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Differences in Art and Music High School Students' SAT Test Scores from 2006 to 2015

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This is to certify that the doctoral dissertation by

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Abstract

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MPhil, Walden University, 2019

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Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Academia and education advocates have reported a concern about the elimination of art and music education classes from high school curriculums in the United States. Studies using mean SAT test scores from 1984 and 1994 versions of the SAT test indicated participants who had art and music education classes had higher verbal and mathematical SAT test scores compared to those who did not. However, since revision of the SAT test in 2005, whether students had significantly increased mean SAT test scores with each added year of art and music education participation, and whether students who participated in art and music education courses had higher mean SAT test scores was unknown. Thus, this nonexperimental comparative study involved examining comparative differences that each additional year (1/2 year or less, 1, 2, 3, 4, 4+) makes in terms of archived mean SAT critical reading, math, and writing SAT test scores, as well as differences between mean SAT test scores of those who took art and music education courses versus those who did not. A one-way ANOVA indicated mean SAT test scores increased from 1/2 year or less to 1 year and from 3 to 4 years. A *t*-test revealed significantly increased mean SAT test scores involving art and music education courses. Thus, findings revealed students continue to benefit from art and music education. Positive social change results from significantly increased academic achievement test scores indicating possible higher functioning due to art and music educational programs. This in turn supports students in terms of functioning in society.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Positive enhancement of cognitive skills such as executive functions, working memory, and long-term memory results from art and music education (Groussard et al., 2020). Enhanced achievement and cognitive skills provide students with lifelong skills that can enhance their ability to function in society, thus leading to possible social change (Catterall; Wan & Schlaug, 2010). However, in Oklahoma, there was a loss of 1,100 fine arts classes between 2014 and 2018. Cuts affected classes such as visual arts, theater, music, and speech and debate. In 2018, 30% of public-school students had no fine arts classes at all (Wendler. 2019). Furthermore, in 2021, 70% of the funding for New York City's arts education was eliminated. In New York state, there are schools without art teachers in grades 7 through 12. This is occurring even though arts education is a part of the core curriculum, and is therefore a student right (Cascone, 2020). There is a need for arts and music education so that all students have an opportunity to acquire related benefits.

Background

Vaughn and Winner (2000) revealed students who participated in arts and music education had higher SAT test scores than nonparticipants. I used SAT data from the 2005-2016 version of the test. I examined the benefits of eight course types of art and music education, including photography and film. Analogy questions were not included in the 2005 version of the SAT test, and essay questions and writing sections were added. Thus, there were a total of three sections in the 2005 version of the SAT test rather than

two sections (verbal and math) that were in the 1984 and 1994 versions of the SAT. Scoring for these three sections also changed to a maximum of 2400 points.

Ellis et al. (2012) indicated neurological growth results from music education involving subjects between 5 and 33. Finn et al. (2014) showed cognitive processing skills predict achievement, and studying the arts enhances cognitive processing skills. Schellenberg (2004) indicated music instruction enhanced cognitive processing and general IQ. Drama education significantly enhanced adaptive skills. Guhn et al. (2019) indicated instrumental music students who took multiple years of music instruction in high school on average were academically one year ahead of their nonparticipating peers. Helmrich (2010) indicated middle school music education students scored higher than nonparticipants in algebra when they were in high school, thus indicating a potential for academic achievement enhancement with music education. Current findings could be used to promote inclusion of arts and music education SAT test programs in all schools. This study is needed because the findings can be used to promote inclusion of arts and music education for students. Students then have opportunities to acquire benefits of programs.

Problem Statement

The problem is that arts and music education are being excluded from school curriculums. This may result in students not receiving benefits of these programs. Students who participated in any art or music education course had on average higher SAT test scores. On average, positive enhancement of SAT test scores was correlated with number of years of participating in arts and music education. Some test questions

were no longer considered appropriate. They were not used in the 2005 version of the SAT test. An essay question was added to the 2006-2015 version of the SAT test.

My study is needed because the findings can be used to examine relevance of possible achievement benefits of arts and music education by using national archived mean SAT data from between 2006 and 2015. Hence, this study provides information about the relevance of achievement benefits of arts and music education based on more current SAT testing data. With these new findings, policymakers may begin to promote policies and procedures that lead to initiating or reinstating arts and music education programs into school curricula. Students may have opportunities to acquire cognitive and achievement benefits due to participating in such programs.

Purpose of the Study

The purpose of this nonexperimental comparative study was to determine differences involving national archived mean SAT test scores of participants and nonparticipants of eight art and music courses. My purpose was to determine differences in terms of archived mean SAT test scores based on number of years of participating in arts and music education. SAT subtests scores that were used include critical reading, mathematics, and writing between 2006 and 2015. The eight courses of study were: acting or play production, art history or appreciation, dance, drama study or appreciation, music study or appreciation, music performance, photography or film, and studio art and design. Independent variables were years of participating in arts and music education courses of study. Dependent variables were critical reading, mathematics, and writing national archived SAT test scores. These scores are measures of central tendency

(means). There were no individual test scores available. Standard deviations were also not available.

Research Questions

RQ1: Is there a significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

H_01: There is no significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a1: There is a significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ2: Is there a significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

H_02: There is no significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a2: There is a significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ3: Is there a significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

H_03: There is no significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a3: There is a significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ4: Is there a significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not?

H_04: There is no significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, and those who did not.

H_a4: There is a significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

RQ5: Is there a significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not

$H_0 5$: There is no significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, those who did not.

$H_a 5$: There is a significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

RQ6: Is there a significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not?

$H_0 6$: There is no significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, and those who did not.

$H_a 6$: There is a significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

Theoretical Framework

Constructivism and Gardner's multiple intelligences theories framed this study. Constructivism is a philosophy that supports student centered learning. Gardner's multiple intelligences are used when processing learning experiences. Cognitive development occurs because of foundational knowledge that incorporates new knowledge that individuals attain from processing of current environmental experiences (Bada, 2015). Thus, cognition comes from individuals experiencing environmental events and

then reflecting on those experiences. This results in reconstruction of foundational knowledge and reconceptualization of environmental experiences. Gardner (2011) postulated individuals have multiple intelligences that they use when processing information and developing concepts from environmental experiences. Types of intelligences include linguistic, musical, logical-mathematical, body-kinesthetic, spatial (including visual-spatial), interpersonal and intrapersonal, and naturalistic intelligences (Gardner, 2011). When individuals develop knowledge via educational experiences, they draw on different intelligences to process and acquire new information and resolve issues. Constructivism and Gardner's theory of multiple intelligences are addressed in Chapter 2.

Nature of the Study

I used a nonexperimental comparative design with secondary national mean SAT test score data that were provided by the College Board between 2006 and 2015. I measured mean SAT test scores of students who answered the art and music section of the questionnaire between 2006 and 2015. To analyze data, I used one-way ANOVA and *t*-tests. I examined differences between critical reading, mathematics, and writing SAT scores in terms of years of participation in art and music education. I used a *t*-test to analyze critical reading, mathematics, and writing SAT scores for eight course types. Participants may have participated in more than one art or music education course. I used separate *t*-tests for each of the eight course types as well as the none group. Independent variables were years of art and music participation and course type. The three dependent variables were mean SAT critical reading, mathematics, and writing test scores between

2006 and 2015. Individual student SAT test scores were not available. To conduct this study, I first obtained SAT data from the College Board. Once Walden University approved the study, the College Board released data between 2006 and 2015 via a web site link.

Definitions

Critical Reading. The ability to read material and purposefully analyze it (Zhang, 2018).

Mathematics: Type of study which involves numbers and operations, algebra, geometry, data analysis, statistics, and probability (Zhang, 2018).

Nonparticipant: Individual who took the SAT test but did not complete the art and music section of the SAT Questionnaire.

Participant: College and career-bound students who completed the SAT Questionnaire which stated their SAT test scores can be used for research purposes.

SAT Test: The SAT test involves calculating students' ability to think rationally by incorporating what students have learned in classes.

Assumptions

I assumed SAT test scores from 2006 to 2015 were valid predictors of students' knowledge and reasoning abilities. I also assumed that students' answers to SAT questionnaires were accurate. Shaw and Matters (2009) indicated when students reported high school grade point average (GPA), and they were compared to their actual averages, there was a strong positive relationship. Underreporting of their GPA occurred more

often than overreporting. Thus, Student answers to the SAT Questionnaire were reliable, and it was appropriate for them to be used for research purposes. I assumed secondary data were representative of this population, and the art and music section of the SAT questionnaire were considered reliable.

Scope and Delimitations

Students are losing the educational benefits of art and music education (Cascone, 2021; Freedberg, 2022). Thus, the focus of this study was examining arts and music education from 2006 to 2015 to determine if it continues to be relevant. There is a need for current information for current policymakers to support inclusion of art and music education in high school curricula. Participants were students who took the SAT test and completed the SAT questionnaire between 2006 and 2015. Students who did not complete the art and music section of the SAT questionnaire were excluded from the study. This study will provide information that can be potentially used to support art and music education for high school students. It has the potential of providing students with opportunities to acquire knowledge as well as cognitive and academic benefits of these programs**.** Findings from one-way ANOVA can be generalized to similar SAT populations.

Limitations

A limitation was that raw SAT data for all students was not available. The College Board averaged SAT test scores and presented average scores as mean critical reading, mean mathematics, and mean writing scores for each of the eight course type for art and music education. I addressed years of participation (1/2 or less, 1, 2, 3, 4, or 4+)

involving art and music education. The sample population included participants who completed the SAT questionnaire and took the SAT test between 2006 and 2015. To address the issue of lack of independence of groups, a series of *t*-tests were used to determine differences in SAT test scores for each of the eight types of art and music education as well as the none-group. I completed a post-hoc power analysis to establish power of the study, thus addressing limitations.

Significance

This study contributes to advancement of knowledge in the psychology discipline by exploring the social problem of lack of high school art and music education. Loss of art and music forms of education can potentially result in the inability of students to acquire cognitive and academic benefits. Findings of the study may potentially be used to promote inclusion of art and music education in schools.

This study involved examination of differences in SAT test scores involving art and music education between 2006 and 2015. When music participants practiced regularly, they excelled in terms of executive functioning, working memory, and nonverbal reasoning skills. Acting participants who practiced regularly excelled in terms of long-term memory and phonetic fluency. This indicated potential benefits and significance of art and music education.

Summary

The issue of concern was lack of art and music education in high school curricula. This concern has resulted in this study about effects of art and music education on academic achievement as measured by the SAT test between 2006 and 2015. My study

includes current information that can be used to promote art and music education curricula for high school students. With art and music education programs, students are potentially able to acquire benefits of programs and become more competitive in terms of the college admissions process (Kowarski, 2018). With enhanced achievement and cognitive skills, there is a potential for positive social change. Chapter 2 includes an extensive discussion of the theoretical foundations of this study as well as a literature review.

Chapter 2: Literature Review

I addressed the problem of exclusion of art and music education curriculum from high school educational programs. New York City's public schools arts program budget was cut by 70% for the 2021 school year (Cascone, 2021), and Florida's arts program budget has also been cut significantly, affecting programs that are funded by Florida's Department of Cultural Affairs (Peterson, 2018). It is imperative that school districts provide students with art and music education because of possible achievement benefits that go beyond incorporating knowledge into memory and extend to enhanced critical thinking skills (Bowen et al., 2014). Enhanced executive functioning skills due to music education also occur (Holochwost et al., 2017). The purpose of this study was to compare differences between participants in art and music education and nonparticipants by using archived mean SAT test scores between 2006 and 2015.

This chapter includes a review of previous studies about the influence of art and music education on archived mean SAT test scores. I identify the literature search strategy, key search terms, databases, and search engines. There is also a discussion of the theoretical foundation. A review of literature based on key variables follows. It is followed by a summary of the chapter.

Literature Search Strategy

The literature search strategy involved investigation of studies about art and music education and archived mean SAT test scores. I used the following search engines: ABI/Inform, Medline, Google Scholar, ERIC, Educational Source, SAGE Journals, ResearchGate, ProQuest Central, ProQuest Dissertations and Theses, Medline,

Neuroscience Information Framework, and PubMed. The following key terms were used: *Vygotsky's sociocultural theory, constructivism theory, Gardner's multiple intelligences theory, SAT test, ACT test, STEAM/STEM with art integration and achievement, art/music education, achievement, art/music curriculum, music, cognition, listening, language, reading achievement, math achievement, art/music and the brain, transfer effect, whole brain functioning,* and *genetics research*.

Studies were published between 2018 and 2023. These studies provided the latest information about the influence of art and music education on SAT test scores. The total number of studies was 296 which were published between 2000 and 2023. Although literature was limited, these studies were used to provide an in-depth review of the problem and broaden. Types of literature included conference papers, dissertations, peer-reviewed articles, and books.

Constructivism and Gardner's Multiple Intelligence Theory

Constructivism and Gardner's theory of multiple intelligences framed this study. Constructivism with an educational perspective is an active student-centered approach to learning that involves teacher-student, student-student, and student interactions with the environment. During learning experiences, the brain is constantly developing cognition by linking and restructuring individual thoughts about environmental learning experiences (Baba, 2015; Gardner, 2011). During these learning experiences, students also use Gardner's multiple intelligences to process environmental experiences. These intelligences cannot be measured by IQ tests. Both theories concern building of knowledge through environmental experiences, including education, that result in brain

development. Knowledge is later used in cognitive tasks. Constructivism and Gardner's multiple intelligences were used to build knowledge. For Gardner, reality and mental constructs are individually constructed by using eight multiple intelligences that interact during processing experiences and thus enhance their development. Gardner intelligences are used by individuals to varying degrees depending on environmental experiences individuals experience or issues they are trying to resolve. Types of intelligences are linguistic, logical-mathematical, musical, bodily-kinesthetic, spatial (including visual-spatial), inter and intrapersonal, and naturalistic. Linguistic intelligence involves how well individuals can use words during speaking or writing. When this type of intelligence is an individual strength, individuals use words well, and can also read and write well. Logical-mathematical intelligence concerns the ability to analyze environmental experiences and then use mathematical operations to work through to resolve issues. This type of intelligence is often a strength for inventors and engineers. Another type of intelligence is spatial. These individuals are good visualizers. They can transpose objects and patterns in space and are often found in visual-spatial arts among other occupational fields. Individuals using Gardner's music intelligence tend to think in patterns as well as enjoy music. Musical intelligence is a strength for musical prodigies. They are also often successful musical writers who can reconstruct sound inwardly and also be talented performers. Art and music education provides environmental experiences that are important in the construction of knowledge and achievement. Another Gardner intelligence is kinesthetic intelligence. It is found in athletics, dance, architecture, and acting fields. These individuals have strengths involving imitation and therefore learns

well from imitating teaching styles. Interpersonal intelligence is an individual introspective sense of self that is constantly modified by environmental experiences. The outward intrapersonal state of being is a social dynamic sense of self that involves other people. These inward and outward senses of self-influence are how individuals respond when interacting with other people. Individuals with naturalistic intelligence can easily relate to plants and animals and may work in plant and animal science fields. Executive functions and enhanced memory are developed during learning of art and musical education (Groussard, 2020). Cognitive skills predict achievement (Finn et al., 2014). Thus. art and music education can potentially promote enhanced cognitive and achievement skills and promote social change (Catterall, 2009; Wan & Schlaug, 2010). It is also through development of Gardner's intelligences via environmental and educational experiences that enhancement of cognitive and achievement skills occurs. These enhancements further develop Gardner's intelligences, and they can become preferred modes of processing which result in individuals becoming unique in society (Gardner, 2011).

Ahvan and Pour indicated a moderate correlation between verbal-linguistic and visual-spatial intelligences. Music intelligence was not a predictor of achievement. However, verbal-linguistic and visual-spatial intelligences were predictors of academic achievement.

Literature Review

The studies related to the construct of interest are the Vaughn and Winner (2000) and the Cooper and Winner (2000) studies. The main argument of the two studies

concerned the effect that participation and nonparticipation in an art and music education had on academic achievement. The Vaughn and Winner (2000) and the Winner and Cooper (2000) studies serve as seminal studies. Their multiple meta-analysis study examined 8, 10, or 12 years of archived mean SAT test scores. They used College Board archived mean SAT test score data from the years 1987 to 1998 to answer the comparative research questions. The two comparative questions concerned the effect of the seven types (courses) of an art and music education and the differences that multiple years (i.e., 1/2 or less, 1, 2, 3, 4, 4+) of art and music education had on mean SAT test scores. Each year's mean SAT test score functioned as one observation. For analysis, the authors used the one-way ANOVA to determine the differences of each year's (i.e., 1/2 or less,1,2,3,4,4+) of participation on the mean SAT score and a Stouffer's Z to determine the effect that each course type of an art and music education had on the mean SAT test score. The findings of the study indicated that the number of years that a student participated in an art and music education had a positive and significant influence on the mean SAT test score. Effect size rose as the levels (years) of participation in an art and music education increased which included one half or less years to four plus years. The findings also indicated significantly higher mean SAT test scores for students who participated in any of the seven types of art and music education. Thus, the effect that at least one year of an art and music education had on academic achievement indicated an enhancement of achievement scores. However, the 21-year-old data used in the study also indicates a need for updating the data in a more current study that uses a newer version of the SAT test.

Currently, multiple updates of the Vaughn and Winner (2000) study occurred in this current study. The Vaughn and Winner (2000) study used data prior to the year 2000. Thus, firstly, the current study will update the Vaughn and Winner study by using SAT data from the years 2006 to 2015. Secondly, the current study will also examine the differences of all eight types of an art and music education on the SAT test score rather than the seven art and music types examined in the Vaughn and Winner (2000) study. Thirdly, it will also use data from three sections of the SAT test rather than just the two verbal and math sections of the SAT test scores of the Vaughn and Winner (2000) study. Finally, an examination of the differences of the years (i.e., 1/2 or less, 1, 2, 3, 4, 4+) of participation (i.e., levels) of an art and music education on SAT test scores will also occur.

In summary, the review of the seminal studies related to the scope of the study included the Vaughn and Winner (2000) and the Winner and Cooper (2000) studies. These studies indicated how researchers have approached the issue about the influence of art and music education on SAT test scores. The studies indicated the enhancement of academic achievement test scores with an art and music education. This enhancement of test scores supports completing the current study using 2006 – 2015 SAT test score data. The study will provide information that can possibly incite positive social change by encouraging a wide-spread adoption of an art and music education for students. In this manner, students can potentially acquire the benefits of the art and music educational programs.

Variables

Art Education

Holmes and the Houston Independent School District Department of Research and Accountability (HISD 2018) indicated that the group of arts magnet school education students exhibited enhanced achievement scores, school attendance, and positive behaviors. This finding was not found with the non-art magnet school students. Additionally, Groussard et al. (2020) examined the effect that practicing acting skills, that were later used in theater presentations, had on cognitive processing skills. The participants were between the ages of 18 years and 84 years old. There were 46 participants who had studied drama (i.e., actors) and 50 nonparticipants (not actors - controls). The participants and nonparticipants were matched by education and age, The findings indicated that those with a history of consistent acting practice excelled in long term memory and phonemic fluency. That enhancement did not occur with the nonparticipating students. Thus, the research findings indicated cognitive skills enhancements had occurred with an art education. Hence, technology positively influenced art education outcomes.

Li and Cheng (2018) investigated how an art infused teaching program influenced teaching methods. Twenty engineering students participated in the study. The study was about how an art education that involved viewing works of art promoted alternative perceptions that, in turn, promoted divergent and creative thinking. The findings from the study indicated that classrooms that included the coupling of art and technology also shifted teaching methods from technical teaching to technical applied teaching. Thus, it

promoted divergent and creative thinking. The teaching method that promoted divergent and creative thinking included the teaching strategy of inquiry (alternative thoughts), cooperation, record keeping, and reflection. Furthermore, in a study involving 120 Vietnamese high school students, Tinh and Quang (2019) found that providing students with an integrative learning experience involving science, technology, engineering, art, mathematics (i.e., STEAM) curriculums that provided an opportunity for the introduction of innovative ideas into student discussions. Thus, STEAM provided students with opportunities to discuss their innovative ideas while incorporating a creative problem-solving process. The STEAM education integrated and promoted the problem-solving skills and the critical thinking skills of the arts into the STEAM curriculums.

Art education develops not only artistic skills but also has the potential to shift teaching methods from technical teaching to technical applied teaching (Li & Cheng, 2018). With a STEAM education, the potential to enhance achievement scores, school attendance, positive behaviors, problem-solving, critical thinking skills exists. Furthermore, the STEAM integrated learning experience also introduces innovative ideas into the learning experience (Tinh & Quang, 2019). Hence, due to the art variable indicating enhanced academic functioning (Stevens & HISD, 2018), this is a justification for the use of the art variable as a variable in the current study that examines the differences in the SAT test scores of the participants and nonparticipants of an art education.

Music Education

This section begins with a discussion about the importance of the delivery method of a music education curriculum. This is important because for students to acquire the benefits of a music education, they must become engaged in a music education program. Kim (2013) indicated that curriculum has the potential of influencing the level of a student's engagement in music instruction. The study that Kim (2013) used a music technology curriculum to determine if music technology could enhance a student's engagement in a music education class. The study involved 12 boys and two girls (5th and 6th grade students) who participated in the music education class. The students engaged in such activities as technologically creating background music for a video and a story. After the comparison of pre and post technological music instruction mind maps, the findings indicated that the post class instruction mind maps had enhanced engagement in the musical activities. This indicated that music technology indicated a positive difference in the student's engagement in music education (Kim, 2013).

To further engage students in music education, attention to the curriculum appears to be important to the student. For a student to acquire the benefits of a music education, they must participate in music education. Pendergast and Robinson (2020) indicated the preferred curriculum choices of 1,081 middle school and high school students. Going from most desired to least desired music education classes, the students indicated that the most desired classes included a guitar and a piano class. Then came music composition and technology, next was a course in popular music groups, and finally a course in music history and theory (Pendergast & Robinson, 2020).

Vaughn and Winner (2000) indicated that a music education positively influenced achievement scores which is one of the benefits of a music education. Heslop (2019) involved 147,268 high school music students and 563,384 non-music high school students. The findings indicated that with at least 2.3 years of a music education, the high school music students had a higher average academic grade point average than non-music students. Additionally, Guhn et al. (2020) involved 110,000 high school students from British Columbia, Canada. The students participated in an instrumental music education class for two to three years. The findings indicated that the participant music students had academic scores that were one year higher than the non-participants. Thus, research indicates that enhanced academic functioning is a potential benefit of a music education. Therefore, the current study will investigate the differences in the SAT test scores of music education participants and nonparticipants.

Holochwost et al. (2017) used a randomly assigned lottery method to select 135 fourth to eighth grade students into an orchestral instrumental music educational program. All the participants came from a disadvantaged neighborhood. Eighty six percent of them were of African American descent. After at least one year in the music program, the findings indicated enhancement of standardized achievement scores, executive functioning skills (i.e., cognitive skill), and short-term memory skills. Furthermore, Groussard et al. (2020) study findings indicated enhanced executive functioning skills. The study examined the effects of consistent music practice on cognitive skills among 18 to 84 years old participants. The 50 (i.e., no music participation) control participants and the 49 music participants had similar educations

and ages. Enhanced executive functioning, working memory, and non-verbal reasoning skills were found with the music education participants who practiced music on a regular basis. Additionally, Finn et al. (2014) completed a study involving 1,367 eighth grade students who attended public, private, and charter schools. The findings indicated that cognitive skills predicted standardized academic achievement test scores.

Findings indicated the potential of music education enhancing achievement scores and student's cognitive skills. Additionally, university admission officers also consider the student's achievement scores when determining a student's readiness for college. Thus, an enhanced achievement score has the potential of assisting the student in attending the college of their choice. Moreover, these findings that indicated enhanced achievement such as in the Guhn et al., (2020) and Heslop (2019) studies, and cognitive functioning skills enhancements found in the Groussard et al. (2020) and the Holochwost et al. (2017) studies of music participants, assists in justifying an examination of the current differences in the SAT test scores of student participants and nonparticipants of a music education when using SAT data from 2006 – 2015.

SAT

High school students take the SAT test or the ACT (American College Test) tests usually during their junior year of high school because the tests meets the college entrance exam requirement of many colleges and universities. The SAT test score operates as a variable for the current study. Its reliability and validity have been established. For reliability, an average and acceptable variation of 32 points has occurred when students took the SAT exam multiple times (College Board, 2010). For predictive

validity, the Beard, Marini, and College Board (2013) study indicated a validity of r = 0.61. To establish this predictive validity, the analysis involved using both the student's SAT test score and the student's high school grade point average (HSGPA). Likewise, for comparison, the ACT assessment tool also assesses college readiness. The comparison of the SAT test and the ACT test indicates the two tests measure similar skills. It takes between 3 to 4 hours to complete the ACT or SAT exam. Yet, a dissimilar feature of the ACT and SAT test includes the ACT test having a science section while the SAT test does not. The SAT test penalizes ¼ point for an incorrect answer while the ACT test does not (Rubin, 2019). For predictive validity, both the SAT and ACT had acceptable college success predictability. Yet, the SAT test had a higher average correlation for college success than the ACT test (Curably, 2016). Therefore, because the SAT test measures achievement and college readiness, and because of the acceptable SAT test's predictive validity and reliability, this assists in justifying the use of the SAT test score as a variable in the current study.

STEAM Curriculum

The STEAM (science, technology, engineering, arts, mathematics) curriculum has also been found to enhance student learning. The Tinh and Quang (2019) study involved 120 Vietnamese high school students from five reginal high schools. After receiving instruction using STEAM methods, 45 teachers gave feedback about the program. The findings indicated that most students used the knowledge they learned in their STEAM classes. Integrating art learning experience introduced innovative ideas by providing opportunities for discussions that incorporated a creative problem-solving process

involving problem-solving and critical thinking skills. Thus, they used an inquiry (i.e., divergent thinking/alternative perceptions) and creative problem-solving method (i.e., novel solutions) such as that found in art education to develop probable solutions for society needs (Tinh & Quang, 2019). Another study that infused art into curriculum involved 20 engineering students who participated in a Li and Cheng (2018) study. The study investigated how art infused teaching methods promoted the development of alternative perceptions. Alternative perceptions occurs because as one views works of art, alternative perceptions of that work of art promotes divergent and creative thinking. Hence, the findings from the study indicated that classrooms that included the coupling of art and technology also shifted teaching methods from technical teaching to technical applied teaching. That method included the teaching strategy of inquiry involving divergent thinking and the creation of alternative perceptions, cooperation, record keeping, and reflection.

A STEAM project-based curriculum integrates the arts into the curriculum. This is done by using a variety of approaches such as EarSketch (i.e., music) (Magerko et al., 2016), IlumDance (i.e., dance) (Flesch et al., 2021), and E-Textiles (i.e., design) (Peppler, 2013). These programs use project-based learning to teach computer science programming skills such as looping, conditional "if-then statements," and functions among other skills. Students that use these methods for learning computer science skills demonstrated high engagement in learning computer programming skills (Flesch et al., 2021). The project-based STEAM study of Yee-King et al. (2017) study involved 11 university undergraduate art and programming students. They found that with STEAM

programming skills, higher final class grades occurred. The study used a STEAM project teaching method (open ended inquiry - art education approach) that used creativity (i.e., novel solutions - art education approach) to solve the programming project. The inductive teaching approach used inquiry to explore solutions to the project. The students completed 6 two-hour STEAM programming lessons (i.e., inquiry based) and 6 two-hour non-STEAM programming lessons (set problem presentation and solutions) over a two-week period. After each STEAM and non-STEAM lesson, the students completed a programming activity. Those students who exhibited STEAM programming skills (i.e., more trial-and-error entries) rather than non-STEAM programming skills (i.e., few trial-and-error entries) tended to have higher class grades. Thus, STEAM project-based curriculum promoted not only a positive learning experience for students but can also result in enhancing achievement.

In summary, these forementioned studies indicated that introducing arts principles, such as inquiry-based skills, into the facts learned in a STEAM curriculum (i.e., coursework) in discussions positively influenced achievement (Cheema & Zhang, 2013; Seitan et al., 2020). Moreover, with computer programming skills, a transfer effect to situations involving creative thinking skills, metacognition, and reasoning skills occurred (Scherer et al., 2018). Hence, STEAM curriculum has become successful in developing successful marketplace workers (Flesch et al., 2021). The STEAM inquiry-based method resulted in students learning basic course concepts such as coding concepts in a coding class which resulted in higher grades (Yee-King et al., 2017). Thus, using the

arts infused STEAM curriculum and teaching method supports promoting the arts as an essential component of a student's education in the United States.

In summary, these forementioned studies positively influenced achievement by integrating arts education methods such as inquiry methods with computer technology. This infusion resulted in the student being able to apply the facts they had learned in their coursework into discussions that they participated in in their classrooms (Cheema & Zhang, 2013; Seitan et al., 2020). Hence, STEAM curriculum has become successful in developing successful marketplace workers (Flesch et al., 2021). The STEAM inquiry-based method resulted in students learning basic course concepts such as coding concepts that also resulted in higher grades (Yee-King et al., 2017). Thus, an arts infused STEAM curriculum involving inquiry teaching methods supports the promotion of the arts as an essential component of student's education in the United States.

Controversial Study

Elpus (2013) appears in the literature. The study addressed the concern that the achievement enhancement found with music education is due to selection bias. Using fixed effects regression analysis, the findings indicated that with statistical control of demographics and prior academic achievement of students with just one music credit in their academic records, no significant difference between the standardized achievement test scores of music students and non-music students occurred. The author reported that the enhancements in SAT scores from enrollment in music education likely occurred because of the SES (socio economic status) advantages and the advantage of prior academic achievement. However, researchers Guhn et al. (2020), Holochwost et al.

(2017), and Ellis (2013) provide additional information from more current research about the association of music education and achievement that provides a different perspective of the association and the Elpus (2013) study. Holochwost et al. (2017) study refutes the selection bias claim of Elpus (2013) by controlling for the prior academic achievement of students. The study demonstrated no difference between groups for the factors of age, grade, ethnicity, and gender classroom. All the participants came from a disadvantaged neighborhood that included 85.7 % African American, 9.1% Hispanic/Latino, 2.6% Asian, and 2.6% European students. With no English as a second language or special education students in the study's participating classroom, the students were divided into a music education participant and non-participant classroom with the use of a lottery system. After at least one year in the music program, the findings indicated enhancement of standardized achievement scores, executive functioning skills, and short-term memory skills for those in 4^{th} to 8^{th} grades. Furthermore, the study by Guhn et al. (2020) controlled for what Elpus (2013) called "omitted variable bias." They controlled for prior academic achievement using grade 7 standardized test score, gender, home language, and neighborhood socio-economic status (SES) by using them as covariates. The findings indicated that students who participated in a multiyear (two to three years) out of school instrumental music education program obtained achievement scores that averaged one year higher than nonparticipating peers. This multiyear study findings indicated enhanced achievement functioning. The Elpus (2013) study did not explore the effects of multi-years of music education. Another study countering the Elpus (2013) statement that prior academic achievement and SES status likely influenced the enhanced achievement test

scores rather than music education. However, Ellis et al. (2013) fMRI study controlled for prior academic achievement and SES. The findings indicated that the changes in functioning of the 84 subjects ranging in ages from 5 to 84 resulted from a music education effect not a maturation effect. The brain functioning that occurred during music education looked different from the growth that occurred from maturation (Ellis et al., 2013). Thus, by controlling prior academic achievement and SES, the findings of these studies counter the Elpus (2013) study findings and provide a current and broader perspective of the association between music education and academic achievement.

Summary

Chapter 2 included an overview of variables test. I addressed lack of art and music education in student curricula . Students need these programs because they need opportunities to acquire cognitive benefits of educational programs. Cognition develops from foundational knowledge that involves incorporating new knowledge that individuals attain from current environmental experiences (Bada, 2015). Development of the brain occurs due to environmental stimulation from experiences such as education (Baba, 2015). Art and music education is an environmental experience. Enhanced academic achievement results from art and music education (Vaughn & Winner, 2000). The constructivism theory and Gardner's multiple intelligences theory frame this study.

This study involved determining differences in SAT test scores for participants in art and music education as well as nonparticipants across eight art and music education courses according to number of years they participated in this education. This study includes valuable information that can support positive social change by promoting more

widespread inclusion of art and music education into school curricula. Students will then have opportunities to acquire benefits from programs. In Chapter 3, I describe the methodology and nonexperimental comparative study design.

Chapter 3: Research Methods

. The purpose of this quantitative nonexperimental study is to compare participants' mean SAT test scores with nonparticipants. I also compare differences of mean SAT test scores with years of participation in art and music education. SAT categories were critical reading, mathematics, and writing. Participants of the study are the high school students who took the SAT test and answered the questionnaire. Nonparticipants were students who took the SAT test and answered questionnaire but did not take art and music education courses. These SAT test scores were compared for participants versus nonparticipants according to art and music course type and number of years that participants took art and music education classes. Archived mean critical reading, mathematics, and writing SAT test scores between 2006 and 2015 were dependent variables. Findings of the study can potentially support policy decisions and promote arts education for students in high schools throughout the United States.

This chapter includes a discussion of the research design and methodology of the study as well as sampling and data collection. Next, I discuss instrumentation and its operationalization, as well as data analysis, including threats to validity and ethical procedures. This is followed by a summary.

Research Design and Rationale

I used a nonexperimental comparative research design. The independent variables are years (1/2 or less, 1, 2, 3, 4, 4+) of studying art or music education, and eight types of courses: acting or play production, art history or appreciation, dance, drama study or appreciation, music study or appreciation, music performance, photography or film, and

studio art and design. Archived mean critical reading, mathematics, and writing SAT test scores between 2006 and 2015 were the dependent variables. SAT mean scores are summary data. Individual scores and standard deviations of the total sample were not available. The nonexperimental design promotes the development of knowledge in the field of psychology. Secondary archived SAT test data from the published College Board reports between 2006 and 2015 were used in the study. The study did not involve any manipulation of art and music education course material by myself or the College Board.

Methodology

I measure differences that number of years of participating in art and music education had on participants' mean SAT critical reading, mathematics, and writing test scores by using a one-way ANOVA for RQ1, RQ2, and RQ3. For RQ4, RQ5, and RQ6, multiple *t*-tests were used to determine differences between critical reading, mathematics, and writing SAT test scores. Findings advance knowledge that is needed in the field of psychology to advance understanding of the relevance of art and music education.

Population

This study involved archived data from the large population of college and career bound high school students who chose to take the optional SAT college entrance exam from 2006 to 2015. The number of students taking the SAT was 1,465,744 million in 2006 and 1,698,521 million in 2015. I planned to use all data from this 10-year data set. It included 680,725 thousand males and 785,019 thousand females in 2006 and 794,802 thousand males and 903,719 thousand females in 2015. The ethnicity range is from 1% in 2006 to 1% in 2015 for American Indian and Alaska Natives, 9% in 2006 to 12% in 2015

for Asian, Asian Americans, and Pacific Islanders, 10% in 2006 to 13% in 2015 for Black and African Americans, 4% in 2006 to 8% in 2015 for Mexican Americans and Mexicans, 1% in 2006 to 2% in 2015 for Puerto Ricans, 5% in 2006 to 10% in 2015 for other Hispanics Latino, and Latin Americans, 56% in 2006 to 47% in 2015 for Whites, 4% in 2006 to 4% in 2015 for others, and 9% in 2006 to 4% in 2015 for no response. The target population is students who provided their informed consent for use of SAT test scores for research purposes to advance knowledge. These students completed the optional SAT questionnaire that was in the SAT registration packet. However, demographic information such as students' names, age, or school attended was not a part of the study. A review of art and music education data sheets from 2006 to 2015 indicated the number of participants who had art and music education as well as the none group which implies that yearly estimated response rates for art and music sections of the optional questionnaire were at least 1,300,000 of the total population, or 1,465,000 for 2006. Thus, an acceptable survey response rate occurred for the SAT questionnaire.

Permissions and Archived Data

Students who participated in this study gave permission for their SAT test data and questionnaire information to be used for research purposes by completing optional art and music education section of the questionnaire. This is a part of the registration packet that students receive when they register to take the SAT test. Students who complete the SAT questionnaire are participants of this study. Students who did not complete the SAT questionnaire excluded themselves from participating.

Participants archived mean SAT test scores for number of years that they have participated in art/music education and mean SAT test scores for each of the eight types of art and music education as well as the none group who did not participate were based on students' responses to SAT questionnaire questions. Participants indicated via the questionnaire if they participated in 1/2 or less, 1, 2, 3, 4, or 4+ years of art and music education. If participants had not participated in any art and music education courses, then those SAT test scores became a part of mean SAT scores for the nonparticipation group. This was completed for each year from 2006 to 2015. The College Board calculated mean SAT test scores and formatted them into charts for each year from 2006 to 2015. The College Board provided access to internet links of public SAT datasets for 2006 to 2015 when I completed the College Board research application request for SAT data and provided them a copy of Walden University IRB approval to complete the study.

Instrumentation and Operationalization of Constructs

The College Board is a non-profit private organization that developed, owns, and publishes the SAT test. The first administration of the multiple-choice test to high school students occurred in 1926. Over 4,000 colleges and universities in the United States use the SAT test score for admissions decision. The College Board (2022) study indicates that eighty-five countries outside the United States also use the SAT test for university and college admission decisions. As in 1926, the SAT test currently reflects the knowledge the student has acquired while in high school and their ability to use the knowledge to complete a variety of reasoning tasks. The SAT test score is a reflection of their college and career readiness skills. The SAT test score is also often used for

scholarship selection and for a variety of awards. Academic counseling also uses the SAT test score when counseling students (College Board, 2015). It takes 3 hours to complete the SAT test. The administration of the SAT test occurs at an official SAT test site. The projected date for the College Board to provide an online test for United States students is 2024. The SAT test is a paper pencil test. Currently, students use a calculator when completing the designated calculator section of the test (Johnson-Hess, 2022). Special accommodation is available for students that qualify for them. Examples of special accommodations include large bubble sheets, taking the essay section on a computer, and having a scribe record your answers (Hembach, 2021). Special needs students, such as a student with a learning challenge, can also take more time when completing the SAT test (Peterson, 2019).

Studies of the SAT test's reliability and predictive validity indicate each is acceptable. The College Board established its reliability with a critical reading score of .91 - .92, mathematics of .92 -.93, and writing MC of .88 - .91, and writing with essay of .89 - .91 (College Board, 2010). The Freshman Year Grade Point Average predictive validity of the SAT involved the College Board using a sample of 151,3216 freshmen college students from 110 four-year colleges. The findings indicated that the student's freshman year college grade point average had a $r = .61$ correlation with the high school grade point average and the SAT critical reading, mathematics, and writing test score. (College Board, 2013). Therefore, due to the SAT test measuring a student's college and career readiness and the SAT's acceptable reliability and validity, it is appropriate to use the SAT test in my study. My study examines the differences between the mean SAT test

scores of the participants of an art and music education and the SAT test scores of the nonparticipants of an art and music education from 2006 to 2015.

The construct validity of the SAT test speaks to how accurately the test measures the learning of potential college and career bound high school juniors and seniors (College Board, 2015). The test is also used as a predictive tool by college and university administrations to predict freshman-year college and career academic success. When the SAT test was analyzed using college and university freshman students, its construct validity was acceptable (College Board, 2013). The comparison of the SAT and ACT tests indicated there was a significant relationship between both the SAT and the ACT tests and college success. However, the SAT had a slightly higher correlation with college grade point average (GPA) than the ACT (Curabay, 2016). The correlation relationship of the SAT test scores to similar tests such as the Medical Admissions College Test (.59) and the Graduate Record Exam (.41), and first year college grade point average (.60's) indicates an acceptable construct validity. The college second year retention rate range is 90% for the top tier of the SAT test scores to 60% for bottom tier. This also supports acceptable construct validity. The 4 - year graduation rate was 75% top tier SAT test score to 20% for the bottom tier. Furthermore, there was also content validity evidence from 5000 high school teachers and college instructors that indicated that most teachers and instructors supported the topics included in the SAT test (Shaw, 2015). These forementioned studies indicate acceptable construct and content validity.

Data Analysis Plan

I will use IBM SPSS Statistics (Version 28) to test to determine the differences in the mean SAT test scores for critical reading, mathematics, and writing by years of participation in an art and music education and by each art and music course type, This section will describe the data screening, testing of assumptions for the one-way ANOVA and t-test, restate the research questions, and provide a detailed description of the statistical tests.

Data Screening and Assumptions

The College Board has computed the mean SAT critical reading, mathematics, and writing test score data for this study and they present the data each year as a yearly report. The report presents the mean SAT test scores associated with years (i.e., ½, 1,2,3,4,4+) of participation in an art and music education. The critical reading, mathematics, and writing SAT test score data for the eight types (i.e., music performance) of an art and music education is the second section of the report. There is one page chart for each of the 10 years (2006 – 2015) included in the data presentation of the SAT test scores. There is no missing data in the report that is provided by the College Board.

For Research Questions 1, 2, and 3, the statistical test that will analyze the SAT test data compiled by the College Board is the one-way ANOVA. This study will use three one-way ANOVA's because there are three dependent variables including critical reading, mathematics, and writing SAT test scores in this study. There are 3 assumptions

for the one-way ANOVA that include, independence of observations, normality, and equal variances (Green et al., 2016).

The years of studying art and music education are independent observations. A student that participates in an art and music education for one year cannot also participate in ½ year or less of an art and music education. Thus, this indicates the assumption of independence of observation is met. To test the assumption of normal distribution, the Shapiro-Wilk test was used. This study has a small number of observations (10 – one observation for each year from 2006 - 2015), and due to the small number of observations, it fits this assessment method (Razali et al., 2011). The Levene's test will determine if there is an equal population variance within the 6 groups for years (i.e., ½ year or less, 1, 2, 3, 4, 4+) of participation. The purpose of the study involves determining the differences that the number of years (one half or less, 1, 2, 3, 4, 4+) of participating in an art and music educational program has on the mean SAT test scores. However, if the assumptions (normality or equal variances) fail, a nonparametric analysis or a transformation will occur (Green et al., 2016).

For Research Questions 4, 5, and 6, multiple *t*-test were used due to lack of independence of SAT test scores by course (i.e., acting, music performance) type. The multiple *t*-tests will compare the difference in the means of the SAT test scores for each dependent variable (i.e., critical reading, mathematics, writing) between participants of each type of course (i.e., acting, music performance) and the mean SAT test scores of the nonparticipant. There are 3 assumptions for the independent samples t-test and they include, independence of observations, normality of distribution, and equal variances of

each independent group (Green et al., 2016). Because students can take more than one of the eight types of course (i.e., acting, music performance) work per year, the assumption of independent observations by type of course is violated. Therefore, using an ANOVA to compare all participants and nonparticipants SAT test scores is not possible. Hence, I used multiple *t*-tests to compare the participants of an art and music education mean SAT test scores for each type (i.e., music performance) of the eight courses to the nonparticipant's mean SAT test scores. However. independence of observation of the "none" group is established because a participant in an art and music educational course cannot also be a nonparticipant of an art and music education. Thus, these two groups are independent observations. The assumption of normality of distribution the Spar Wilks normality test determined by visual inspection and a Levene's test that will be used to test for equal variances across groups (Van den Berg, 2023).

Research Questions

RQ1: Is there a significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

H_01: There is no significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a1: There is a significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ2: Is there a significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

$H_0$2: There is no significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a2: There is a significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ3: Is there a significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

$H_0$3: There is no significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a3: There is a significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ4: Is there a significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not?

H_04: There is no significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, and those who did not.

H_a4: There is a significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

RQ5: Is there a significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not

H_05: There is no significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, those who did not.

H_a5: There is a significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

RQ6: Is there a significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not?

H_06: There is no significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, and those who did not.

H_a6: There is a significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

Data Analyses

The data analysis used in this study includes determining the differences that the years of studying (i.e., 1/2 or less, 1, 2, 3, 4, or 4+ years) an art and music education has on the critical reading, mathematics, and writing SAT test scores for each year from 2006 - 2015. Three one-way ANOVAs will analyze the archived mean scores for each year (i.e., 1/2 year or less, 1, 2, 3, 4, and 4+ years) to determine the differences in the number of years that a student participated in an art and music education had on the critical reading, mathematics, and writing SAT test scores. This was completed for each of the years from 2006 – 2015. The F test findings indicated what the differences were in the SAT mean critical reading, mathematics, writing test scores for those participating in ½ or less, 1, 2, 3, 4 or 4+ years of an art/music education, and if the differences were significant for the years 2006 - 2015.

After the one-way ANOVA analysis was completed for Research Questions 1, 2, and 3, a series of *t*-tests were used to analyze Research Questions 4, 5, and 6. The participants and nonparticipants (i.e., none) of an art and music education archived mean critical reading, mathematics, and writing SAT test scores for the eight types (i.e., acting, music performance) of the art and music education was analyzed using multiple *t*-tests. The eight types of an art and music education include: acting or play production, art history or appreciation, dance, drama study or appreciation, music study or appreciation,

music performance, photography or film, and studio art and design, and the "none" no participation group. The *t*-test results indicated whether there were differences in SAT mean critical reading, mathematics, and writing test scores for students that participated in any of the eight types of an art and music education and those that did not participate in any art and music education courses.

The findings from the multiple *t* tests for each dependent variable compared students who took one of the eight art or music courses to those who did not take any art or music courses. A significant *t test* demonstrated the differences in the critical reading, mathematics, or writing mean SAT test scores of those taking a specific type of art or music course (i.e., acting, music performance) and those not taking any art or music education course.

Threats To Validity

Although the target population for the study was large, there was a threat to validity because the data was archived mean test score data. However, the College Board collected the original research data and calculated the critical reading, mathematical, and writing mean SAT test score data. Furthermore, the SAT test scores that were used in this study came from a voluntary self-selected population consisting of those students that completed the SAT Questionnaire. These students gave their permission for their test scores and questionnaire information to be used for research purposes. Hence, there is no possibility of selection bias on my part in this study because I am using all the available archival data in the art and music section of the SAT Questionnaire and all of the mean SAT test score data. However, the students that chose to answer the SAT Questionnaire

questions could have characteristics that are different from the characteristics of the students that chose not to complete the SAT Questionnaire. This possible difference between the students that completed the SAT Questionnaire and those that did not could possibly have influenced the SAT test scores. Furthermore, the students self-selected themselves to be participants in the study by completing the SAT Questionnaire and providing answers related to their arts and music education. Among the questions the students responded to were questions about the number of years (i.e., 1/2 or less, 1, 2, 3, 4, 4+) they had participated in an art and music education and about the type (i.e., music performance) of art and music educations courses they had taken or planned to take Thus, the study results, if significant, would generalize to students who completed the SAT Questionnaire from year to year.

A threat to statistical conclusion validity involves the use of secondary data because secondary may limit the relevance of the study. There is also the possibility of the data being out of date. The secondary data for this study is from 2006 to 2015 and that indicates the data is not "out of date". These limitations were occurring even though the study has a large number of students that took the SAT test and completed the SAT Questionnaire. However, to update the findings of the Vaughn and Winner (2000) study, this study was conducted in a similar manner as the Vaughn and Winner (2000) study. College Board secondary archived mean SAT scores across a 10-year period was used. This study reported significant differences in Mean SAT test scores for "years" (i.e., ½ or less, 1, 2, 3, 4, 4+) of an art and for music education, and "type of course" (i.e., music performance) of an art and music education. However, the Vaughn and Winner (2000)

had 8, 10 or 12 years of mean SAT data rather than the 10 years of data used for the current study. Therefore, due to not having enough observation (i.e., years of data) data for this study, a post hoc power analyses will be conducted.

Ethical Procedures

This non-experimental comparative research study used archived mean SAT test data. The study followed the ethical APA principles. I had no personal interaction with participants or school employees at any time. This was also true for the College Board. The College Board included the optional SAT Questionnaire in the registration packet for the student to complete. Thus, no personal contact was made with the student. Therefore, ethical procedures that address the interaction with participants do not apply to this study. Furthermore, this study did not use any of the student's personal demographic information. Thus, those ethical standards do not apply to this study.

The high school student gives their informed consent for the use of their SAT test scores for research purposes when they complete the optional SAT Questionnaire that they complete while registering to take the SAT test. Thus, there was no recruitment of high school students. They self-select themselves into this study when they complete the SAT Questionnaire. Hence, there were no ethical concerns related to recruitment of participants. The use of national mean SAT data in this study resulted in no harm occurring to students because no personal SAT scores are used. Furthermore, the researcher has no student personal demographic data, and the researcher has no contact with any of the students. Hence, this study follows all the ethical procedures of the APA.

Summary

This nonexperimental comparative research study involved measuring differences in secondary archived mean SAT test scores for number of years that students participated in art and music education, as well as eight types of art and music education courses. I did not manipulate art and music variables or the curriculum. I used 10 years (2006 to 2015) of archived mean art and music education SAT test score data. Years of participation in art and music education data came from information students provided via the SAT questionnaire. The one-way ANOVA was used as the analysis method to analyze years of participation in art and music education. A series of *t*-tests were used to analyze and compare critical reading, mathematics, and writing SAT test scores of participants across each of the eight types of art and music education.

It was appropriate to use the SAT questionnaire and test to complete the study. Due to only using archived mean SAT data and no personal student data, no ethical concerns existed. Personal contact with students by me or the College Board was not necessary for this study. The College Board computed critical reading, mathematics, and writing mean SAT test scores and compiled students' answers to the optional SAT questionnaire. Thus, there were no ethical concerns for this study. In Chapter 4, the results of this study are discussed. It includes data collection and analysis of data. Findings of the study are reported.

Chapter 4: Results

The purpose of this nonexperimental comparison research was to determine differences in archived mean SAT test scores for years that students participated in art and music education. My purpose was also to determine differences in terms of national archived mean SAT test scores of participants and nonparticipants across eight art and music education courses of study. SAT test scores in this study are national archived mean critical reading, mathematics, and writing SAT subtests scores for 2006 to 2015. These archived test scores were compiled by the College Board who are creators of the SAT test. The College Board provided national mean and archived test scores immediately after IRB approval.

Research Questions and Hypotheses

RQ1: Is there a significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

$H_0$1: There is no significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a1: There is a significant difference in terms of SAT mean critical reading scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ2: Is there a significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

$H_0$2: There is no significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a2: There is a significant difference in terms of SAT mean mathematics scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ3: Is there a significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education?

$H_0$3: There is no significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

H_a3: There is a significant difference in terms of SAT mean writing scores between students who participated in one half or less, 1, 2, 3, 4, or 4+ years of arts and music education.

RQ4: Is there a significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not?

$H_0$4: There is no significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, and those who did not.

H_a4: There is a significant difference in terms of SAT mean reading scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

RQ5: Is there a significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not

$H_0$5: There is no significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, those who did not.

H_a5: There is a significant difference in terms of SAT mean mathematics scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

RQ6: Is there a significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not?

$H_0$6: There is no significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design, and those who did not.

H_a6: There is a significant difference in terms of SAT mean writing scores between students who took acting, art appreciation, dance, drama, music appreciation, music performance, photography, or art design and those who did not.

In this chapter, I review the purpose of the study and research questions. This is followed by a thorough discussion of the data collection process. The results section includes analysis methods and findings. A summary of the chapter follows.

Data Collection

This nonexperimental comparative study involved using secondary mean SAT test score data. There were two forms of secondary data in this study. There were secondary data from the SAT test and questionnaire. All the data was compiled by the College Board. They collected SAT test score data (answers to SAT test questions) from each student's responses in the critical reading, mathematics, and writing sections of the SAT test. They compiled those critical reading, mathematics, and writing test scores into the mean SAT test scores. This study used these mean SAT test scores for years 2006 to 2015 (College Board, 2010).

The SAT Questionnaire questions that this study used concerned the number of years (1/2 or less, 1, 2, 3, 4, 4+) the student had studied in art and music education. It also concerned the art and music courses (i.e., acting, music performance) the students had taken. The answers to those questions were the data used to answer the research questions. The data was obtained by associating the student's SAT Questionnaire answers to the students' mean critical reading, mathematics, and writing SAT test scores. This process is entailed in the following paragraph.

The student requests a registration packet from the College Board so they can take the SAT test. In the registration packet is the optional SAT Questionnaire (College Board, 2010); The question in the SAT Questionnaire that this study was interested in was the question about the number of years that the student has been involved in art and music education and the courses they have taken. Vaughn and Winner (2000, pp. 77 - 78) report the question of interest as stated in the SAT Questionnaire, "Indicate the total number of years of high school courses (in grades 9 – 12) [in Arts and Music] you have taken or plan to take in each subject listed below. If you have not taken any courses in a subject and do not plan to take any in high school, fill in the oval 'None' column. If you repeat a course, count it only once."

The national mean SAT test scores appear in the College Board public report each year. An example of the profile is: 2010 College-Bound Seniors Total Group Profile Report. However, the report is copyrighted. Therefore, I asked for their permission to use their data for my study. The database links were sent to me by the College Board in August of 2023 when the IRB approved my study.

Demographic Data

The basic ethnic and gender demographic data of the students that completed the SAT Questionnaire and became the sample for this study is unknown. However, it is known for students (i.e., population) that completed the SAT test for each of the 10 years (2006 – 2015) involved in this study. No response data to the gender question was available for only the years 2007 and 2008. See Table 1 and Table 2.

Table 1

Gender of Total Student SAT Test Takers

Years	Total No. of Test Takers	Male	Female	No Response to Gender
2006	1,465,744	680,725	785,019	
2007	1,494,531	690,500	798,030	6,001
2008	1,518,859	704,226	812,764	1,869
2009	1,530,128	711,368	818,760	
2010	1,547,990	720,793	827,197	
2011	1,647,123	770,605	876,518	
2012	1,664,479	778,142	886,337	
2013	1,660,074	776,092	883,955	
2014	1,672,395	783,570	888,825	
2015	1,698,521	794,802	903,719	

Table 2

Race and Ethnicity of Total Student SAT Test Takers by Year

Years	Pct White	Black or Black American	American Indian or Alaska Native	Asian, Asian Am or Pacific Islander	Hispanic Or Latino or Latin Am	Missing Data
2006	56	10	1	9	5	19
2007	55	11	1	9	6	18
2008	57	11	1	10	6	15
2009	56	12	1	10	7	14
2010	54	13	1	11	7	14
2011	53	13	1	11	8	14
2012	51	13	1	12	8	15
2013	50	13	1	12	9	15
2014	49	13	1	12	9	16
2015	**47**	13	1	12	10	17

Descriptive Statistics for the SAT Test

The College Board provided all the descriptive mean SAT test score data for this study. It was provided in report form (pdf). The College Board also provided the SAT questionnaire data. That data included the number of years (i.e., ½ year or less, 1, 2, 3, 4, 4+) a student spent studying art and music education. That questionnaire data was associated with the corresponding critical reading, mathematics, and writing SAT test scores. This study is a 10-year study (2006 – 2015) so there was one report (pdf) for each year.

Descriptive Statistics for the Critical Reading Subtest of the SAT Test

The descriptive statistics of the critical reading mean data, as well as the years of participation are presented in Table 3. As the table indicates, the lowest mean SAT score was 478.00 (*SD* = 4.163) and it corresponds with 1/2/ year or less participation in an art and music education. The highest mean SAT score was 534.10 (*SD* = 4.358) and it corresponds with 4 years of art and music education. That was a difference of 56.10 mean SAT test score points. See Table 3.

Table 3

Descriptive Statistics for Critical Reading and Years of Participation

Years of Participation	Mean	*Standard Deviation*	N
½	478.00	4.163	10
1	498.50	3.837	10
2	501.50	3.837	10
3	505.80	3.967	10
4	534.10	4.358	10
4+	529.90	3.107	10

Total	507.97	19.659	60

Descriptive Statistics for the Mathematics Subtest of the SAT Test

The descriptive statistics of the mathematics mean data, as well as the years of participation are presented in Table 4. As the table indicates, the lowest mean SAT score was 496.70 (*SD* =2.946) and it corresponds with 1/2/ year or less participation in an art and music education. The highest mean SAT score was 543.90 (*SD* = 4.606) and it corresponds with 4+ years of art and music education. That was a difference of 47.20 mean SAT test score points. See Table 4.

Table 4

Descriptive Statistics for Mathematics and Years of Participation

Years of Participation	Mean Math	Std. Deviation	N
½	496.70	2.946	10
1	516.20	2.616	10
2	513.50	2.759	10
3	512.10	2.601	10
4	536.50	3.659	10
4+	543.90	4.606	10
Total	519.82	16.278	60

Descriptive Statistics for the Writing Subtest of the SAT Test

The descriptive statistics of the writing mean and standard deviation data, as well as the years of participation are presented in Table 5. As the table indicates, the lowest mean SAT test score was 467.20 (*SD* = 4.367) and it corresponds with 1/2/ year or less of years of participation in art and music education. The highest mean SAT score was

525.30 (SD = 4.668) and it corresponds with 4 years of art and music participation. That was a difference of 58.10 means SAT test score points.

Table 5

Descriptive Statistics for Writing and Years of Participation

Years of Participation	Mean Writing	Std. Deviation	N
½	467.20	4.367	10
1	489.00	2.906	10
2	492.90	3.725	10
3	497.20	4.185	10
4	525.30	4.668	10
4+	522.30	2.627	10
Total	498.98	20.440	60

Assumptions Testing for Analyses of Variance

The one-way ANOVA's three basic assumptions for critical reading, mathematics, and writing have been met. They include homogeneity of variance, normality, and the independence of groups. There was also independence of groups. The proof for these assumptions is that a student that has taken 1 year of art and music education cannot also, during the same time span, have taken 3 years of an art and music education. Furthermore, there is no formal test for testing for independence of groups. Therefore, the independence of groups assumption was met. The independent variable is measured on a nominal level and the dependent variable is measured on a continuous level. Thus, using an alpha of 0.01, and a confidence level of 95%, the Levene's Test of Homogeneity of variances tests the null hypothesis that the error variance of the dependent variable is equal across groups. For critical reading the Levene's results indicated $F(5, 54) = .269$, p

= .928. For mathematics the Levene's results were $F(5, 54) = 1.575$, $p = .183$. and for writing the Levene's results were $F(5, 54) = 1.141$, $p = .350$. All Levene's tests were not significant. This indicated a homogeneity for variances between groups. There was then a failure to reject the null hypothesis. See Table 6.

Table 6

Levene's Tests for Critical Reading, Mathematics, and Writing

		Levene Statistics	df1	df2	Sig
Reading SAT Scores	Based on Mean	.269	5	54	.928

		Levene Statistic	df1	df2	Sig
Mathematic SAT Scores	Based on Mean	1.575	5	54	.183

		Levene Statistic	df1	df2	Sig
Writing SAT scores	Based on Mean	1.141	5	54	.350

Shapiro-Wilk and Critical Reading, Mathematics, and Writing Normality Test

The assumption of Shapiro-Wilk's normality test for critical reading, mathematics, and writing involves failing to reject or rejecting the null hypothesis that the sample is normally distributed and comes from a normally distributed population. The alpha level for this assumption is 0.01 (Mack, 2016).

To demonstrate the results of the Shapiro-Wilk's assumption of normality for the critical reading subtest of the SAT test indicated that all years (1/2 year or less, 1, 2, 3, 4, 4+) were normally distributed in critical reading. To demonstrate this, I am presenting the range of data for the Shapiro-Wilk's. If the highest and lowest years (1/2 year or less, 1, 2, 3, 4, 4+) range score is normally distributed then all the years (1/2 year or less, 1, 2, 3, 4, 4+) scores are also normally distributed. The highest statistic score and p-value was for 3 years of participation with $W = .939$, $p = .543$. The lowest statistic score was for 1 year of participation with $W = .832$, $p = .035$. Thus, all p-values were between .543 and 035. This demonstrated that the p-values for all years (1/2 year or less, 1, 2, 3, 4, 4+) were not significant. Therefore, the mean SAT scores for each year (1/2 year or less, 1, 2, 3, 4, 4+) for critical reading were all normally distributed. There was then a failure to reject the null hypothesis (see Table 7).

Table 7

Test of Normality Critical Reading

Shapiro-Wilk	Years	Statistic	Df	Sig.
Reading	½	.924	10	.395
	1	.832	10	.035
	2	.897	10	.205
	3	.939	10	.543
	4	.932	10	.463
	4+	.846	10	.052

Note. Alpha level is 0.01.

As with the test results for critical reading, the test results for the Shapiro-Wilk's normality test in mathematics indicated that the mean SAT test scores for all years (1/2

year or less, 1, 2, 3, 4, 4+) were normally distributed while using an alpha of 0.01. To demonstrate this result, I am reporting the range of the results. The highest statistic score and its corresponding significance value was for 4+ years of participation with $W = .939$, $p = .820$. The lowest statistic was for ½ year or less of participation with $W = .882$, $p = .136$. Thus, the Shapiro-Wilk's for years (1/2 year or less, 1, 2, 3, 4, 4+) were not significant, indicating that SAT mean test scores for mathematics were normally distributed. There was then a failure to reject the null hypothesis (see Table 8).

Table 8

Tests of Normality for Mathematics

Shapiro-Wilk	Years	Statistic	Df	Sig
Mathematic	½	.882	10	.136
	1	.889	10	.165
	2	.950	10	.666
	3	.914	10	.312
	4	.937	10	.525
	4+	.963	10	.820

Note. Alpha level is 0.01.

As with the critical reading and mathematics Shapiro-Wilk's test results, the assumption of normality test statistic in writing indicated the assumption for normality was met. The highest range statistic score and significance value was for 4+ years of participation with $W = .956$, $p = .745$. The lowest statistic and significance value was for ½ year or less of participation with $W = .865$, $p = .087$. Thus, the Shapiro-Wilks test of normality for years (1/2 year or less, 1, 2, 3, 4, 4+) were not significant, indicating that

the SAT mean test scores for writing were all normally distributed. There was then a failure to reject the null hypothesis (see Table 9).

Table 9

Tests of Normality for Writing

Shapiro-Wilk	Years	Statistic	Df	Sig
Writing	½	.865	10	.087
	1	.956	10	.745
	2	.941	10	.568
	3	.911	10	.289
	4	.935	10	.498
	4+	.934	10	.486

Note. Alpha level is 0.01.

Results

RQ1

differences in mean SAT critical reading test scores for years (fixed factor-data collected at all levels) of participation (1/2 year or less, 1, 2, 3, 4, 4+), and the one-way ANOVA was conducted. The results indicated there was a significant difference between the group means F (5,54) = 289.372, p <.001, η^{2} = .964. Thus, there was a significant difference between the means of at least two of the groups of years (i.e., ½ year or less, 1, 2, 3, 4, 4+) of studying art and music education. This indicates that the number of years (1/2 year or less, 1, 2, 3, 4, 4+) a student studies art and music education may result in a possible significant enhancement in the mean SAT test scores. For critical reading mean SAT scores, there was a large effect size (η^2 = .964) for differences between the SAT test scores for years (1/2 year or less, 1, 2, 3, 4, 4+) of participating in art music education.

Note that eta squared was close to 1 and the closer eta is to one the more of the variance was explained by the variable years (1/2 year or less, 1, 2, 3, 4, 4+) for critical reading (see Table 10).

Table 10

ANOVA Mean SAT Test Scores for Critical Reading by Year of Participation

ANOVA Reading SAT Scores	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	21981.533	5	4396.307	289.372	<.001
Within Groups	820.400	54	15.193		
~~Ups~~					
Total	22801.933	59			

The comparison of the critical reading mean differences SAT test scores for the years 1/2 year or less, 1, 2, 3, 4, 4+ of participation in an art and music education indicated that 1/2 year or less of participation in an art and music education had mean SAT critical reading scores that were different from 1 year (mean difference = -20.50, $p <$ .001), 2 years (mean difference = -23.500, $p <$.001, 3 years mean difference = -27.800, $p <$.001), 4 years (mean difference =-56.100, $p <$.001), and 4+ years (mean difference = -51.900, $p <$.001).

One-year critical reading mean SAT test scores were significantly different for ½ year (mean difference = 20.500, $p <$.001), 3 years (mean difference = -7.300, $p <$.001), 4 years (mean difference = -35,600, $p <$.001), and 4+ years (mean difference = -31.400, $p <$.001) years of participation.

Two years critical reading mean SAT test scores were different for ½ year or less (mean difference = 23.500, p <.001), 4 years (mean difference = -32.600, p <.001), and 4+ years (mean difference = -28.400, p <.001) years of participation.

Three years critical reading mean SAT test scores were significantly different for ½ year or less (mean difference = 27.800, p <.001), 1-year (mean difference = 7.300, p <.001), 4 years (mean difference = -28.300, p <.001), and 4+ years (mean difference = -24.100, p <.001) years of participation.

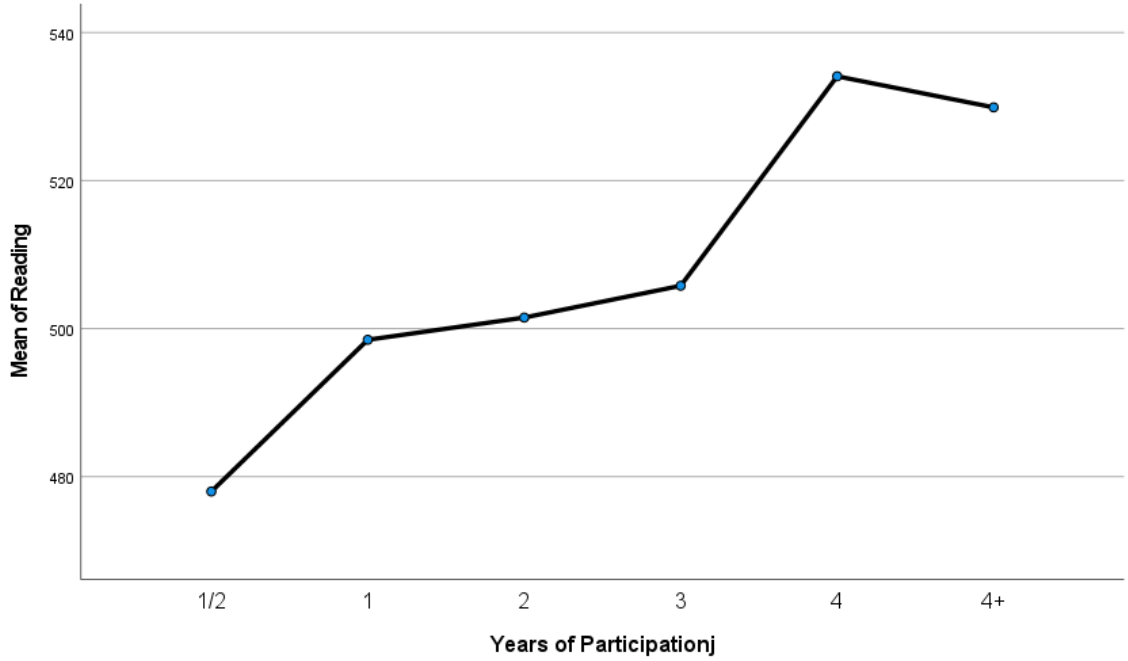
Four years critical reading mean SAT test scores were different for ½ year or less (mean difference = 56.100, p <.001), 1-year (mean difference = 35.600, p <.001), 2 years (mean difference = 32.600, p <.001), 3 years (mean difference = 28.300, p <.001) of participation.

Four plus years critical reading mean SAT test scores were different for ½ year or less (mean difference = 51.900, p <.001), 1-year (mean difference = 31.400, p <.001), 2 years (mean difference = 28.400, p <.001), 3 years (mean difference = 24.100, p <.001),

However, there was no significant difference (mean difference = -3.000, p = .524) found between 1 and 2 years of art and music participation. There was no significant difference (mean difference = 4.300, p <.152) found between 2 and 3 years of art and music participation, and there was no significant difference (mean difference = 4.200, p <.171) found between 4 and 4+ years of art and music participation. See Figure 1.

Figure 1

Years Critical Reading Mean SAT Test Scores



RQ2

The one-way ANOVA for mathematics indicated there was a significant difference between the means of at least two of the mean SAT scores for the years -1/2, 1, 2, 3, 4, 4+ of studying art and music education, F (5,54) = 280.046, p <.001, n^2 = .963. Thus, there was a significant difference between the means of at least two of the groups of years (i.e., ½ year or less, 1, 2, 3, 4, 4+) of studying art and music education. Furthermore, the effect size for differences by years (1/2 or less, 1, 2, 3, 4, 4+) of

participating in art and music education on mean SAT test scores was large. See Table 11.

Table 11

ANOVA Mean SAT Test Scores Mathematics Years of Participation

Math	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	15052.483	5	3010.497	280.046	<.001
Within Groups	580.500	54	10.750		
Total	15632.983	59			

The comparison of years of participation in an art and music educations was conducted to examine the differences between the mathematics mean SAT test scores for the years (e.g., 1/2 year or less, 1, 2, 3, 4, 4+) of participation. The1/2 year or less mathematics mean SAT scores were significantly different for 1 year (mean difference = -19.500, p <.001), 2 years (mean difference = -16,800, p <.001), 3 years (mean difference = -15.400, p <.001), 4 years (mean difference = -39.800, p <.001) and 4+ years (mean difference = -47.200, p <.001).

The 1-year mathematics mean SAT test scores were significantly different for ½ year (mean difference = 19.500, p <.001), 4 years (mean difference = -20.300, p <.001), and 4+ years (mean difference = -27.700, p <.001) years of participation.

The 2-year mathematics mean SAT test scores were significantly different for ½ year or less (mean difference = 16.800, p <.001), 4 years (mean difference = -23.000, p <.001), and 4+ years (mean difference = -30.400, p <.001) years of participation.

The 3-year mathematics mean SAT test scores were significantly different for ½ year or less (mean difference = 15,400, p <.001), 4 years (mean difference = -24.400, p <.001), and 4+ years (mean difference = -31.800, p <.001) years of participation.

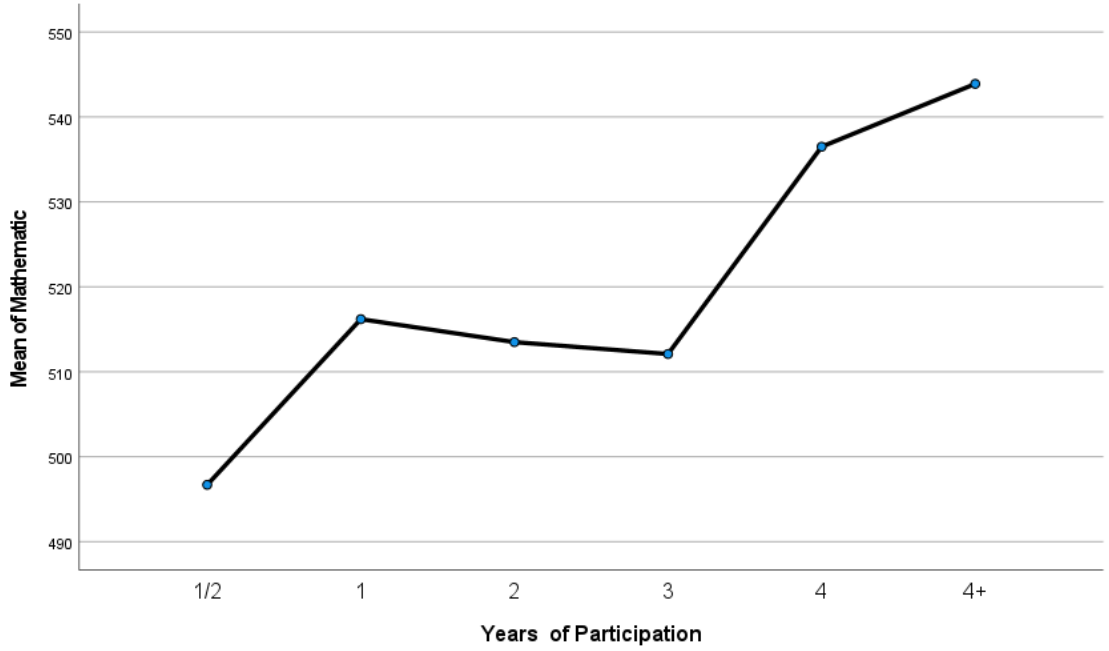
The 4-year mathematics mean SAT test scores were significantly different for ½ year or less (mean difference = 39.800, p <.001), 1-year (mean difference = 20.700, p <.001), 2 years (mean difference = 23.000, p <.001), 3 years (mean difference = 24.400, p <.001), and 4+ years (mean difference = -7.400, p <.001) years of participation.

The 4+ year mathematics mean SAT test scores were significantly different for ½ year or less (mean difference = 47.200, p <.001), 1-year (mean difference = 27.700, p <.001), 2 years (mean difference = 30.400, p <.001), 3 years (mean difference = 31.800, p <.001), and 4 years (mean difference = 7.400, p <.001) years of participation.

However, there was no significant difference between the mean SAT test scores of 1 and 2 years (mean difference = 2.700, p = .449). There was also no significant difference between 1 and 3 years (mean difference = 4.100, p = .073) of participation in an art and music education. There was also no significant difference (mean difference =1.400, p = .930) between the mean SAT test scores of 2 and 3 years of participation in art and music education. See Figure 2.

Figure 2

Years Mathematics Mean SAT Test Scores



RQ3

The one-way ANOVA results for writing indicated there was a significant difference between the means of at least two of the mean SAT scores from the participating years (less than half a year, 1, 2, 3, 4, 4+) of studying art and music education. F (5,54) = 326.928, p <.001, n^2 =. 968. Thus, there was a significant difference between the means of at least two of the groups of years (i.e., ½ year or less, 1, 2, 3, 4, 4+) of studying art and music education. The effect size for years (1/2 or less, 1, 2, 3, 4, 4+) of participating in art music education on mean SAT test scores was large. Thus, the null hypothesis was rejected. See Table 12 and Figure 3.

Table 12

ANOVA Mean SAT Test Scores Writing by Year of Participation

Writing SAT Scores	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	23862.683	5	4772.537	326.928	<.001
Within Groups	788.300	54	14.598		
Total	24650.983	59			

The comparisons were conducted to examine the differences between the writing mean SAT test scores for the years (i.e., 1/2 year or less, 1, 2, 3, 4, 4+) of participation in an art and music education.

The 1/2 year or less writing mean SAT scores were significantly different for 1 year (mean difference = -21.800, p <.001), 2 years (mean difference = -25.700, p <.001), 3 years (mean difference = -30.000, p <.001), 4 years (mean difference = -58.100, p <.001) and 4+ years (mean difference = -55.100, p <.001).

The 1 year writing mean SAT test scores were significantly different for ½ year (mean difference = 21.800, p <.001), 3 years (mean difference = -8.200, p <.001), 4 years (mean difference = -36.300, p <.001), and 4+ years (mean difference = -33.300, p <.001) years of participation.

The 2-yeasr writing mean SAT test scores were significantly different for ½ year or less (mean difference = 25.700, p <.001), 4 years (mean difference = -32.400, p

<.001), and 4+ years (mean difference = -29.400, p <.001) years of participation in an art and music education.

The 3-year writing mean SAT test scores were significantly different for ½ year or less (mean difference = 30.000, p <.001), 1 year (mean difference = 8.200, p <.001), 4 years (mean difference = -28.100, p <.001), and 4+ years (mean difference = -25.100, p <.001) years of participation.

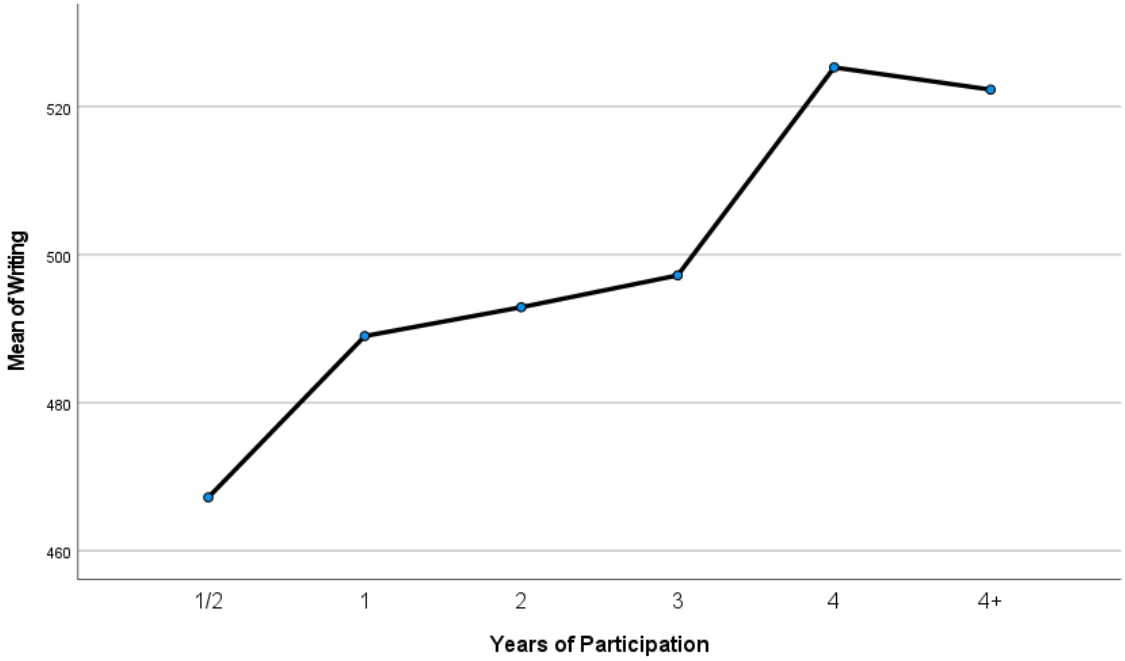
The 4-year writing mean S1-yeart scores were significantly different for ½ year or less (mean difference = 58.100, p <.001), 1 year (mean difference = 36.300, p <.001), 2 years (mean difference = 32.400, p <.001), 3 years (mean difference = 28.100, p <.001).

The 4+ year writing mean SAT test scores were significantly different for ½ year or less (mean difference = 55.100, p <.001), 1-year (mean difference = 33.300, p <.001), 2 years (mean difference = 29.400, p <.001), 3 years (mean difference = 25.100, p <.001).

However, there was no significant difference (mean difference = -3.900, p = .219) between the mean SAT test scores of 1 year and 2 years. There was also no significant difference (mean difference = -4.300, p = .137) between 2 years and 3 years of participation in an art and music education. There was also no significant difference (mean difference = 3.000, p = .502) between the mean SAT test scores of those that had 4 and 4+ years of participation in art and music education. See Figure 3.

Figure 3

Years Writing Mean SAT Test Score



Comparison by Courses of Art and Music Education

Descriptive Statistics for SAT Critical Reading Scores

The College Board provided all the descriptive mean SAT test score data for this study. The data was provided in report form (pdf). This study is a 10-year study (2006 – 2015) and there was one report (pdf) for each year. The descriptive statistics involving the mean and standard deviation data for the 8 courses of study and the "none" category are presented in Tables 13, 14, 15.

As Table 13 indicates, the lowest mean SAT test score was 472.10 *(SD* = 2.644) and it occurred for the "None" no participation in art and music education group. The highest mean SAT score was 538.00 (*SD* = 2.160) and it was for the Acting course of

study group of students. That is a difference of 65 .90 mean SAT test score points. See Table 13.

Table 13

Critical Reading Descriptive Statistics

Reading Mean SAT Test Scores	N	Mean	Std. Deviation
Acting	10	538.00	2.160
Art History	10	507.10	3.843
Dance	10	494.00	3.496
Drama Study	10	517.00	5.437
Music Study	10	532.30	2.163
Music Performance	10	527.80	2.044
Photography or Film	10	512.10	5.363
Studio Art and Design	10	518.40	2.633
None	10	472.10	2.644

The descriptive statistics for the mathematics subtest of the SAT test include the mean and standard deviation data. They are presented in Table 14. As the table indicates, the lowest mean SAT test score is 496.70 (*SD = 3.342*) and it occurred with the "none" no participation group of art and music education. The highest mean SAT score was 536.50 (*SD = 2.593*) for Music Performance participation in art and music education. That is a difference of 42.00 mean SAT test score points. See Table 14.

Table 14

Mathematics Descriptive Statistics

Math Mean SAT Scores	N	Mean	Std. Deviation
Acting	10	530.50	2.068
Art History	10	512.10	3.143
Dance	10	498.50	2.415
Drama Study or Appreciation	10	512.80	2.781

Music Study or Appreciation	10	534.90	2.283
Music Performance	10	536.50	2.593
Photography or Film	10	517.40	3.777
Studio Art and Design	10	525.30	2.541
None	10	494.50	3.342

Descriptive Statistics for SAT Writing Scores

The descriptive statistics of the Writing subtest of the SAT test including the mean and standard deviation data, as well as the courses the students' participation in are presented in Table 15. As the table indicates, the lowest mean SAT test score was 460.70 (*SD = 3.945*) and it occurred with the "none" no participation group of art and music education. The highest mean SAT score was 527.50 (*SD = 2.461*) for the Acting participation group of art and music education. That was a difference of 66.80 mean SAT test score points. See Table 15.

Table 15

Writing Descriptive Statistics

Writing Mean SAT Scores	Mean	Std. Deviation	N
Acting	527.50	2.461	10
Art History	498.30	4.296	10
Dance	494.40	3.307	10
Drama Study Appreciation	508.40	5.892	10
Music Study Appreciation	522.70	2.214	10
Music Performance	519.00	2.449	10
Photography and Film	504.50	5.126	10
Studio Art Design	509.90	2.601	10
None	460.70	3.945	10

Assumptions

The Independent Sample *t*-test assumptions include the dependent variable having ratio data and the independent variable having nominal data. That assumption was met. Next comes homogeneity of variance and the data being normally distributed. Both of those assumptions were met. There is also the independence of groups that was met, and the random sample assumption that was not met. Thus, the discussion of assumptions begins with the dependent variable, which is the mean SAT test scores, and they are ratio data. The independent variable, which is the art and music education courses (i.e., acting, music performance) is nominal data. This assumption was met. However, the sample is a convenience sample not a random sample. However, the mean SAT data does come from a large population and the College Board has stated that the data is appropriate for research purposes (College Board, 2015). The independence of groups assumption was also met because all the mean SAT test scores associated with the art and music education courses (i.e., acting, music performance) were compared to only the mean SAT

test scores of the "none" group. The Homogeneity of Variance assumption was also met using an alpha of 0.01 (Kim & Park, 2019). The test was conducted for the critical reading, mathematics, and writing subtests of the SAT test and for each of the 8 (i.e., acting, music performance) courses of study. There was then a failure to reject null hypothesis of equal variances across all groups (Kim & Park, 2019). See Table 16.

Table 16

Levene's Test for Homogeneity of Variance

Courses – Values	*P* Critical Reading	Mathematics	Writing
Acting	.328	.404	.154
Art History	.438	.984	.956
Dance	.459	.509	.434
Drama Study	.014	.750	.102
Music Study	.277	.503	.086
Music Performance	.208	.660	.118
Photography or Film	.019	.728	.403
Studio Art and Design	.881	.561	.200

Note. Alpha level = 0.001.

Shapiro-Wilk Normality Assumption Assessment for Critical Reading

To assess the assumption of normality, the Shapiro-Wilk test for critical reading, mathematics, and writing SAT scores was conducted. The null hypothesis for this assumption is that the sample comes from a normally distributed population and is normally distributed. The alpha level for this assumption was 0.01 (Mack, 2016). Hence, due to the lowest significance level "none" no participation in art and music education) being $W(10) = .878$, $p < .123$ and the highest level (music study participation (course) in

an art and music education) being W (10) = .958, p = .768, there was a failure to reject the null hypothesis. See Table 17.

Table 17

Tests of Normality for Critical Reading

Shapiro-Wilk	Courses	Statistic	df	Sig
Reading SAT Scores	Acting	.924	10	.393
	Art History	.887	10	.156
	Dance	.934	10	.484
	Drama Study	.952	10	.692
	Music Study	.958	10	.768
	Music Performance	.950	10	.665
	Photography or Film	.949	10	.658
	Studio Art and Design	.931	10	.461
	None	.878	10	.123

Note. Alpha level = 0.01.

Shapiro-Wilk Normality Assumption Assessment for Mathematics

To assess the assumption of normality for the mathematics subtest of the SAT test, the Shapiro-Wilk was conducted. Each of the courses (i.e., acting, music performance) normality results were not significant. The assumption of normality involves failing to reject or rejecting the null hypothesis that the sample is normally distributed and comes from a normally distributed population. The alpha level for this assumption is 0.01. Hence, due to the lowest significance level "none" no participation in art and music education) being W (10) = .744, p = .003 and the highest level (music

study participation (course) in an art and music education) being $W(10) = .934$, $p = .493$, there was a failure to reject null hypothesis. See Table 18.

Table 18

Test of Normality for Mathematics

Shapiro-Wilk	Courses	Statistics	df	Sig
Math SAT Scores	Acting	.862	10	.081
	Art History	.931	10	.460
	Dance	.918	10	.337
	Drama Study	.915	10	.320
	Music Study	.934	10	.493
	Music Performance	.837	10	.040
	Photography or Film	.890	10	.169
	Studio Art and Design	.903	10	.239
	No Participation	.744	10	.003

Shapiro-Wilk Normality Assumption Assessment for Writing

To assess the assumption of normality for the writing subtest of the SAT test, the Shapiro-Wilk was conducted. Each of the courses (i.e., acting, music performance) normality results were not significant. The assumption of normality involves failing to reject or rejecting the null hypothesis that the sample is normally distributed and comes from a normally distributed population. The alpha level for this assumption is 0.01. Hence, due to the lowest significance level (art history participation in art and music education) being $W(10) = .894$, $p = .189$ and the highest level (music study participation (course) in an art and music education) being $W(10) = .950$, $p = .674$, there was a failure to reject the null hypothesis, See Table 19.

Table 19

Test of Normality for Writing

Shapiro-Wilk	Courses	Statistics	df	Sig
Writing SAT Scores	Acting	.923	10	.383
	Art History	.894	10	.189
	Dance	.943	10	.589
	Drama Study Appreciation	.940	10	.548
	Music Study Appreciation	.912	10	.298
	Music Performance	.910	10	.278
	Photography and Film	.950	10	.674
	Studio Art Design	.924	10	.389
	None	.957	10	.750

Note. Alpha level = 0.01.

RQ4

Due to differences in the means of the critical reading subtest of the SAT test, the art and music education courses are ranked by using their corresponding means. The means are ranked from highest to lowest. The highest SAT mean is associated with the art and music education course Acting (*M* = 538.00, *SD* = 2.160) and it is followed by: Music Study (*M* = 532.30, *SD* = 2.163), Music Performance (*M* = 527.80, *SD* = 2.044), Studio Art and Design (*M* = 518.40, *SD* = 2.633), Drama Study (*M* = 517.00, *SD* = 5.437), Photography and Film (*M* = 512.80, *SD* = 5.363,), Art History (M = 507.10, *SD* = 3.843), Dance (*M* = 494.00, *SD* = 3.496), and None (*M* = 472. 10, *SD* = 2.644).

To determine if the differences in SAT test score means were significant different and therefore whether to fail to reject or reject the null hypothesis, eight individual *t*-test were conducted. The results for critical reading courses indicated the course comparison

of Acting and None was ~~a~~ t (18) = 61.041, p <.001, Art History and None had a t (18) = 23.792, p <.001. Dance and None had a t (18) = 15.800, p <.001. Drama Study and None was t (18) = 23.49, p <.001, and Music Study, Appreciation and None was t (18) = 53.73, p <.001. Music Performance and None was t (18) = 54.08, p <.001 while Photography, Film and None was t (18) = 21.15, p <.001. Therefore, the null hypothesis of no differences between the mean SAT test scores of participants and nonparticipants of an art and music education was rejected because the results of the *t*-tests indicated a significant difference for all 8 courses of study of the participants when compared to the mean SAT test score of the nonparticipants. Therefore, the null hypothesis was rejected. See Table 20 and Figure 4.

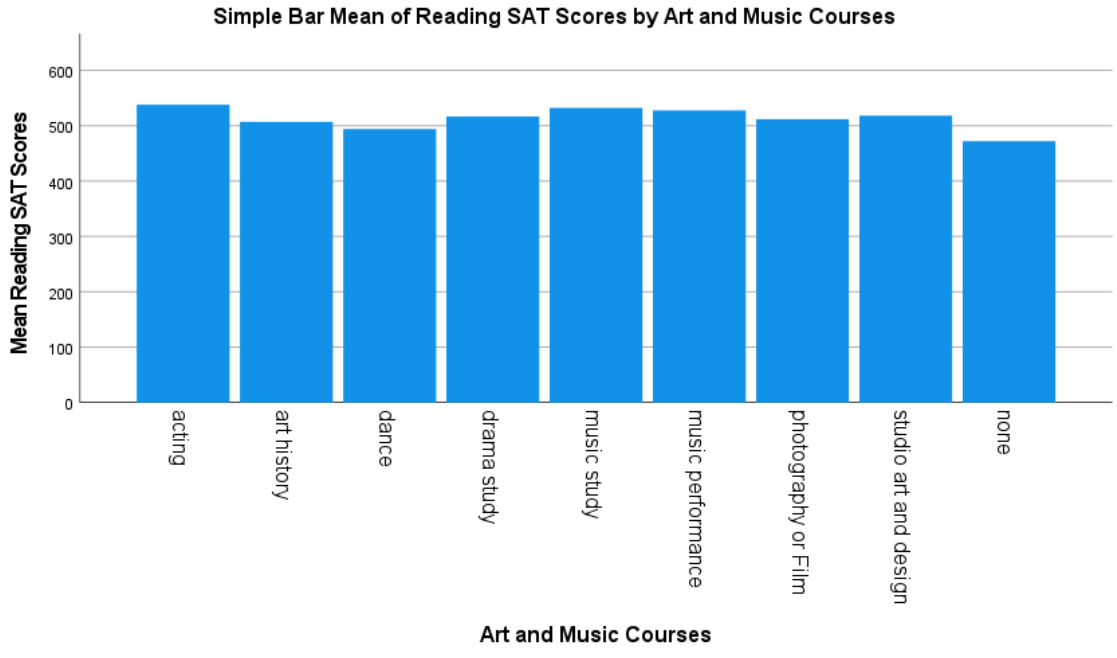
Table 20

Courses Critical Reading Mean SAT Test Scores Comparison

Courses	Mean	Std Deviation	*t*-test	Significance *t*-test
Acting	538	2.160	61.041	<.001
Art History	507	3.843	23.792	<.001
Dance	494	3.635	15.800	<.001
Drama Study	517	5.437	23.487	<.001
Music Study	532	2.163	55.734	<.001
Music Performance	528	1.912	54.085	<.001
Photography / Film	512	5.363	21.154	<.001
Studio Art / Design	518	2.623	39.240	<.001
None	472	2.644		

Figure 4

Means Plot of Art and Music Courses for Reading SAT Test Scores



RQ5

To demonstrate the differences in the means of the mathematics subtest of the SAT test, the means are ranked from highest to lowest and then associated with their corresponding art and music education course. The ranking is as follows: Music Performance has the highest mean (M = 536.50, SD = 2.593), next comes Music Study (M = 534. 90. SD = 2.593), followed by: Acting (M = 530.50. SD = 068), Studio Art and Design (M = 525.30, SD = 2.541), Photography and Film (M = 217.40, SD = 3.777), Drama Study (M = 5132.80, SD = 2.781), Art History (M = 512.10, SD = 3.143), Dance (M = 498.50, SD = 2.415), None (M = 494.50, SD = 3.342).

The t-test was used to answer research questions about the differences in SAT test score means. The result for Acting and None was t (18) = 28.97, p <.001. For Art History and None, the result was t (18) = 12.13, p <.001 and for Dance t (18) = 3.07, p = .003. For Drama Study, t (18) = 13.31, p <.001, and for Music Study and None, the t statistic was t (18) = 31.57, p <.001. For Music Performance, t (18) = 31.40, p <.001 and for Photograph and Film, the t statistic was t (18) = 14.36, p <.001. For Studio Art and Design, the t statstic was t (18) = 23.20, p <.001. This indicates there was a significant difference between the means of the SAT test scores of the participants and nonparticipants of an art and music education for all 8 art and music education courses. Therefore, the null hypothesis of no difference between the mean SAT test scores of the participant and nonparticipant was rejected. See Table 21 and Figure 5.

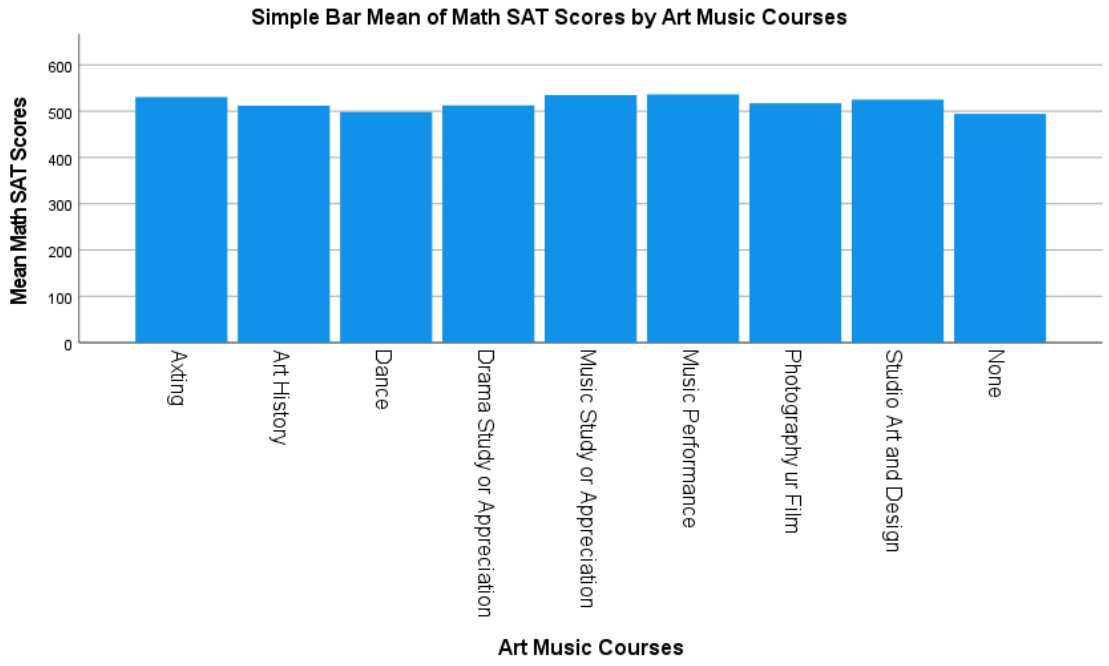
Table 21

Critical Reading Mean SAT Test Scores Comparison

Courses *t*-test	Mean	Std Deviation	*t*-test	Significance
Acting	531	2.068	28.97	<.001
Art History	512	3.143	12.13	<.001
Dance	498	2.415	3.07	<.003
Drama Study	513	2.781	13.31	<.001
Music Study	535	2.283	31.57	<.001
Music Performance	537	2.593	31.40 14.36	<.001 <.001
Photography / Film	517	3.777	23.20	<.001
Studio Art / Design	525	2.541		
None	495	3.342		

Figure 5

Mathematics SAT Test Scores Comparison



RQ6

To demonstrate the differences in the means of the SAT test, the art and music education courses are ranked according to their means. The mean and standard deviation are associated with its corresponding art and music education course and reported going from highest mean to the lowest mean. The ranking is as follows: Acting (M = 527.50, SD = 2.461), Music Study (M = 522.70, SD = 2.214), Music Performance (M = 519.00, SD = 2.449), Studio Art and Design (M = 509.90. SD = 2.601), Drama Study (M = 508.40, SD = 5.892), Photography and Film (M = 504.50, SD = 5.126), Art History (M = 498.30, SD = 4.296), Dance (M = 494.40, SD = 3.307), None (M = 460.70, SD = 3.943).

The *t*-test was used to determine the significance of the differences in the mean SAT test scores and therefore, whether the null hypothesis could be accepted or rejected. The results of the t - test for Acting and None was t (18) = 45.43, $p < .001$ and for Art History and None it was t (18) = 20.39, $p < .001$. For Dance and None, the t statistic was t (18) = 20.70, $p < .001$, and for Drama Study and None the t statistic was t (18) = 21.27, $p < .001$. Music Study and Appreciation and None, t statistic was t (18) = 43.34, $p < .001$, and for Music Performance and None, t (18) = 39.70, $p < .001$. For Photography and Film and None, t statistic was t (18) = 21.41, $p < .001$, and for Studio Art and None the result was t (187) = 32.92, $p < .001$. This indicates there was a significant difference between the participants of an art and music education mean SAT test scores for all 8 art and music education courses and the mean SAT test scores of the nonparticipating group (None). Therefore, the null hypothesis of no difference between the mean SAT test scores of the participant and nonparticipant was rejected. See Table 22 and Figure 6.

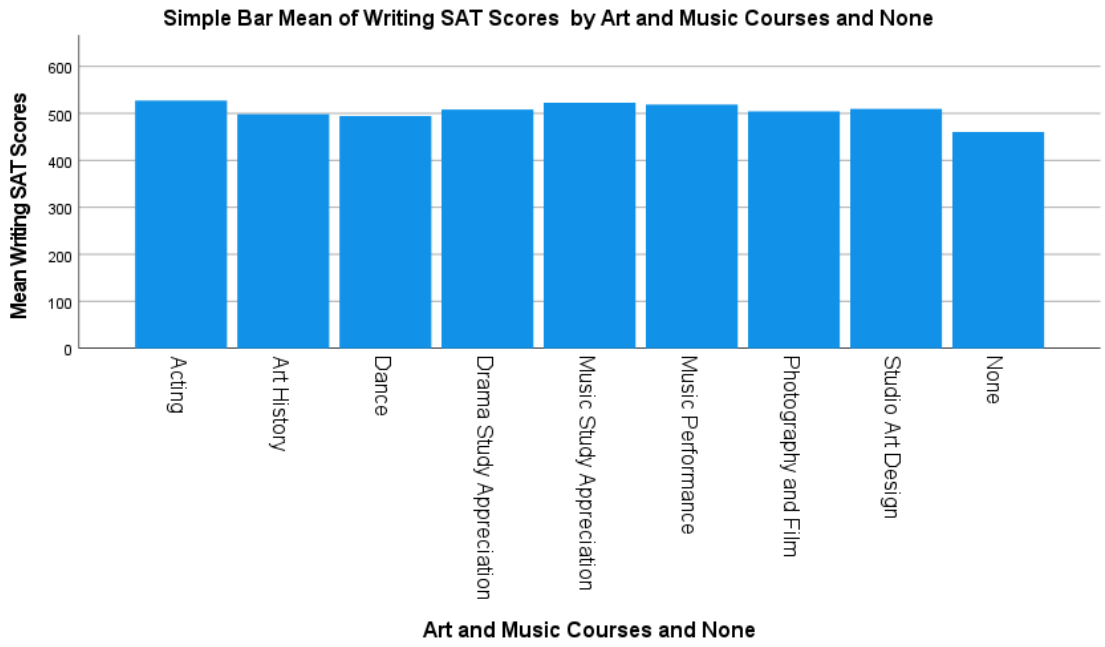
Table 22

Writing Mean SAT Test Scores Comparison

Courses *t*-test	Mean	Std Deviation	*t* test	Significance
Acting	528	2.461	45.43	<.001
Art History	499	4.296	20.39	<.001
Dance	494	3.307	20.70	<.001
Drama Study	508	5.892	21.27	<.001
Music Study	523	2.214	43.34	<.001
Music Performance	519	2.449	39.70	<.001
Photography / Film	505	5.126	21.41	<.001
Studio Art/ Design	510	2.601	32.92	<.001
None	461	3.945		

Figure 6

Writing SAT Test Scores Comparison



Summary

Results of this study answered the research questions. Results indicated a significant increase in terms of critical reading, mathematics, and writing mean SAT test scores for participants with 1/2 hour or less of art and music education when compared to critical reading, mathematics, and writing mean SAT test scores of participants with 1, 2, 3, 4, and 4+ years of experience. There was also a significant increase in critical reading and writing mean SAT test scores between participants with 1/2 years or less of participation and 1 and 2 years of art and music education. After 3 years of participation in art and music education, there was an even larger significant increase in critical reading, mathematics, and writing mean SAT test scores from 3 to 4 years. Moreover, a significant increase of mean SAT test scores continued for mathematics for those with 4+ years of experience.

This was followed by a comparison of critical reading, mathematics, and writing mean SAT test scores of participants with and without art and music education. There were eight art and music education courses that participants had opportunities to study. Results indicated a significant increase in critical reading, mathematics, and writing mean SAT test scores for those taking any art and music education course when compared to scores for students who took no art or music education courses.

In Chapter 5, I interpret findings of the study. Limitations of the study are also discussed. This is followed by recommendations for future research. This is followed by implications of the study for social change.

Chapter 5: Discussion, Conclusions, and Recommendations

This study was conducted due to concerns that students were missing benefits of art and music education. Therefore, the purpose of this nonexperimental comparative study was to determine differences in terms of national archived mean critical reading, mathematics, and writing mean SAT test scores of students who participated in ½ year or less, 1, 2, 3, 4, or 4+ years of arts and music education between 2006 and 2015. My purpose was also to determine differences in terms of national archived mean critical reading, mathematics, and writing SAT test scores of participants and nonparticipants across eight art and music courses during this time period.

Key Findings

Findings by Years of Participation

SAT test scores were compared based on years students participated in art and music education. There was a significant increase in critical reading, mathematics, and writing mean SAT test scores from 1/2 year or less to 1 year. When mean SAT test scores for 3 to 4 years of participation were compared, there was another significant increase. This significant increase continued for mathematics when SAT test scores for 4 and 4+ years were compared.

However, due to no significance difference in mean SAT test scores for those students who only participated in art and music education for 1, 2, and 3 years, they did not show further increases in critical reading, mathematics, and writing mean SAT test scores. Those who continued their education for a total of 4 years had even higher increases in mean SAT test scores compared to those with 2 or 3 years of art and music

education. Moreover, students with 4+ years of art and music education had an even higher increase in mean SAT test scores in mathematics than students who stopped their education after 4 years. These findings suggest students benefit from art and music education.

Findings by Courses of Study

Mean SAT test scores of students who participated in art and music education classes were compared to nonparticipants. Findings indicated significantly higher mean SAT test scores for critical reading, mathematics, and writing for students who took art and music education.

Interpretation of Findings

My study supports research in the field of psychology that students benefit from art and music education. This indicates students who participated in art and music education classes had significantly higher SAT test scores than those who did not participate in any art and music education classes. I used a newer version of the SAT test and analyzed photography and film courses and a new writing section. Findings indicated students who participated in art and music education courses had the potential for increasing mean SAT test scores. This increases the possibility of attending colleges or universities that only accept students with higher SAT test scores.

Ellis et al. (2012) indicated neurological growth resulted from music education. There were changes in the brain's grey and white matter that occurred during music training that were not the result of maturation. Furthermore, Finn et al. (2014) showed cognitive processing skills predict academic achievement, and studying the arts increased

cognitive processing skills. Additionally, Schellenberg (2004) indicated music instruction enhanced cognitive processing and enhanced general ability. Drama education significantly enhanced adaptive skills. Guhn et al. (2019) indicated instrumental music students who took multiple years of music instruction in high school on average were academically 1 year ahead of their nonparticipating peers. There is a possibility of underlying neuro and cognitive mechanisms involved in art and music education that support increases in academic achievement test scores.

Holochwost et al. (2017) indicated enhancement of standardized achievement scores, executive functioning skills, and short-term memory skills. In addition, Guhn et al. (2020) indicated students who participated in a multiyear (2 to 3 years) instrumental music education had achievement scores that were an average 1 year ahead of nonparticipating peers. Thus, enhanced achievement functioning occurred. Findings from my study indicated learning was occurring due to spikes in mean SAT test scores which occurred after 1 year and again 4 years.

Theoretical Implications

The findings of my study support the theories of Constructivism and Gardner's theory of multiple intelligence with an educational perspective. My study's findings indicated that with art and music educational experiences there were general increases in mean SAT test scores. Constructivism and Gardner's theory of multiple intelligences state that during the learning experiences, the brain is constantly developing cognition by linking and restructuring the individual's thoughts about their environmental learning experiences (Baba, 2015; Gardner, 2011). Hence, constructivism and Gardner's multiple

intelligences theories are related to my study because both theories concern the building of knowledge through environmental experiences (Constructivism) and using one's natural abilities. In this study the intelligences of interest are musical intelligence and artistic intelligences identified as using a variety of Gardner's intelligences.

Vaughn and Winner (2000) believed that the development that occurred in the brain with art and music education probably enhanced cognitive skills (constructivism and Gardner's intelligences) that the student would then use during academic achievement testing. This is supported by the Groussard et al. (2020) study findings that indicated that with regular music practice executive functioning, working memory, and non-verbal reasoning skills were found while regular acting practice enhanced long term memory skills and fluency performance. Regular practice was highly associated with enhanced cognitive skills and occurred in the environment and corresponded to the Constructivism theory. Additionally, Finn et al. (2014) completed a study involving 1,367 eighth grade students who attended public, private, and charter schools. The findings indicated that cognitive skills predicted standardized academic achievement test scores. Thus, Finn et al. (2014) study, and the Groussard et al. (2020) study findings indicated the importance of art and music education (constructivism environmental experience) that uses the student's natural Gardner's intelligences in developing a student's cognitive skills.

My study supported Constructivism and Gardner's multiple intelligences. This occurred because the finding of my study indicated spikes of growth at one year oparticipation in an art and music education that were similar to the spike that was found

at four years of participation in art and music education. Learning was occurring even though my study did not measure brain development directly. This spike also occurred between three and four years of the verbal, mathematics, and composite subtest in the Vaughn and Winner (2000) study. Moreover, when students participated in art and music education courses such as music performance, the mean SAT test scores were significantly higher than the mean SAT test scores of the nonparticipants of an art and music education. Because all educational courses are occurring in the environment and students are using Gardner's multiple intelligences, my study supports Constructivism and Gardner's multiple intelligence theories.

Limitations of the Study

The limitations of this study include the methodological issue of convenience sampling rather than random sampling. The sample was the 10 years of SAT test score data and a sample of 10 observations is considered a small sample. Furthermore, completing the SAT questionnaire was optional. Additionally, the mean SAT scores of the participants and nonparticipants were secondary data that was compiled by the College Board. Individual test scores of the students were not available. These issues limited the generalization of the findings of the study. However, although the sample is considered small (10 years), over a million students each year from 2006 to 2015 took the SAT test. This is an exceptionally large population, and the samples were normally distributed and had homogeneity of variances across ten years of SAT test score data. Furthermore, although completing the SAT Questionnaire was optional, the College Board has completed reliability and validity testing and the SAT test scores are

considered reliable and valid and can be used for research purposes. This study used mean SAT test scores, therefore what the College Board compiled was relevant to the study and was accurate. Thus, this study was completed.

Recommendations

The current study is a nonexperimental comparative study. Hence, in two years there will be 10 years of data available from the 2016 version of the SAT test that can be used to update the 2005 version and determine the differences in the SAT test scores of participants and nonparticipants of an art and music education. Furthermore, a study that provides predictive information about the increase in mean SAT score points that can occur by studying the arts would be helpful information for students, parents, counselors, and policy makers.

Implications and Social Change

The often-unexpected ramification of studying art and music education is the development of cognitive skills. Research indicates these newly developed cognitive skills are commonly used in the classroom by students when learning new skills and during achievement testing. Thus, individual positive social change occurs for the student because the student is operating cognitively at a higher level and that higher level is reflected in higher achievement scores. Thus, the student may be able to attend a college or university that requires these higher achievement scores. In society, this could mean that the induvial has the skills to become an attorney rather than to train to become a paralegal., It is therefore important that students, parents, and policy makers support the inclusion of art and music education in all schools. This inclusion has the potential to

result in positive social change due to an art and music education promoting the development of cognitive skills that are reflected in higher academic test scores.

Theoretically, Constructivism and Gardner's multiple intelligences theories also support this enhanced positive social change that occurs with studying art and music education. Constructivism offers an explanation for the brain growth that occurs during art and music education. Once there is an art and music environmental experience, the student then reflects back on that experience and organizes the current experience with past experiences that prepares the brain for its next art and music educational experience. During this environmental art and music experience Gardner's multiple intelligences are also being used to process the environmental experience. It is this process that results in increasing cognitive skills that are then used to increase academic achievement skills. It is this knowledge that practitioners can use to explain the importance of art and music education in schools and in this process, they are creating positive social change.

Conclusion

In conclusion, it is important that schools offer art and music education for all students because it does appear to enhance cognitive skills, and thus, achievement tests scores. There is a significant increase in mean SAT test scores when a student takes any art and music education course. Four years of participation provides the highest mean SAT test scores when compared to those that took less than 4 years of art and music participation.

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