity to practice skills." (U.S. Department of Education, 2005, p.3)

A result of dedicating instruction to the study of core subjects in preparation for standardized assessments has been a decrease in class time available for performing and fine arts such as instrumental music. "As school districts across the nation respond to challenges of the No Child Left Behind law, children are spending more classroom time on reading and mathematics and as a result some are spending less time on music and art" (Beveridge, 2010, p.4). This represented a major threat to the fine arts and, in turn, to academia as a whole. "Some of the short-term effects of this law have troubling

implications for subjects that are not evaluated for the purposes of determining adequate yearly progress (AYP), the measure that serves as the basis for all federal funding" (Beveridge, 2010, p.4). Both the resources allocated and the time allotted has declined for the non-core subjects as a direct result of NCLB. In 2008 almost 800,000 high school students and 1.3 million elementary school students were not provided any music instruction at all (Pederson, 2007).

Notable is the economic factor that played a role in the de-emphasis of non-core subject instruction. The economic recession between 2007 and 2009 impacted not only the nation's unemployment rate but had a great effect both directly and indirectly on America's interest in the arts (Opdycke & Miringoff, 2010). The economic downturn forced states and local governments to focus their declining and limited resources on tested core subjects, which placed subjects like music first on the list when looking for ways to reduce costs (Pederson, 2007).

Socioeconomic Status Achievement Gap

Students with an economically disadvantaged background come to school each day with a plethora of challenges that directly and indirectly affect their ability and readiness to learn (Rouse, Brooks-Gunn, & McLanahan, 2005). An academic achievement gap between students of a low socioeconomic status and middle to high SES students presents a variety of opportunities to reduce the differences and encourage all students to improve and advance their own skills and conceptual understandings. (Reardon, 2011).

Multiple studies have shown a strong correlation between performance on achievement tests and socioeconomic status (Arnold & Doctoroff, 2003; Cooper & Crosnoe, 2007; Flores, 2007; Taylor, 2005). Caldas and Bankston (1997) reported a negative impact on test scores related to those of a low socioeconomic status. 10 years later Cooper & Crosnoe (2007) described the effects that a demonstration of low academic achievement can have on both the school system and the student, including decreased funding and academic confidence, both perpetuating the cycle of low achievement.

One of the factors that plays a role in student success is parental involvement. Parents of a low socioeconomic status have a documented tendency to be less involved in their child's schooling efforts than their peers of higher income levels in a variety of ways. Parental involvement shows a marked decrease as family income decreases (Cooper & Crosnoe 2007). Low income parents are the least likely to serve on school committees or volunteer their time for school programs (Barton, 2003). This may be due to the prevalence of these family leaders being forced to work multiple jobs or odd shifts in order to meet basic financial needs, making it more challenging to attend school events (Gardner, 2007).

Parental involvement, as it pertains to student behavior, has been studied extensively. Research results show that students from a low SES background have a higher incidence of engaging in misbehavior in the school setting (Brooks-Gunn & Duncan, 1997), thus creating a higher incidence of negative communication between educators and students' parents (Amatea & West-Olatunji, 2007). This higher probability of a negative reaction may lead low SES parents to view any contact with educators as

potentially negative and to view the educators as the enemy (Lott, 2001). Often, without positive and active parental communication, behavior is not corrected fully and the cycle of bad behavior and negative communication is left to perpetuate, ultimately damaging potential academic achievement.

Financial shortcomings can also affect factors that typically decrease student achievement. What is commonly referred to as the 'summer slide', the loss of academic forward motion and in some cases complete knowledge or skill loss, can impact students from lower SES groups more than students who do not face that challenge. A study by Alexander, Entwisle, and Olson (2001) showed that students of a low SES showed little to no educational gains when they were not actively engaged in a school setting whereas their non-low SES peers tended to have at least slight gains throughout the summer months. Another study indicates a decline in knowledge and skills during the summer months for low SES students as compared to their higher SES peers (Reardon, 2003). This implies that academic growth during the school year could be compounded during the summer months for all but the lowest SES class, allowing that student population to fall behind their peers.

Conclusion

In this chapter current research literature, pertaining to the three key factors in the development of the problem statement, was presented. The impact of music on academic achievement was demonstrated to be significant. The accountability movement was shown as a primary factor in the de-emphasis on non-core subjects in American public education. Additionally, the socioeconomic achievement gap was revealed to be prevalent and complex in its impact on academic achievement. In the following chapter, a

clear description of the methodology, including a description of the sample and the instruments used for assessment will be presented. The approach to the data analysis will be described, including reasons for specific statistical test selections.

CHAPTER III

METHODOLOGY

Introduction

Chapter three will present the methodologies used to answer the research questions. The focus is on investigating the correlational relationship between participation in band or choir in the high school setting and academic achievement of students of a low socioeconomic status. The research design, population and sample, research questions, hypothesis, instrumentation, data collection, and data analysis are explained.

Research Design

Correlational quantitative research methodology will be used to explore the relationship between enrollment in band or choir, socioeconomic status, and performance on standardized assessments. Archival research using historical student records will be performed. As a correlational study, this design will not allow the researcher to determine cause and effect, only to compare the relationship between music study of low and non-low SES students, and their standardized test scores, to the scores of their non-music study low and non-low SES peers.

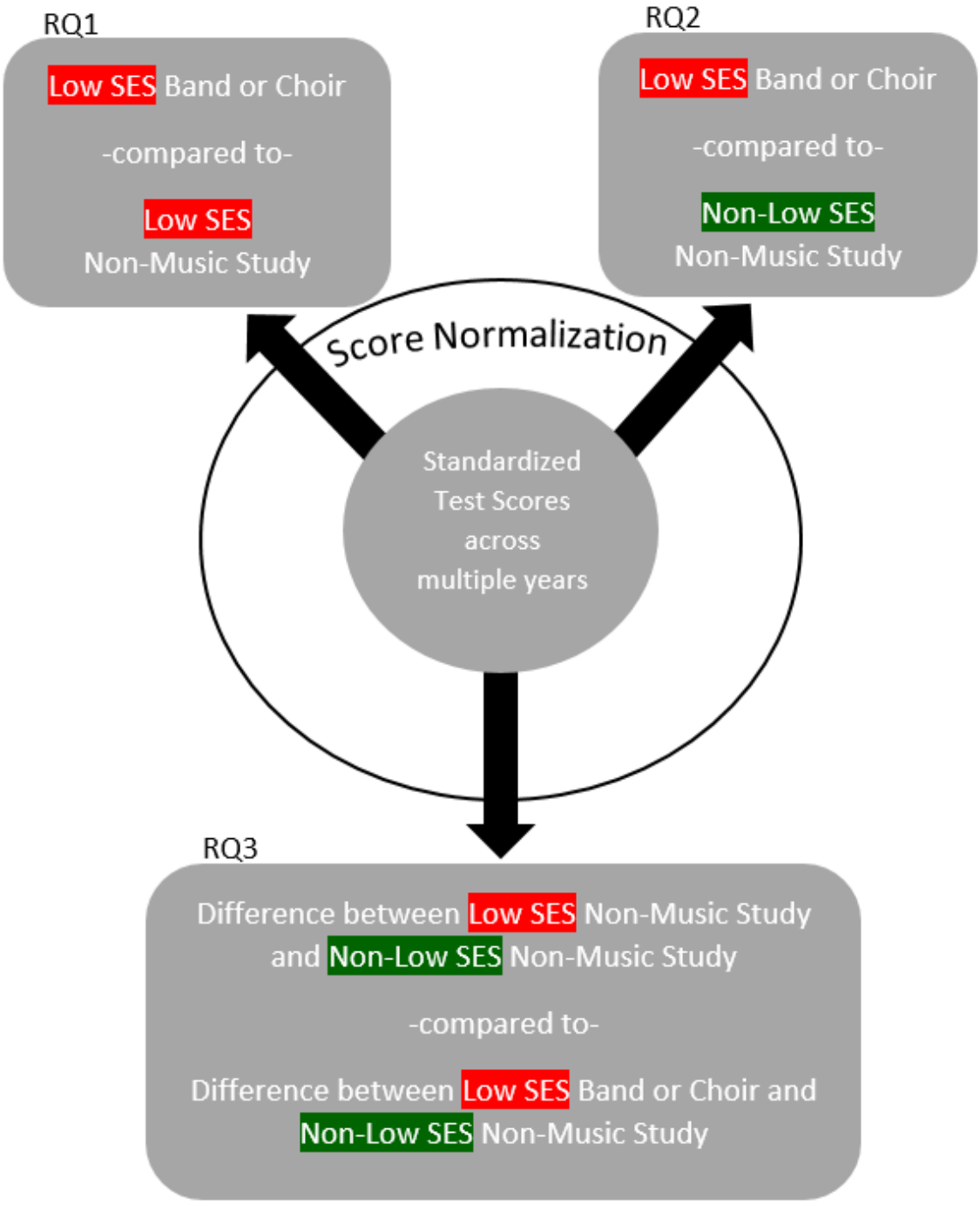

Figure 1. Correlational quantitative research design model

Research Questions and Hypotheses

Research Questions

1. Do high school students from a low SES who enroll in band or choir score higher on core subject standardized tests than their low SES peers who do not enroll in formal music education?
2. Do high school students from a low SES who enroll in band or choir score higher on core subject standardized tests than their average/above average SES peers who do not enroll in formal music education?
3. Can enrollment and participation in band or choir at the high school level narrow the achievement gap between low SES students and their average/above average SES peers?

Null Hypotheses

HO1. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average core subject standardized test scores compared to their low SES peers who are not enrolled in formal music education.

HO2. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average core subject standardized test scores compared to their average/above average SES peers who are not enrolled in formal music education.

HO3. The enrollment and participation in band or choir at the high school level does not

significantly narrow the achievement gap between low SES students and their average/above average SES peers.

Population and Sample

The population consists of ninth through twelfth grade students enrolled in in a Midwest senior high school located in a rural medium sized school system (cannot mention the state) during the 2018-2019 school year. Of the 1216 students enrolled, 453 (37%) are classified as a low socioeconomic status as identified through participation in the free and reduced lunch program, and 763 (63%) are not classified as low socioeconomic status. Additionally, 608 students identify as male and 608 students identify as female, providing an exact 50/50 split of the population. Eighty-seven percent, 1057, of students report their race as white, 48 (4%) as black, 41 (3%) as Hispanic, 34 (3%) as multi-race, 28 (2%) as Asian, 7 (0.5%) as Indian, and 1 as Pacific Islander, as seen in Figure 2.

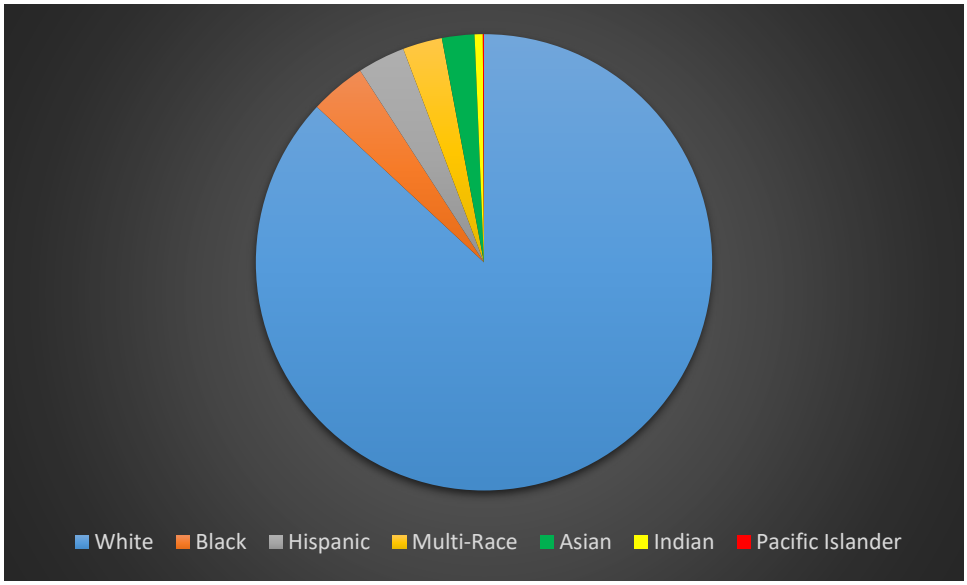

Figure 2. Race/Ethnicity of Sample Population

Of the 1216 students enrolled, 308 (25%) have participated in a minimum of one full semester of band or choir during their ninth through twelfth grade years. A total of 908 (75%) students have not participated in band or choir during their ninth through twelfth grade years. Of the 308 students enrolled in band or choir during their ninth through twelfth grade years, 98 (32%) students are classified as low SES and 210 (68%) are not classified as low SES. Of the 908 non-music participation students 355 (39%) are classified as low SES and 553 (61%) are not classified as low SES.

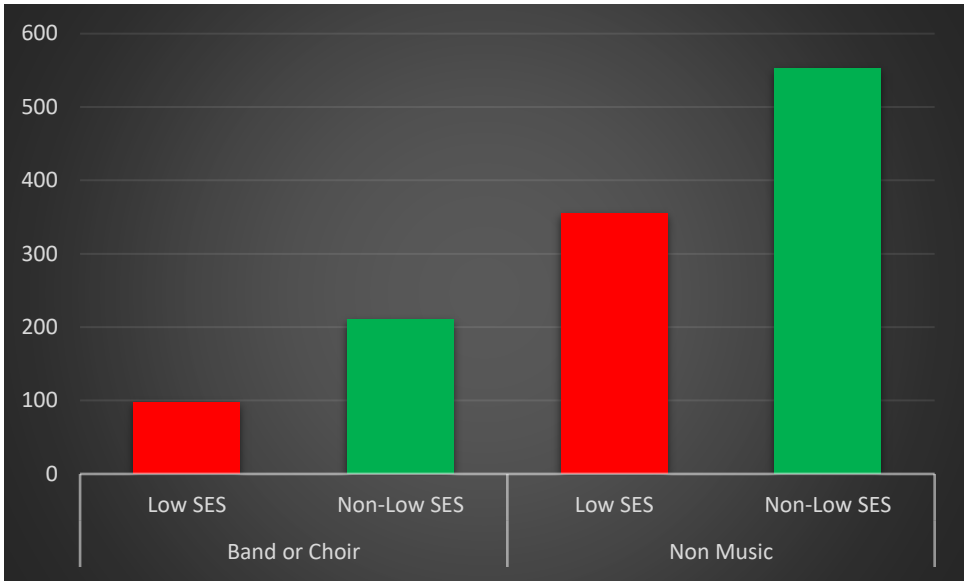

Figure 3. Socioeconomic Status by Enrollment for Sample Population

The population is separated into three sample groups with multiple sub-groups within each sample for comparison.

- Sample Group 1 (Band Students), n=223
    - 1.1 (Low SES Band Students), n=55
    - 1.2 (Non-Low SES Band Students), n=168
- Sample Group 2 (Choir Students), n=102
    - 2.1 (Low SES Choir Students), n=47

    - 2.2 (Non-Low SES Choir Students, n=55
- Sample Group 3 (Non-Music Study Students), n=908
    - 3.1 (Low SES Non-Music Study Students), n=355
    - 3.2 (Non-Low SES Non-Music Study Students), n=553

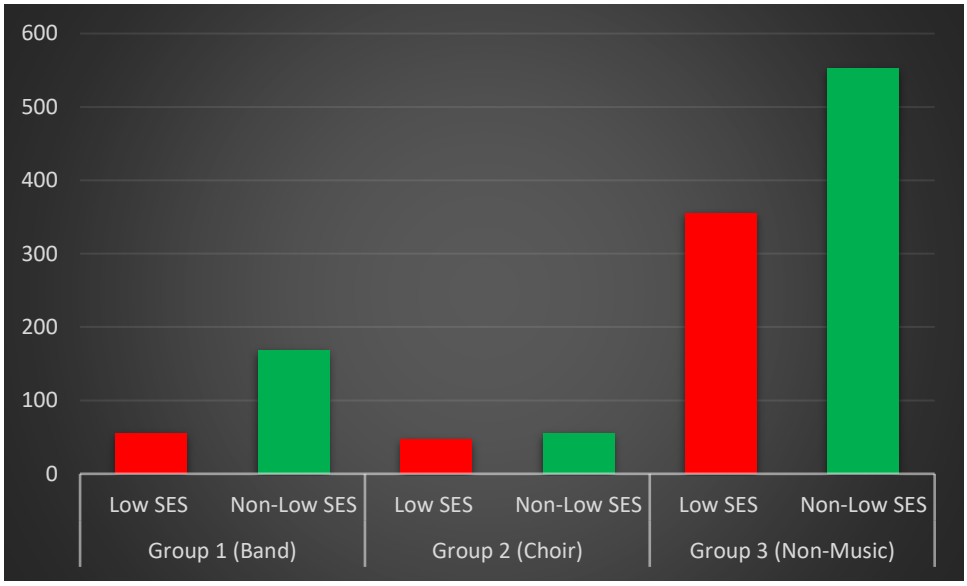

Figure 4. Population Size by Group and Subgroup

Only students from each sample and subsample who have a Missouri End of Course Assessment (EOC) score reported will be used in analysis for each core subject EOC.

Instrumentation

A single instrument will be utilized in this study to assess the academic achievement of the sample population. The Missouri End of Course (EOC) assessment in the following fields of study; Algebra I, Geometry, English I, and Biology.

Missouri End of Course Assessment

As a tool used in the Missouri Assessment Program, a program designed to assess progress toward the established Missouri Learning Standards, the Missouri (EOC) is administered at the conclusion of each of the following core subject semesters of study; Biology, Algebra I, Algebra II, English I, English II, Geometry and US Government and Physical Science (MDESE, 2019). Students in Missouri are required to complete the EOC assessments in Algebra I, English II, Biology and Government prior to high school graduation. Some students complete the Algebra I EOC assessment prior to entering high school and are then required to complete the Algebra II EOC assessment. Several categories of students are designated as exempt from the EOC assessment process.

"Exempt student groups include:

- Student's whose IEP teams have determined that they are eligible to participate in the Missouri Assessment Program - Alternate (MAP-A)
- English Language Learners (ELL) who have been in the United States 12 cumulative months or fewer at the time of administration may be exempted from taking the English II and or English I assessments.
- Foreign exchange students (not required to participate, but may do so at the district's discretion)
- Home schooled students (not required to participate, but may do so at the district's discretion)
- Private school students" (MDESE, 2019)

Questar Assessment, the company responsible for the creation and management of the Missouri EOC assessments, "uses the student's correct responses and points earned

to derive the EOC scale score" (MDESE, 2019). Each student receives a scale score when he or she has had a valid attempt at a test session. Students were tested in the 2015-16, 2016-17, 2017-18, and 2018-19 academic years. Scale score ranges and their corresponding achievement levels for each year extracted from MDESE's End of Course Assessments Guide to Interpreting Results are as follows:

Table 1. Scale Score Ranges for MDESE End of Course Assessments 2018-19

2018-2019	Below Basic	Basic	Proficient	Advanced
Algebra I	325-388	389-399	400-408	409+
Algebra II	325-387	388-399	400-410	411+
Geometry	325-386	387-399	400-413	414+
English I	325-383	384-399	400-414	415+
English II	325-383	384-399	400-419	420+
Biology	Avail Fall 2019	-	-	-
Government	Untested	Untested	Untested	Untested

Note. Scale scores created from results of all Missouri students with completed assessments. Data compiled from MDESE End of Course Assessments Guide to Interpreting Results (2019).

Table 2. Scale Score Ranges for MDESE End of Course Assessments 2017-18

2017-2018	Below Basic	Basic	Proficient	Advanced
Algebra I	100-186	187-199	200-224	225-250
Algebra II	100-185	186-199	200-224	225-250
Geometry	100-188	189-199	200-244	225-250
English I	100-179	180-199	200-224	225-250
English II	100-181	182-199	200-224	225-250
Biology	100-176	177-199	200-224	225-250
Government	100-178	179-199	200-224	225-250

Note. Scale scores created from results of all Missouri students with completed assessments. Data compiled from MDESE Online End of Course Assessments Guide to Interpreting Results (2018)

Table 3. Scale Score Ranges for MDESE End of Course Assessments 2016-17

2016-2017	Below Basic	Basic	Proficient	Advanced
Algebra I	100-186	187-199	200-224	225-250
Algebra II	100-185	186-199	200-224	225-250
Geometry	100-188	189-199	200-244	225-250
English I	100-179	180-199	200-224	225-250
English II	100-181	182-199	200-224	225-250
Biology	100-176	177-199	200-224	225-250
Government	100-178	179-199	200-224	225-250

Note. Scale scores created from results of all Missouri students with completed assessments. Data compiled from MDESE Online End of Course Assessments Guide to Interpreting Results (2017)

Table 4. Scale Score Ranges for MDESE End of Course Assessments 2015-16

2015-2016	Below Basic	Basic	Proficient	Advanced
Algebra I	100-186	187-199	200-224	225-250
Algebra II	100-185	186-199	200-224	225-250
Geometry	100-187	188-199	200-244	225-250
English I	100-179	180-199	200-224	225-250
English II	100-181	182-199	200-224	225-250
Biology	100-176	177-199	200-224	225-250
Government	100-178	179-199	200-224	225-250

Note. Scale scores created from results of all Missouri students with completed assessments. Data compiled from MDESE Online End of Course Assessments Guide to Interpreting Results (2016)

The MDESE End of Course Assessments Guide to Interpreting Results indicates that “No test provides a perfect measure of a student’s ability. This is expected since all tests contain some degree of measurement error. The standard error of measurement (SEM) reports the amount of variability that can be expected in a student’s test score due to the imprecision of the test.” (MDESE, 2019) The +/- standard error is reported on student’s individual score reports but have not been indicated in the data set being analyzed.

Data Collection

The data collection process was initiated with an exempt review request proposal to the University of Missouri St. Louis (UMSL) Institutional Review Board. An exempt request was sought because each data set requested had been previously collected by the participating school district and all identifying data was removed. Upon receipt of approval from the UMSL Institutional Review Board, collection of data from the participating school district commenced.

The school district administration office was contacted concerning the data request and approval for the release of data was gained from the assistant superintendent. The data and testing coordinator for the school district was appointed to assist in providing the requested data. High school band and choir enrollment records for all students grades 9-12 in the 2018-19 academic year were provided for each of the past four years, with each record assigned a confidential unique identifier of which the researcher did not have access. The data and testing coordinator also provided the individual EOC assessment scale scores and dates of each exam, for each student. A log of all students enrolled in the Missouri Free and Reduced Lunch Program during the 2018-19 school year with each student name replaced with the same unique identifiers was provided. Demographic data, including gender and race was also provided for each unique student.

Data Analysis

Prior to analysis, the data was prepared by organizing into multiple data sets, by group and subgroup. The data set was checked for missing data. Missing data included semesters in which students were not enrolled in high school, for example a freshman during the 2018-19 school year would not have been enrolled at the high school level in the previous semesters provided in the data set.

Comparison of test scores from multiple years is required in this analysis. Because the total range of the scale scores reported in the data set have a different range potential in 2018-19 than in the three previous years, a normalized score for each test was created by dividing each score by the potential range for each test and year in which the test was taken and multiplied by 100. This provided a normalized score across all testing years in the form of a percentage of the range potential.

For example, a score on the Algebra I EOC in 2016 of 187 within the range potential of 100 to 250 (Table 4) converts to a score of 58.00% when dividing 87 (score above low end of range) by 150 (range) and multiplying by 100. A score on the same EOC in 2018 of 412 (also 87 points above low end of range) within the range potential of 325 to 453 (Table 1) calculates to a normalized percentage of 67.96%.

In response to research question 1 and 2, an analysis of variance (ANOVA) test as well as a post-hoc Tukey's HSD test will be done for four of the available EOC subjects (Algebra I, Geometry, English I, and Biology) on a single multiple condition test group.

- Test Group 1: Sample Groups 1.1, 1.2, 2.1, 2.2, 3.1, and 3.2
    - Low-SES Band – B(LSES)

- Non-Low-SES Band – B(NLSES)
- Low-SES Choir – C(LSES)
- Non-Low-SES Choir – C(NLSES)
- Low-SES Non-Music Study – NM(LSES)
- Non-Low-SES Non Music Study – NM(NLSES).

A One-Way ANOVA test was used to determine if there were any statistically significant differences between the mean scores of the six categories within the test group. If results indicate that there is a statistically significant difference among the categories within the group, a post-hoc Tukey's HSD is to determine which means were significantly different from each other. The Tukey HSD test was chosen for its conservative method of considering all possible pairwise differences in means at the same time, with unequal sample sizes. The combination of these two statistical tests appropriately reveal if, as stated in research questions 1 and 2, high school students from a low SES who enroll in band or choir score higher on core subject standardized tests than their low SES or non-low SES peers who do not engage in formal music study.

In response to research question 3, the achievement gap is defined as the difference between the mean score of two categories of students. The baseline achievement gap is measured between Low-SES Non-Music Study students and Non-Low-SES Non-Music Study students. The researcher will perform a simple comparison of means paired with results of the Tukey's HSD to determine the statistical significance of any differences in the means of the groups. For a group to report as altering the achievement gap two conditions must be met. First, there must be a statistically significant difference between the two baseline student categories, to establish the

existence of a gap. Second, there must a statistically significant difference between one (or more) of the music study conditions and the Low-SES Non-Music Study condition.

Conclusion

In this chapter the methodology used to investigate the correlational relationship between participation in band or choir in the high school setting and academic achievement, as defined by scores on standardized assessments of students of a low socioeconomic status was explained. The correlational qualitative research design, the population and sample, research questions, hypothesis, end of course assessment instrumentation, data collection and data analysis procedures were each outlined and explained.

CHAPTER IV

RESULTS

Introduction

Chapter IV will present the results from the data analysis described in Chapter III. The results are broken into four sections, each representing the results for a different End of Course Assessment (EOC). The EOC's with reported results include: Algebra I, Geometry, English I, and Biology. The results and their relationship to each research question are discussed with each test group.

Algebra I - EOC Assessment

Research Questions

1. Do high school students from a low SES who enroll in band or choir score higher on the Missouri Algebra I EOC than their low SES peers who do not enroll in formal music education?
2. Do high school students from a low SES who enroll in band or choir score higher on the Missouri Algebra I EOC than their average/above average SES peers who do not enroll in formal music education?
3. Can enrollment and participation in band or choir at the high school level narrow the achievement gap between low SES students and their average/above average SES peers for Algebra I?

Null Hypotheses

HO1. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average Algebra I test scores compared to their low SES peers who are not enrolled in formal music education.

HO2. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average Algebra I test scores compared to their average/above average SES peers who are not enrolled in formal music education.

HO3. The enrollment and participation in band or choir at the high school level does not significantly narrow the achievement gap between low SES students and their average/above average SES peers for Algebra I.

A one-way ANOVA was conducted to compare the effect of band or choir enrollment on Algebra I EOC assessment scores. The scores of 740 male and female students were analyzed. These students were separated into eight subgroups based on their enrollments in music and their socioeconomic status:

- Low-SES Band – B(LSES)
- Non-Low-SES Band – B(NLSES)
- Low-SES Choir – C(LSES)
- Non-Low-SES Choir – C(NLSES)
- Low-SES Non-Music Study – NM(LSES)
- Non-Low-SES Non Music Study – NM(NLSES)

Table 5. Algebra EOC: Sample Size(N), Mean and Standard Deviation of Categories

Condition	Abbreviation	N	Mean Score	Std Dev
Band, Low-SES	B (LSES)	35	0.69888863	0.12904796
Band, Non-Low-SES	B (NLSES)	130	0.79121509	0.12637890
Choir, Low-SES	C (LSES)	26	0.61400146	0.14760142
Choir, Non-Low-SES	C (NLSES)	38	0.74583152	0.15626231
Non-Music, Low-SES	NM (LSES)	176	0.66120461	0.11834416
Non-Music, Non-Low-SES	NM (NLSES)	335	0.72342881	0.13259633

B(NLSES) showed the greatest mean score, 79.12%, while the C(LSES) condition showed the lowest mean score, 61.40% (Table 5).

The threshold for significance is p=0.05. There was a significant effect of enrollment/SES on Algebra I EOC assessment scores at the $p < 0.05$ level for the sample containing the six conditions [$F(7, 949) = 19.07$, $p < 0.0001$].

Table 6. Algebra EOC: Degrees of Freedom (DF), Sum of Squares and ANOVA p value

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	2.31817988	0.33116855	19.07	<.0001
Error	949	16.47699085	0.01736248		
Corrected Total	956	18.79517073			
Notes. p < .0001 indicates significant effect					

Research questions focus on the relationship of music study to non-music study student scores. For this reason the researcher is reporting primarily on significant results relating to music study vs. non-music study comparisons. Post hoc comparisons using the Tukey honestly significant difference (HSD) test indicated that the mean score for the

NM(LSES) condition (M = 0.66, SD = 0.12) was significantly different ($p < 0.05$) from the following conditions (Table 7):

- B(NLSES), (M = 0.79, SD = 0.13)
- C(NLSES), (M = 0.75, SD = 0.16)
- NM(NLSES), (M = 0.72, SD = 0.13)

It is notable that the NM(LSES) mean score was not significantly different from any of the low SES conditions. This will play a role in the identification of the achievement gap.

The mean score for the NM(NLSES) condition (M = 0.72, SD = 0.13) was significantly different ($p < 0.05$) from the following conditions:

- B(NLSES), (M = 0.79, SD = 0.13)
- C(LSES), (M = 0.61, SD = 0.15)
- NM(LSES), (M = 0.66, SD = 0.12)

Notably, the only condition to show no significant difference from either non-music study condition was the Band (LSES) condition. This indicates that Low SES Band students score just as high as their non-music study peers.

Table 7. Algebra EOC: P value for each categorical combination

Least Squares Means for effect Condition Pr > |t| for H0: LSMean(i)=LSMean(j) Dependent Variable: Percentage						
i/j	**B (LSES)**	**B (NLSES)**	**C (LSES)**	**C (NLSES)**	**NM (LSES)**	**NM (NLSES)**
B (LSES)		0.0028*	0.1188	0.6373	0.6209	0.8959
B (NLSES)	0.0028*		<.0001*	0.4069	<.0001*	<.0001*
C (LSES)	0.1188	<.0001*		0.0010*	0.5132	0.0006*
C (NLSES)	0.6373	0.4069	0.0010*		0.0039*	0.9156
NM (LSES)	0.6209	<.0001*	0.5132	0.0039*		<.0001*
NM (NLSES)	0.8959	<.0001*	0.0006*	0.9156	<.0001*	
Note: * indicates statistical significance between conditions at the p<0.05 level						

Taken together, these results suggest that enrollment choices show a partial effect on EOC assessment scores for Algebra I with respect to the analyzed conditions. Specifically, there is no significant difference between the NM(LSES) condition and any of the LSES music study conditions. This provides a generally negative response to research question one. There is no evidence to suggest that students from a low SES who enroll in band or choir score higher on Algebra I than their low SES peers who do not enroll in music education. HO1 is accepted.

Interestingly, there is no statistically significant difference between the mean scores of the B(LSES) condition and the NM(NLSES) condition ($p = 0.8959$), but there is a significant difference when comparing the C(LSES) condition with the NM(NLSES) condition ($p = 0.0006$). C(LSES) has a lower mean score than that of the NM(NLSES) condition (0.61 vs 0.72). In response to research question two, this indicates that there is no evidence that students from a low SES who enroll in band or choir score higher on

Algebra I than their average/above average peers who do not enroll in music education. HO2 is accepted. There is evidence to suggest, however, that Low SES Band students score statistically just as high as Non-Music Non-Low SES students.

In response to research question three we see in Table 8 that there is a statistically significant difference in the mean of the NM(NLSES) condition and the NM(LSES), ($p < 0.001$). These two means create a baseline achievement gap of 6.22% (Table 9). For a condition to have altered the achievement gap it must have a statistically significant difference from the low end of the baseline condition. In this case, the NM(LSES) baseline condition does not have a statistically significant difference from any of the three low-SES music study conditions (Table 8). A conclusion can then be drawn that enrollment in band and or choir at the high school level does not narrow the achievement gap between low SES students and their average/above average SES peers. The null hypotheses is accepted.

Table 8. Algebra EOC: Percentage Gap between mean of NM(NLSES) and all other Categories

Conditon	Mean %	NM(NLSES) Mean %	Gap %
B (LSES)	69.98	72.34	2.36
B (NLSES)	79.12	72.34	-6.78
C (LSES)	61.40	72.34	10.94
C (NLSES)	74.58	72.34	-2.24
NM (LSES)	66.12	72.34	6.22

Notes. NM(LSES) serves as the baseline low of the gap. NM(NLSES) serves as the high end of the gap. A negative Gap % indicates a condition that has a higher score than the high end of the gap, called an inverse gap

It is notable that while the focus of this research is on low-SES students, the results of these tests indicate that Non-Low SES Band Students score significantly higher on the Algebra I EOC than their peers of any SES who do not study music (Table 7 and 8). While the research does not reveal a significant narrowing of the achievement gap between low SES conditions, it does indicate an inverse gap related to Non-Low SES categories (Table 8). That is, there is a gap between the music study and non-music study students of a Non-Low SES wherein the music study students have a greater mean score, and significantly so in the case of the Band condition.

In summary, the answers to research questions 1, 2, and 3 are all no. This results in an acceptance of the researcher's stated null hypothesis for each question. While enrollment in music did not appear to have any significant impact on Algebra I test scores of low SES students, the research did reveal that students of a non-low SES who enroll in band or choir have significantly higher test scores than any other condition, with Non-Low SES Band students leading the set as shown in Figure 5.

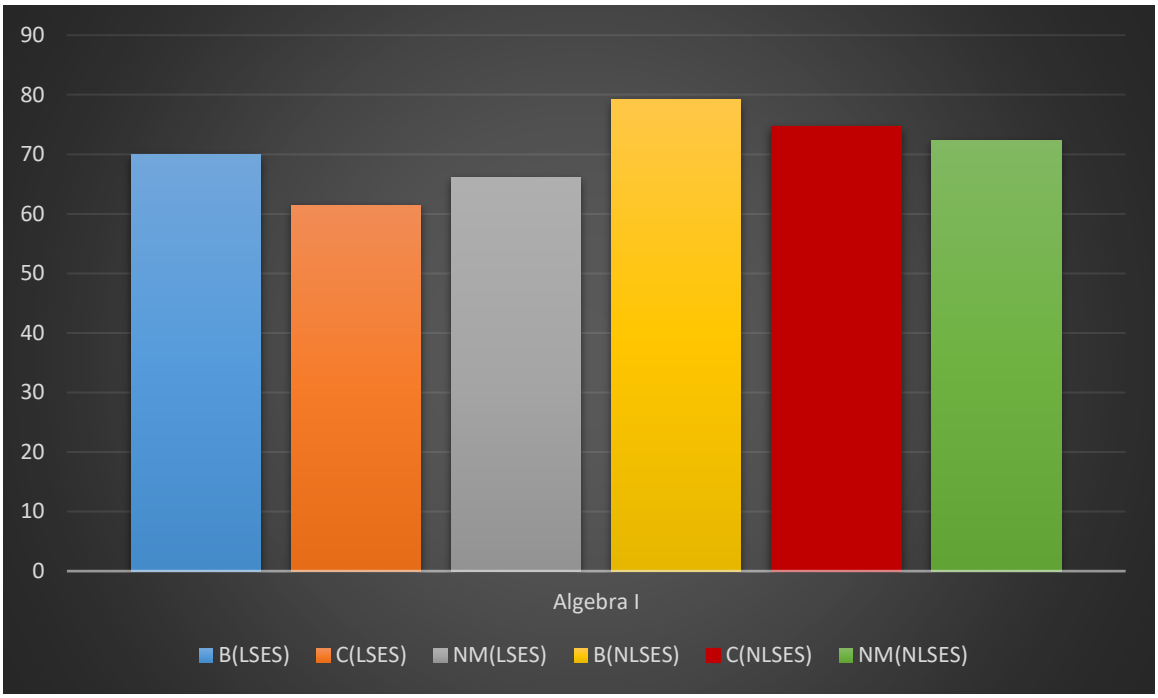

Figure 5. Algebra Summary – Mean EOC Score. This figure illustrates the mean scores across all six conditions.

Geometry - EOC Assessment

Research Questions

1. Do high school students from a low SES who enroll in band or choir score higher on the Missouri Geometry EOC than their low SES peers who do not enroll in formal music education?
2. Do high school students from a low SES who enroll in band or choir score higher on the Missouri Geometry EOC than their average/above average SES peers who do not enroll in formal music education?

3. Can enrollment and participation in band or choir at the high school level narrow the achievement gap between low SES students and their average/above average SES peers for Geometry?

Null Hypotheses

HO1. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average Geometry test scores compared to their low SES peers who are not enrolled in formal music education.

HO2. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average Geometry test scores compared to their average/above average SES peers who are not enrolled in formal music education.

HO3. The enrollment and participation in band or choir at the high school level does not significantly narrow the achievement gap between low SES students and their average/above average SES peers for Geometry.

A one-way ANOVA was conducted to compare the effect of band or choir enrollment on Geometry EOC assessment scores. The scores of 241 male and female students were analyzed. These students were separated into six subgroups based on their enrollments in music and their socioeconomic status:

- Low-SES Band – B(LSES)
- Non-Low-SES Band – B(NLSES)
- Low-SES Choir – C(LSES)

- Non-Low-SES Choir – C(NLSES)
- Low-SES Non-Music Study – NM(LSES)
- Non-Low-SES Non Music Study – NM(NLSES).

Table 9. Geometry EOC: Sample Size(N), Mean and Standard Deviation of Categories

Condition	Abbreviation	N	Mean Score	Std Dev
Band, Low-SES	B (LSES)	10	0.76800000	0.17412355
Band, Non-Low-SES	B (NLSES)	59	0.81152542	0.13697795
Choir, Low-SES	C (LSES)	4	0.74500000	0.20957629
Choir, Non-Low-SES	C (NLSES)	13	0.89230769	0.12932435
Non-Music, Low-SES	NM (LSES)	32	0.66770833	0.09353449
Non-Music, Non-Low-SES	NM (NLSES)	123	0.76964770	0.12814269

C(NLSES) had the greatest mean score, 89.23%, while the NM(LSES) condition had the lowest mean score, 66.77% (Table 9). As a result of a small sample size, the standard deviation of both B(LSES) and C(LSES) are rather high at above 0.17.

The threshold for significance is p=0.05. There was a significant effect of enrollment/SES on Geometry EOC assessment scores at the $p < 0.05$ level for the sample containing the six conditions [$F(5, 235) = 7.49$, $p < 0.0001$] (Table 10).

Table 10. Geometry EOC: Degrees of Freedom (DF), Sum of Squares and ANOVA p value

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	0.63208609	0.12641722	7.49	<.0001
Error	235	3.96810349	0.01688555		
Corrected Total	240	4.60018958			
Notes. p < .0001 indicates significant effect					

Research questions focus on the relationship of music study to non-music study student scores. For this reason the researcher is reporting primarily on significant results relating to music study vs. non-music study comparisons. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the NM(LSES) condition ($M = 0.67$, $SD = 0.09$) was significantly different ($p < 0.05$) from the following conditions (Table 11):

- B(NLSES), ($M = 0.81$, $SD = 0.14$)
- C(NLSES), ($M = 0.89$, $SD = 0.13$)
- NM(NLSES), ($M = 0.77$, $SD = 0.13$)

It is notable that the NM(LSES) mean score was not significantly different from any of the low SES conditions. This will play a role in the identification of the achievement gap for research question three.

The mean score for the NM(NLSES) condition ($M = 0.77$, $SD = 0.13$) was significantly different ($p < 0.05$) from the following conditions:

- C(LSES), ($M = 0.75$, $SD = 0.21$)
- NM(LSES), ($M = 0.67$, $SD = 0.09$)

Notably, neither the B(LSES) nor the C(LSES) condition showed a significant difference from either non-music study condition. In fact, these two conditions showed no significant difference in mean from any other condition in the test.

Table 11. Geometry EOC: P value for each categorical combination

Least Squares Means for effect Condition Pr > |t| for H0: LSMean(i)=LSMean(j) Dependent Variable: Percentage						
i/j	**B (LSES)**	**B (NLSES)**	**C (LSES)**	**C (NLSES)**	**NM (LSES)**	**NM (NLSES)**
B (LSES)		0.9241	0.9997	0.2088	0.2753	1.0000
B (NLSES)	0.9241		0.9205	0.3291	<.0001*	0.3257
C (LSES)	0.9997	0.9205		0.3554	0.8721	0.9990
C (NLSES)	0.2088	0.3291	0.3554		<.0001*	0.0172*
NM (LSES)	0.2753	<.0001*	0.8721	<.0001*		0.0014*
NM (NLSES)	1.0000	0.3257	0.9990	0.0172*	0.0014*	
Note: * indicates statistical significance between conditions at the p<0.05 level						

Taken together, these results suggest that enrollment choices show a partial effect on EOC assessment scores for Geometry with respect to the analyzed conditions. Specifically, there is no significant difference between the NM(LSES) condition and any of the LSES music study conditions. This provides a generally negative response to research question 1. There is no evidence to suggest that students from a low SES who enroll in band or choir score higher on Geometry than their low SES peers who do not enroll in music education. The first null hypothesis is accepted.

Interestingly, there is no statistically significant difference between the mean scores of the B(LSES) or C(LSES) conditions and the NM(NLSES) condition ($p = 1.000$, $p = 0.9990$). In response to research question 2, this indicates that there is no evidence that students from a low SES who enroll in band and/or choir score higher on Geometry than their average/above average peers who do not enroll in music education. The null hypothesis, HO2, is accepted. This same evidence suggests, however, that Low SES

Band and Choir students score statistically just as high as Non-Music Non-Low SES students, which is notable.

In response to research question 3 we see in Table 11 that there is a statistically significant difference in the mean of the NM(NLSES) condition and the NM(LSES), ($p = 0.0014$). These two means create a baseline achievement gap of 10.19% (Table 12). For a condition to have altered the achievement gap it must have a statistically significant difference from the low end of the baseline condition. In this case, the NM(LSES) baseline condition does not have a statistically significant difference from any of the two low-SES music study conditions (Table 11). A conclusion can then be drawn that enrollment in band and or choir at the high school level does not narrow the achievement gap between low SES students and their average/above average SES peers. HO3, the third null hypothesis, is accepted.

Table 12. Geometry EOC: Percentage Gap between mean of NM(NLSES) and all other Categories

Condition	Mean %	NM(NLSES) Mean %	Gap %
B (LSES)	76.80	76.96	0.16
B (NLSES)	81.15	76.96	-4.19
C (LSES)	74.50	76.96	2.46
C (NLSES)	89.23	76.96	-12.27
NM (LSES)	66.77	76.96	10.19

Notes. NM(LSES) serves as the baseline low of the gap. NM(NLSES) serves as the high end of the gap. A negative Gap % indicates a condition that has a higher score than the high end of the gap, called an inverse gap

It is notable that while the focus of this research is on the increased academic achievement of low-SES students through music study, the results of these tests indicate

that all categories of non-low SES music students score equal to or significantly higher on the Geometry EOC than their peers of any SES who do not study music (Tables 9 and 11). While the research does not reveal a significant narrowing of the achievement gap between low SES categories, it does indicate an inverse gap related to Non-Low SES categories (Table 12). That is, there is a gap between the music study and non-music study students of an Non-Low SES wherein the music study students have a greater mean score, and significantly so in the case of the Choir condition.

In summary, the answers to research questions 1, 2, and 3 are all negative. This results in an acceptance of the researcher's stated null hypotheses for each question. While enrollment in music did not appear to have any significant impact on Geometry test scores of low SES students, the research did reveal that students of a non-low SES who enroll in band or choir have significantly higher test scores than any other condition, with Non-Low SES Choir students leading the Geometry set, as shown in Figure 6.

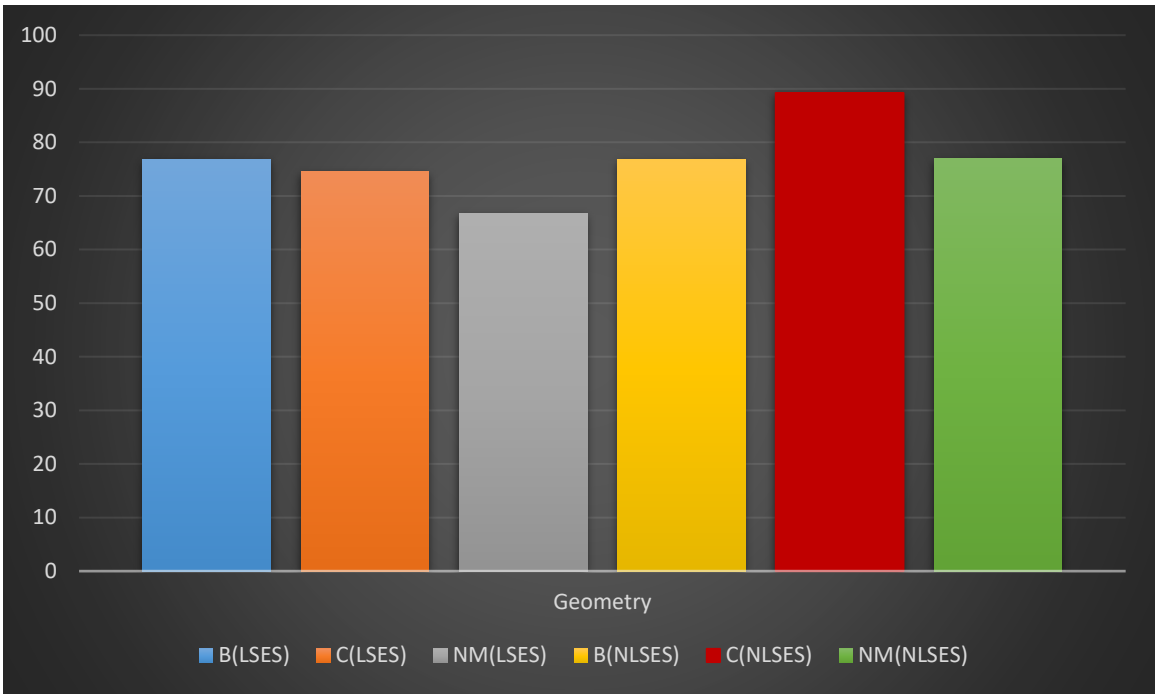

Figure 6. Geometry Summary – Mean EOC Score. This figure illustrates the mean scores across all six conditions.

English I - EOC Assessment

Research Questions

1. Do high school students from a low SES who enroll in band or choir score higher on the Missouri English I EOC than their low SES peers who do not enroll in formal music education?
2. Do high school students from a low SES who enroll in band or choir score higher on the Missouri English I EOC than their average/above average SES peers who do not enroll in formal music education?
3. Can enrollment and participation in band or choir at the high school level narrow the achievement gap between low SES students and their average/above average SES peers for English I?

Null Hypotheses

HO1. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average English I test scores compared to their low SES peers who are not enrolled in formal music education.

HO2. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average English I test scores compared to their average/above average SES peers who are not enrolled in formal music education.

HO3. The enrollment and participation in band or choir at the high school level does not significantly narrow the achievement gap between low SES students and their average/above average SES peers for English I.

A one-way ANOVA was conducted to compare the effect of band or choir enrollment on English I EOC assessment scores. The scores of 488 male and female students were analyzed. These students were separated into six subgroups based on their enrollments in music and their socioeconomic status:

- Low-SES Band – B(LSES)
- Non-Low-SES Band – B(NLSES)
- Low-SES Choir – C(LSES)
- Non-Low-SES Choir – C(NLSES)
- Low-SES Non-Music Study – NM(LSES)
- Non-Low-SES Non Music Study – NM(NLSES).

Table 13. English I EOC: Sample Size(N), Mean and Standard Deviation of Categories

Condition	Abbreviation	N	Mean Score	Std Dev
Band, Low-SES	B (LSES)	16	0.72500000	0.08409871
Band, Non-Low-SES	B (NLSES)	80	0.79216667	0.08976779
Choir, Low-SES	C (LSES)	22	0.66878788	0.09813901
Choir, Non-Low-SES	C (NLSES)	24	0.74805556	0.10758624
Non-Music, Low-SES	NM (LSES)	109	0.67951070	0.08839076
Non-Music, Non-Low-SES	NM (NLSES)	237	0.72652602	0.10182413

B(NLSES) had the greatest mean score, 79.21%, while the C(LSES) condition had the lowest mean score, 66.87% (Table 13).

The threshold for significance is p=0.05. There was a significant effect of enrollment/SES on English I EOC assessment scores at the $p < 0.05$ level for the sample containing the six conditions [$F(5, 482) = 14.33$, $p < 0.0001$] (Table 14).

Table 14. English I EOC: Degrees of Freedom (DF), Sum of Squares and ANOVA p value

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	0.66926711	0.13385342	14.33	<.0001
Error	482	4.50184837	0.00933993		
Corrected Total	487	5.17111548			
Notes. $p < .0001$ indicates significant effect					

Research questions focus on the relationship of music study to non-music study student scores. For this reason the researcher is reporting primarily on significant results relating to music study vs. non-music study comparisons. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the NM(LSES) condition (M = 0.68,

SD = 0.09) was significantly different ($p < 0.05$) from the following conditions (Table 15):

- B(NLSES), (M = 0.79, SD = 0.09)
- C(NLSES), (M = 0.75, SD = 0.11)
- NM(NLSES), (M = 0.73, SD = 0.10)

It is notable that the NM(LSES) mean score was not significantly different from any of the low SES conditions. This will play a role in the identification of the achievement gap.

The mean score for the NM(NLSES) condition (M = 0.73, SD = 0.10) was significantly different ($p < 0.05$) from the following conditions:

- B(NLSES), (M = 0.79, SD = 0.09)
- NM(LSES), (M = 0.68, SD = 0.09)

Notably, neither the B(LSES) nor the C(LSES) condition showed a significant difference from either non-music study condition. In fact, the B(LSES) condition showed no significant difference in mean from any other condition in the test.

Table 15. English I EOC: P value for each categorical combination

Least Squares Means for effect Condition Pr > |t| for H0: LSMean(i)=LSMean(j) Dependent Variable: Percentage						
i/j	**B (LSES)**	**B (NLSES)**	**C (LSES)**	**C (NLSES)**	**NM (LSES)**	**NM (NLSES)**
B (LSES)		0.1153	0.4861	0.9769	0.4940	1.0000
B (NLSES)	0.1153		<.0001*	0.3664	<.0001*	<.0001*
C (LSES)	0.4861	<.0001*		0.0626	0.9970	0.0810
C (NLSES)	0.9769	0.3664	0.0626		0.0216*	0.9042
NM (LSES)	0.4940	<.0001*	0.9970	0.0216*		0.0004*
NM (NLSES)	1.0000	<.0001*	0.0810	0.9042	0.0004*	
Note: * indicates statistical significance between conditions at the p<0.05 level						

Taken together, these results suggest that enrollment choices show a partial effect on EOC assessment scores for English I with respect to the analyzed conditions. Specifically, there is no significant difference between the NM(LSES) condition and any of the LSES music study conditions. This provides a generally negative response to research question 1. There is no evidence to suggest that students from a low SES who enroll in band or choir score higher on English I than their low SES peers who do not enroll in music education. The first null hypothesis, HO1, is accepted.

Interestingly, there is not a statistically significant difference between the mean scores of the B(LSES) or C(LSES) conditions and the NM(NLSES) condition ($p = 1.000$, $p = 0.0810$). In response to research question 2, this indicates that there is no evidence that students from a low SES who enroll in band and/or choir score higher on English I than their average/above average peers who do not enroll in music education. HO2, the second null hypothesis, is accepted. This same evidence suggests, however, that Low

SES Band and Choir students score statistically just as high as Non-Music Non-Low SES students, which is notable.

In response to research question 3 we see in Table 15 that there is a statistically significant difference in the mean of the NM(NLSES) condition and the NM(LSES), ($p = 0.0004$). These two means create a baseline achievement gap of 4.70% (Table 16). For a condition to have altered the achievement gap it must have a statistically significant difference from the low end of the baseline condition. In this case, the NM(LSES) baseline condition does not have a statistically significant difference from any of the two low-SES music study conditions (Table 15). A conclusion can then be drawn that enrollment in band and or choir at the high school level does not narrow the achievement gap between low SES students and their average/above average SES peers. Thus, HO3 is accepted.

Table 16. English I EOC: Percentage Gap between mean of NM(NLSES) and all other Categories

Condition	Mean %	NM(NLSES) Mean %	Gap %
B (LSES)	72.50	72.65	0.15
B (NLSES)	79.21	72.65	-6.56
C (LSES)	66.88	72.65	5.77
C (NLSES)	74.80	72.65	-2.15
NM (LSES)	67.95	72.65	4.70

Notes. NM(LSES) serves as the baseline low of the gap. NM(NLSES) serves as the high end of the gap. A negative Gap % indicates a conditon that has a higher score than the high end of the gap, called an inverse gap

It is notable that while the focus of this research is on low-SES students, the results of these tests indicate that all categories of non-low SES music students score

equal to or significantly higher on the English EOC than their peers of any SES who do not study music (Table 13 and 15). While the research does not reveal a significant narrowing of the achievement gap between low SES categories, it does indicate an inverse gap related to Non-Low SES categories (Table 15). That is, there is a gap between the music study and non-music study students of a Non-Low SES wherein the music study students have a greater mean score, and significantly so in the case of the Band condition.

In summary, the research results indicate a negative response to all three research questions. This result matches the researcher's stated null hypothesis for each question. While enrollment in music did not appear to have a statistically significant impact on English I test scores of low SES students, the research did reveal that students of a non-low SES who enroll in band or choir have significantly higher test scores than any other condition, with Non-Low SES Band students leading the English I set, as shown in Figure 7.

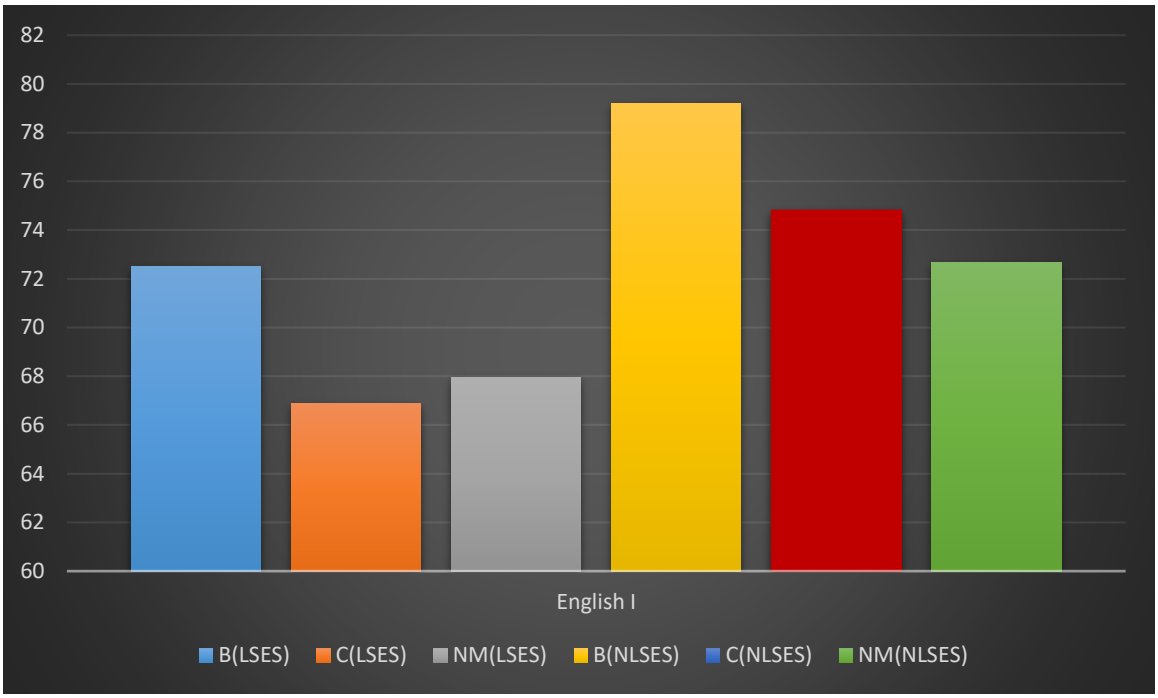

Figure 7. English Summary – Mean EOC Score. This figure illustrates the mean scores across all six conditions.

Biology - EOC Assessment

Research Questions

1. Do high school students from a low SES who enroll in band or choir score higher on the Missouri Biology EOC than their low SES peers who do not enroll in formal music education?
2. Do high school students from a low SES who enroll in band or choir score higher on the Missouri Biology EOC than their average/above average SES peers who do not enroll in formal music education?

3. Can enrollment and participation in band or choir at the high school level narrow the achievement gap between low SES students and their average/above average SES peers for Biology?

Null Hypotheses

HO1. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average Biology test scores compared to their low SES peers who are not enrolled in formal music education.

HO2. Students of a low SES who are enrolled in band or choir at the high school level do not show higher average Biology test scores compared to their average/above average SES peers who are not enrolled in formal music education.

HO3. The enrollment and participation in band or choir at the high school level does not significantly narrow the achievement gap between low SES students and their average/above average SES peers for Biology.

A one-way ANOVA was conducted to compare the effect of band or choir enrollment on Biology EOC assessment scores. The scores of 450 male and female students were analyzed. These students were separated into six subgroups based on their enrollments in music and their socioeconomic status:

- Low-SES Band – B(LSES)
- Non-Low-SES Band – B(NLSES)
- Low-SES Choir – C(LSES)

- Non-Low-SES Choir – C(NLSES)
- Low-SES Non-Music Study – NM(LSES)
- Non-Low-SES Non Music Study – NM(NLSES).

Table 17. Biology EOC: Sample Size(N), Mean and Standard Deviation of Categories

Condition	Abbreviation	N	Mean Score	Std Dev
Band, Low-SES	B (LSES)	23	0.70463768	0.11012270
Band, Non-Low-SES	B (NLSES)	67	0.77671642	0.11886882
Choir, Low-SES	C (LSES)	17	0.72235294	0.09252451
Choir, Non-Low-SES	C (NLSES)	26	0.81435897	0.14629884
Non-Music, Low-SES	NM (LSES)	97	0.71436426	0.11278602
Non-Music, Non-Low-SES	NM (NLSES)	220	0.78203030	0.11178964

C(NLSES) had the greatest mean score, 81.43%, while the B(LSES) condition had the lowest mean score, 70.46% (Table 17).

The threshold for significance is p=0.05. There was a significant effect of enrollment/SES on Biology EOC assessment scores at the $p < 0.05$ level for the sample containing the six conditions [$F(5, 444) = 7.56$, $p < 0.0001$] (Table 18).

Table 18. Biology EOC: Degrees of Freedom (DF), Sum of Squares and ANOVA p value

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	0.49652273	0.09930455	7.56	<.0001
Error	444	5.82942927	0.01312935		
Corrected Total	449	6.32595200			
Notes. p < .0001 indicates significant effect					

Research questions focus on the relationship of music study to non-music study student scores. For this reason the researcher is reporting primarily on significant results relating to music study vs. non-music study comparisons. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the NM(LSES) condition ($M = 0.71$, $SD = 0.11$) was significantly different ($p < 0.05$) from the following conditions (Table 19):

- B(NLSES), ($M = 0.78$, $SD = 0.12$)
- C(NLSES), ($M = 0.81$, $SD = 0.15$)
- NM(NLSES), ($M = 0.78$, $SD = 0.11$)

It is notable that the NM(LSES) mean score was not significantly different from any of the low SES conditions. This will play a role in the identification of the achievement gap when addressing research question three.

The mean score for the NM(NLSES) condition ($M = 0.78$, $SD = 0.11$) was significantly different ($p < 0.05$) from the following conditions:

- B(LSES), ($M = 0.70$, $SD = 0.11$)
- NM(LSES), ($M = 0.71$, $SD = 0.11$)

Notably, neither the B(LSES) nor the C(LSES) condition showed a significant difference from the NM(LSES) condition. In fact, the C(LSES) condition showed no significant difference in mean from any other condition in the test.

Table 19. Biology EOC: P value for each categorical combination

Least Squares Means for effect Condition Pr > |t| for H0: LSMean(i)=LSMean(j) Dependent Variable: Percentage						
i/j	**B (LSES)**	**B (NLSES)**	**C (LSES)**	**C (NLSES)**	**NM (LSES)**	**NM (NLSES)**
B (LSES)		0.0986	0.9967	0.0114*	0.9991	0.0264*
B (NLSES)	0.0986		0.5014	0.7138	0.0087*	0.9995
C (LSES)	0.9967	0.5014		0.1058	0.9998	0.3056
C (NLSES)	0.0114*	0.7138	0.1058		0.0013*	0.7506
NM (LSES)	0.9991	0.0087*	0.9998	0.0013*		<.0001*
NM (NLSES)	0.0264*	0.9995	0.3056	0.7506	<.0001*	
Note: * indicates statistical significance between conditions at the p<0.05 level						

Taken together, these results suggest that enrollment choices show a partial effect on EOC assessment scores for Biology with respect to the analyzed conditions. Specifically, there is no significant difference between the NM(LSES) condition and any of the LSES music study conditions. This provides a generally negative response to research question 1. There is no evidence to suggest that students from a low SES who enroll in band or choir score higher on Biology than their low SES peers who do not enroll in music education. HO1, the first null hypothesis, is accepted.

Interestingly, there is no statistically significant difference between the mean score of the C(LSES) condition and the NM(NLSES) condition ($p = 0.3056$) for the Biology test. There is, however, a significant difference between the B(LSES) condition and the NM(NLSES) condition ($p = 0.0264$). In this case, B(LSES) has a significantly lower mean score than the NM(NLSES) condition (0.70 vs 0.78). In response to research question 2, this indicates that there is no evidence that students from a low SES who

enroll in band or choir score higher on Algebra I than their average/above average peers who do not enroll in music education. The second null hypothesis, HO2, is accepted. This same evidence suggests, however, that Low SES Choir students score statistically just as high as Non-Music Non-Low SES students, which is notable.

In response to research question 3 we see in Table 19 that there is a statistically significant difference in the mean of the NM(NLSES) condition and the NM(LSES), ($p < 0.0001$). These two means create a baseline achievement gap of 6.77% (Table 20). For a condition to have altered the achievement gap it must have a statistically significant difference from the low end of the baseline condition. In this case, the NM(LSES) baseline condition does not have a statistically significant difference from any of the two low-SES music study conditions (Table 19). A conclusion can then be drawn that enrollment in band and or choir at the high school level does not narrow the achievement gap between low SES students and their average/above average SES peers in Biology. HO3, the third null hypothesis, is accepted.

Table 20. Biology EOC: Percentage Gap between mean of NM(NLSES) and all other Categories

Condition	Mean %	NM(NLSES) Mean %	Gap %
B (LSES)	70.46	78.20	7.74
B (NLSES)	77.67	78.20	0.53
C (LSES)	72.23	78.20	5.97
C (NLSES)	81.43	78.20	-3.23
NM (LSES)	71.43	78.20	6.77

Notes. NM(LSES) serves as the baseline low of the gap. NM(NLSES) serves as the high end of the gap. A negative Gap % indicates a condition that has a higher score than the high end of the gap, called an inverse gap

It is notable that while the focus of this research is on low-SES students, the results of these tests indicate that all categories of non-low SES music students score equal to or significantly higher on the Biology EOC than their peers of any SES who do not study music with the exception of the B(LSES)/NM(NLSES) relationship (Table 17 and 19). While the research does not reveal a significant narrowing of the achievement gap between low SES categories, it does indicate an inverse gap related to a single Non-Low SES condition (Table 20). That is, there is a gap between the choir and non-music study students of a Non-Low SES wherein the choir students have a greater mean score. This is the only test in the study in which B(NLSES) did not create an inverse gap as well.

In summary, the research results indicate a negative response to all three research questions. This result matches the researcher's stated null hypothesis for each research question. While enrollment in music did not appear to have any significant impact on Biology test scores of low SES students, the research did reveal that students of a non-low SES who enroll in band or choir have equal or significantly higher test scores than almost any other condition, with Non-Low SES Choir students leading the Biology set, as shown in Figure 8.

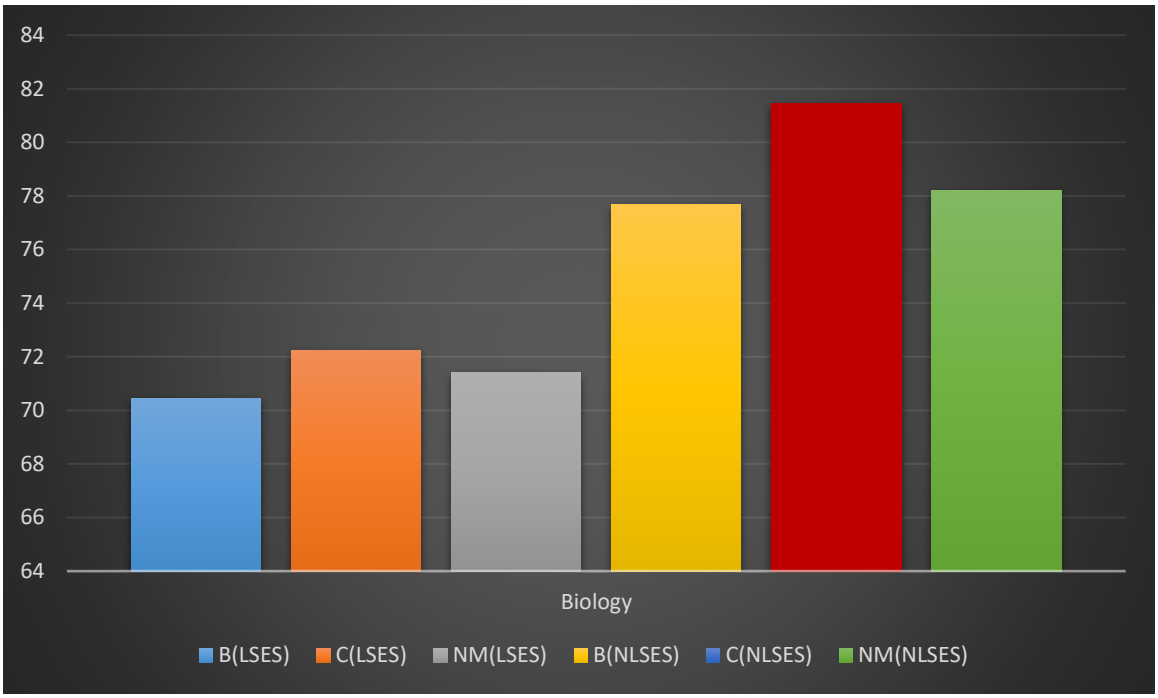

Figure 8. Biology Summary – Mean EOC Score. This figure illustrates the mean scores across all six conditions.

Summary of Findings

The results in all four core subject test groups indicated relatively consistent findings. As can be seen in Figure 9 the mean EOC scores stayed consistently within the 60-80 range with very few outliers. When viewing the mean scores by subject as demonstrated in Figure 10, however, it is apparent that scores within conditions varied widely depending on the subject being tested. Regardless of the raw mean scores for this sample, there were not statistical significances relevant to the research questions presented. In all four cases, in relation to the presented research questions, the following results were determined:

- There is no evidence to suggest that students from a low SES who enroll in band or choir score statistically significantly higher than their low SES peers who do not enroll in music education
- There is no evidence that students from a low SES who enroll in band or choir score statistically significantly higher than their average/above average peers who do not enroll in music education.
- Enrollment in band and or choir at the high school level does not narrow the achievement gap between low SES students and their average/above average SES peers in a statistically significant way.

A complete summary of findings, including notable results and trends, their relation to the currently available literature and implications for future research will be presented in the following chapter.

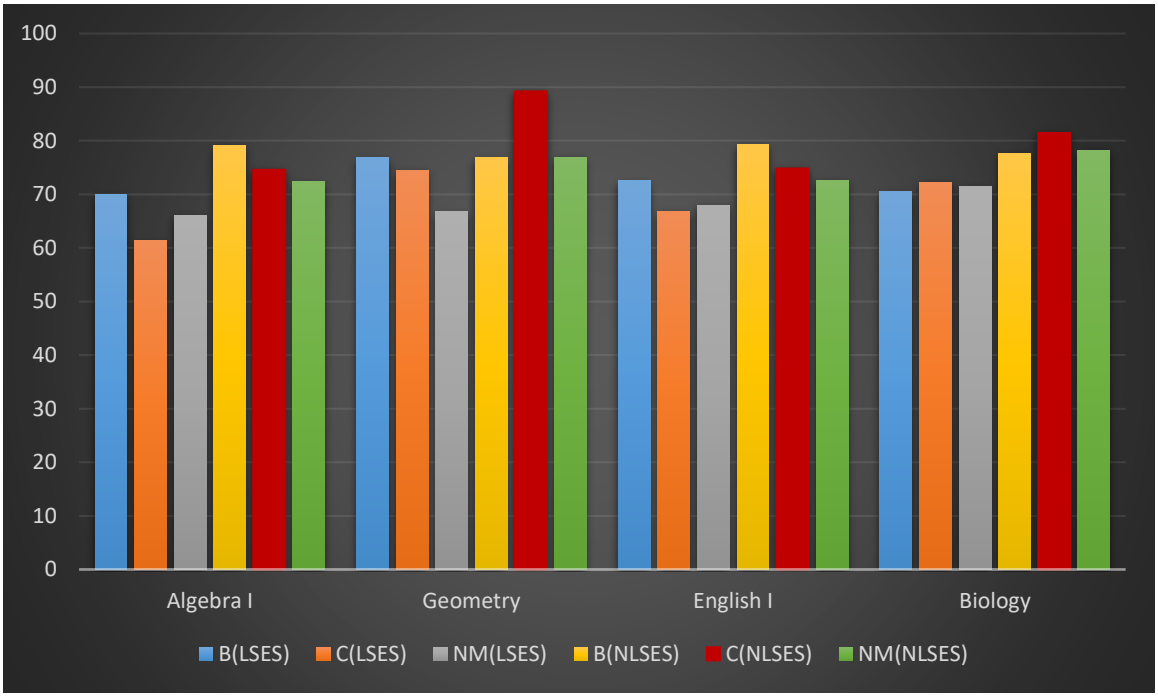

Figure 9. Full Assessment Summary – Mean EOC Score by Subject. This figure illustrates the mean scores across all four subjects.

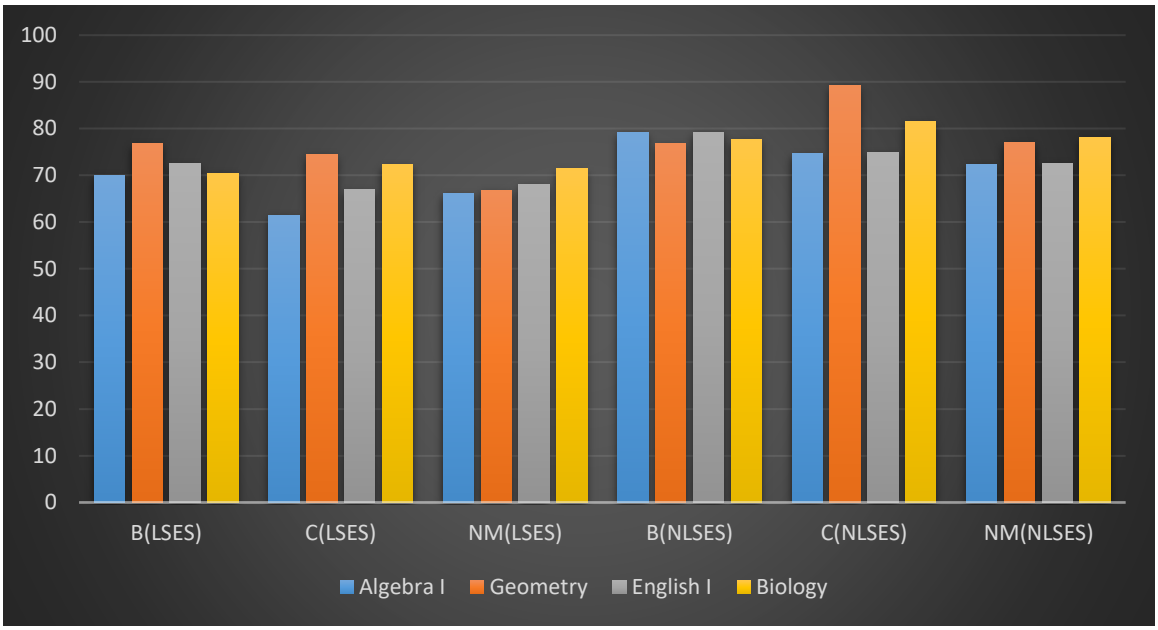

Figure 10. Full Assessment Summary – Mean EOC by Condition. This figure illustrates the mean scores across all conditions.

CHAPTER V

CONCLUSION

Introduction

This chapter contains a full summary of the results of the study including a discussion of the results and their relationship to the theoretical framework and relevant literature. Notable trends and patterns are identified and discussed. The limitations of the study are addressed and recommendations for future research are made.

Summary of Findings

The theoretical framework noted in Chapter I, Bronfenbrenner's ecological systems theory, indicates that there is a clear relationship between the different ecological systems in which a student learns. That relationship is complex, intertwining, and is theorized to be a leading factor in the individual course of development that each person journeys through (Brofenbrenner, 1979). The participation in music study, enrollment in band or choir, serves as one of the many microsystems in which students can learn. The intent of this study was to determine if students' participation in the music study microsystem has a significant effect on academic achievement in core subject areas. It is generally concluded in previous research literature that music study students show higher scores on core subject assessments than their non-music study peers (Elpus, 2013; Olson, 2010; Fitzpatrick, 2006; Thomas, 2011; Costa Giomi, 1999; Babo, 2004). This conclusion is often attributed less to music's ability to improve students' prowess in other subject areas and more to the potential self-selection of students into music. The theory is that students who already have the potential to be successful in core subject areas are

somehow more attracted to music study. In short, it may not be that the music study is contributing to the student's core academic success, it may simply be that academically successful students choose music (Fitzpatrick, 2006; Hash, 2011; Kinney, 2008; Elpus, 2013).

In an attempt to undermine a piece of that theoretical argument the researcher chose to study specifically those students whom, current literature shows, are the lowest scoring category of students in most districts. These are students from families of low-income. Low-socioeconomic status students, as outlined in Chapter II, often face an uphill battle toward success in academics with roadblocks including; parental involvement, available resources, and the prevailing impact of the ecological system of poverty (Arnold & Doctoroff, 2003; Cooper & Crosnoe, 2007; Flores, 2007; Taylor, 2005). The idea being that if students who normally would have been in the lowest scoring category move up academically, simply due to music enrollment, it may provide evidence that music study itself plays a role in the increased achievement in other core subject areas.

In direct response to all three research questions, the results of this study can be summarized as follows:

- There is no evidence to suggest that students from a low SES who enroll in band and/or choir score higher on core subject assessments than their low SES peers who do not enroll in music education.
- There is no evidence to suggest that students from a low SES who enroll in band and/or choir score higher on core subject assessments than their average/above average peers who do not enroll in music education.

- Enrollment in band and/or choir at the high school level does not significantly narrow the achievement gap between low SES students and their average/above average peers.

Conclusions

Low-SES Music Study vs. Low-SES Non-Music Study

The first of three research questions asked the following: do high school students from a low SES who enroll in band or choir score higher on core subject standardized tests than their low SES peers who do not enroll in formal music education?

This question was asked in order to determine if low-SES music study students could set themselves apart from their non-music peers simply through enrollment in band or choir. The study of four subjects (Algebra, Geometry, English and Biology) each led to similar overall conclusions with unique subject specific outcomes.

All four subject assessments showed that there is no evidence to suggest that students from a low SES who enroll in band or choir score statistically significantly higher than their low SES peers who do not enroll in music education. While the results did not meet the threshold of statistical significance, there were noteworthy results across the whole that are worth reporting for the sake of practical pedagogy.

Ranking scores among categories of students variedly widely depending on the subject area being assessed. The mean score of low-SES band students in this study was consistently the highest among the low-SES categories in Algebra, Geometry and English. Conversely, low-SES band students actually had the lowest mean score among

the low-SES categories on the Biology EOC. Low-SES Choir students had the lowest mean scores on the Algebra and English EOC but ranked middle in Geometry and highest on the Biology EOC. Non-Music Low-SES students did not have the highest mean score on any assessment in this study. This result shows music study having a strong correlation to high academic achievement in English(Reading) and Mathematics which largely mirrors a result of Babo's 2004 study.

Table 21. Low SES v. Low SES Summary: Mean scores by subject and condition

	Algebra	Geometry	English	Biology
Band - LSES	69.8	76.8	72.5	70.4
Choir - LSES	61.4	74.5	66.8	72.2
Non-Music – LSES	66.1	66.7	67.9	71.4
Notes. Green highlight indicates highest mean for subject, red highlight indicates lowest mean for subject.				

The lack of statistical significance in the results of the study and the variety of rankings of mean scores lead the researcher to the conclusion that, while participation in band appears to show a greater occurrence of higher mean scores, the window for self-selection into band stays open in the case of low-SES students. As Elpus stated in a 2013 study, "…music is somehow attractive to those students who are already likely to perform well academically." It is reasonable to conclude, from these results alone, that low-SES students with the most academic potential have self-selected into music, particularly band.

Low-SES Music Study vs. Average/Above Average-SES Non-Music Study

The second research question asked the following: do high school students from a low SES who enroll in band and/or choir score higher on core subject standardized tests than their average/above average SES peers who do not enroll in formal music education?

With the basic assumption, drawn from current literature, that students of a low-socioeconomic status score lower than their non-low-SES peers, this question was asked to understand if low-SES music study students could break the trend simply through enrollment in band or choir. The study of four subjects (Algebra, Geometry, English and Biology) each led to similar overall conclusions with unique subject specific outcomes.

All four subject assessments showed that there is no evidence to suggest that students from a low SES who enroll in band or choir score statistically significantly higher than their average/above average SES peers who do not enroll in music education. While the results didn't meet the threshold of statistical significance, there were again noteworthy results across the whole that are worth reporting for the sake of practical pedagogy.

Ranking scores among categories of students had little variation depending on the subject area being assessed. The mean score of Non-Low-SES Non-Music study students in this study was consistently the highest among all three categories relating to this research question. Conversely, Low-SES choir students actually had the lowest mean score on all but the Biology EOC. Low-SES music study students did not have the

highest mean score on any assessment when comparing categories related to the second research question.

Table 22. Low SES v. Average/Above Average SES Summary: Mean scores by subject and condition

	Algebra	Geometry	English	Biology
Band - LSES	69.8	76.8	72.5	70.4
Choir - LSES	61.4	74.5	66.8	72.2
Non-Music – NLSES	72.3	76.9	72.6	78.2
Notes. Green highlight indicates highest mean for subject, red highlight indicates lowest mean for subject.				

The lack of statistical significance in the results of the study, as well as the lack of variety in the rankings of mean scores provides ample evidence, or lack thereof, for a conclusion to be drawn. The mere enrollment in music does not result in a positive impact on academic achievement in core subject areas when comparing low-SES music study students to Non-Low-SES Non-Music study students. This is a noteworthy result as it pertains to the self-selection theory. One would assume that if music study simply attracts the smartest students, socioeconomic status should not have a large bearing on that outcome. These results instead imply that if self-selection plays a role in increased academic achievement of music study students the effect is not great enough to overcome the roadblock of socioeconomic inequality.

All Condition Comparison

There are no research questions in this study that specifically address mean scores across all categories including comparing non-low-SES music study to non-low-SES

non-music study. There are, however, some noteworthy results from the sample as can be seen in Table 23. The following statements can be made:

- The highest mean score for each test was achieved by a music study condition.
- The lowest mean score for each test was achieved by a low-SES condition.
- Non-Music Non-Low-SES students did not rank highest or lowest on any EOC.
- There is a consistent >10pt gap between the highest and lowest mean score on each EOC

Table 23. All Condition Comparison Summary: Mean scores by subject and condition

	Algebra	Geometry	English	Biology
Band - LSES	69.8	76.8	72.5	70.4
Band - NLSES	79.1	81.1	79.2	77.6
Choir - LSES	61.4	74.5	66.8	72.2
Choir - NLSES	74.5	89.2	74.8	81.4
Non-Music – LSES	66.1	66.7	67.9	71.4
Non-Music – NLSES	72.3	76.9	72.6	78.2
Notes. Green highlight indicates highest mean for subject, red highlight indicates lowest mean for subject.				

Upon the application of the statistical tests described in Chapter 3 a few statistically significant results were revealed that do not have a direct correlation to any research question but provide context for the overall results and fodder for future research. The following statistically significant differences were found:

- Algebra
    - B(NLSES) > NM(LSES), ($p = < 0.0001$)
    - B(NLSES) > NM(NLSES), ($p = < 0.0001$)
- Geometry
    - C(NLSES) > NM(LSES), ($p = < 0.0001$)
    - C(NLSES) > NM(NLSES), ($p = 0.0172$)
- English
    - B(NLSES) > NM(LSES), ($p = < 0.0001$)
    - B(NLSES) > NM(NLSES), ($p = < 0.0001$)
- Biology
    - B(NLSES) > NM(LSES), ($p = 0.0087$)
    - C(NLSES) > NM(LSES), ($p = 0.0013$)

These results reveal that in Algebra, Geometry, and English non-low-SES music study student categories not only had the highest mean scores of all categories, but in each case the highest mean score was statistically significantly higher than both non-music study categories. This indicates that the statistically highest scoring condition of students on each EOC had a music study background. While the results of low-SES music students do not show a significant increase in academic achievement compared to their peers, there is evidence that the average/above average SES music students do. It is also noteworthy that three of the lowest mean scores came from music study categories and that in two cases (Algebra and English) there was a significant gap between the high

and low mean scores as a result of a below average choir condition mean score, where a band condition was the highest.

All of these results taken together provide evidence that music study students regularly outscore their non-music study peers within their socioeconomic category and that the highest academic achievers in every subject are music study students. While this does not eliminate the theory of self-selection into music study, it does confirm previous research on the topic while adding noteworthy evidence that there may be a difference worth further study on academic achievement of band versus choir students.

It is important to note that while a Gouzouasis, Guhnn, & Kishor (2007) study reported that participation in music courses does not hamper achievement in other domains, there were some instances in this study wherein music students actually scored lower than their peers. While this rarely proved to be statistically significant the researcher still cautions the reader, as Fitzpatrick did in 2006, not to make generalizations because of the clear large differences in the sample sizes of the compared populations.

Narrowing the Achievement Gap

The final research question asked the following: can enrollment and participation in band or choir at the high school level narrow the achievement gap between low SES students and their average/above average SES peers?

To qualify as a narrowing of a gap two conditions must be met. There must first be a statistically significant identifiable gap between the mean scores of NM(LSES) students and NM(NLSES) students. After that condition is met, there must be a

statistically significant identifiable gap between the mean score of the NM(LSES) condition and the mean score of one of the low-SES music study conditions.

In the case of all four core subject EOC assessments, at the outset, there was a statistically significant achievement gap between the mean of the NM(NLSES) and the NM(LSES) condition as seen in Table 24.

Table 24. NM(LSES) v. NM(NLSES): Mean scores, Gap, p value

	NM(LSES) Mean	NM(NLSES) Mean	Gap	p value
Algebra	66.12	72.34	6.22	< 0.0001
Geometry	66.77	76.96	10.19	0.0014
English	67.95	72.65	4.70	0.0004
Biology	71.43	78.20	6.77	< 0.0001

With the first condition being met, the data then revealed that there was no statistically significant difference in the mean scores of NM(LSES) and either of the music study low-SES conditions as outlined in Tables 25 and 26. This provides statistical evidence that although there is a significant baseline gap, there is no evidence to suggest that enrollment in band or choir play a significant role in narrowing that gap. It is noteworthy that in five cases, for this particular sample, the gap between the NM(LSES) and NM(NLSES) mean scores was narrowed by music study conditions. In three cases, however, the gap was widened (although not significantly) by music study conditions.

Table 25. NM(LSES) v. B(LSES): Mean scores, Gap, p value

	NM(LSES) Mean	B(LSES) Mean	Gap	p value
Algebra	66.12	69.88	3.76	0.6209
Geometry	66.77	76.80	10.03	0.2753
English	67.95	72.50	4.55	0.4940
Biology	71.43	70.46	-0.97	0.9991

Table 26: NM(LSES) v. C(LSES): Mean scores, Gap, p value

	NM(LSES) Mean	C(LSES) Mean	Gap	p value
Algebra	66.12	61.40	-4.72	0.5132
Geometry	66.77	74.50	7.73	0.8721
English	67.95	66.88	-1.07	0.9970
Biology	71.43	72.23	0.8	0.9998

Limitations

There are four notable limitations of the study that are the result of both the Missouri government created assessment and the data set that was provided to the researcher by the rural school district.

The State of Missouri has changed the EOC standardized test format and content multiple times throughout the course of the collected data. Most means were calculated from the results of EOCs across multiple years. This provides for potential inconsistencies in scores depending on the year in which a student completed the assessment.

It is also apparent from the data that some students may have moved in and/or out of the district during the course of their high school career. This presents the opportunity to call into question both the consistency of student experience as an outcome factor as well as the reliability of the data. There is the potential that a student could have enrolled in music in a previous district prior to taking a State EOC, in which case that student could be incorrectly included in the non-music study condition sample.

Sample size also may have played a role in this study when it comes to determining statistical significance. The sample sizes varied widely and were sometimes quite small, providing for face-value differences in mean scores but not always meeting the threshold for statistical significance. A larger study, including multiple school districts and a balancing of sample sizes may show a different result in terms of statistical significance.

Finally, the data was separated by socioeconomic status based on the most current academic year free/reduced lunch data. It is reasonable to assume that some students may have been in a different socioeconomic class during the time they completed an EOC assessment. This creates potential for students to be incorrectly placed in a condition sample for a given EOC.

Whereas each of these limitations of the study are present, it is the researcher's contention that given the healthy overall sample size and the low potential for inconsistency, the results are still valid.

Recommendations for Future Research

There are a number of gaps in our knowledge about the impact of music education on academic achievement. While it is clear that the topic is complex due to the various potential factors, from neurology to pedagogy, it is also clear that the recurring research outcome could be potentially explained by self-selection into music. Research is needed to understand student's achievement potential prior to enrollment in music. This type of research will be important to understand more fully if there is a correlative attraction to music among students who have a higher achievement potential. Howard Gardner's theory of multiple intelligences could be used as a theoretical framework to draw parallels and commonalities between individuals strong in musical intelligence and both the logical-mathematical and the linguistic-verbal intelligences (Gardner, 1983).

In addition, a new set of questions arose from this research but went unanswered. What is the difference in impact on academic achievement by music study medium? Do band students show a higher level of achievement than choir students as was implied in the results within this study? Furthermore, could achievement be delineated by instrument? Which has the highest potential for increased academic achievement; voice, string, wind or percussion?

Lastly, a key to unlocking the potential impact music enrollment has on academic achievement might be combining the efforts of Johnson & Memmott (2006), Catterall, Chapleau, & Iwanaga (1999) and Hash (2011). Research combining these studies would look at early achievement potential, quality of instruction, and improvement over time, all as factors in the achievement outcomes of students who study music.

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