7-8-2022

# The Impact of Music Education on Middle School Students' Attendance Rates and Academic Achievement on Math and English Language Arts

Irene Wang Shi

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by

Irene Wang Shi

A Dissertation submitted to the Education Faculty of Lindenwood University in partial fulfillment of the requirements for the degree of

Doctor of Education

School of Education

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This Dissertation has been approved as partial fulfillment

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Lindenwood University, School of Education

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Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work at Lindenwood University and that I have not submitted it for any other college or university course or degree.

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## Acknowledgments

I dedicate this dissertation to my ever-supportive husband, Dr. Gensheng Shi, and my daughter Anna. Completion of this work would never have been possible without their endless time, love, and support. I would like to thank Ying Li, a librarian, for assistance in conducting literature searches. I am also grateful for the expertise of my study committee, staff of Lindenwood University COEHS Graduate School, and their helpful comments and suggestions on this paper: Dr. Robyne Elder, Dr. Kevin Winslow, Dr. Roger "Mitch" Nasser, Dr. Francesco Giuseffi and Dr. Sherrie Wisdom.

I also would like to thank the participants of the survey for their cooperation in sharing their experiences, and their insights into the topic in the survey. Thank you to my coworkers, Dr. Tim Jamieson and Sandy Matney, who continually supported and encouraged me in this endeavor.

I appreciate all that these friends, families, coworkers, instructors, professors and supportive individuals have given to make this accomplishment possible.

## Abstract

In recent years, students' standardized test scores have become one of the major measurements for students' learning. However, music as a non-tested subject is often viewed as a lesser valued subject compared to core subjects. The purpose of this study was to investigate the impact music programs have on student academic achievement and attendance rate. The data was collected from one middle school of a large school district located in the northeast of Missouri. The study population includes sixth, seventh, and eighth-grade students who enrolled in the 2017-2018, 2018-2019, and 2020-2021 school years. The population was divided into students who participated in music classes (band, choir, and orchestra) and students who did not participate in music classes. A survey was also conducted to align with the research question: "What are middle school music educators' perceptions of music education's impact on academic achievement?" The research used descriptive and inferential statistical procedures: *t*-test, ANOVA, and Chi-square ($\chi 2$) tests to examine data for study purposes. The analyzed data proved the proposed hypothesis and theory, that there was statistically significant data from the English Language Art (ELA) and Mathematics (MATH) assessments to show the positive impact music education could have on both ELA and MATH achievements. The students involved and enrolled in music education courses had higher ELA and mathematics assessment scores and performance levels. Though the results of the students' attendance days were not as significant, it still statistically showed that music education also had a positive effect on student attendance days. From the analysis of the survey, the finding indicated that all the survey participants agreed that music education has a positive impact on students' academic achievement. It also suggested that middle

school music teachers believed that not only can music education help students improve their academic performances, but it can also provide students with the principle abilities to learn and to succeed in other core academic areas.

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# Chapter One: Introduction

## Introduction and Background

Along with the development of technology in the 21st century, music has become more intertwined with one's everyday life. Each day provides one with an opportunity to encounter music. Anyone with a cell phone can set a ring tone with a favorite sound or song, watching a show on television or in a theatre allows one to participate more fully as the music creates different moods, and attending a live concert is the perfect atmosphere to experience immersion into the music. Whether on the way to work or on a long road trip, many drivers play music through the speakers to make the experience more enjoyable. Even simple acts such as standing in an elevator, visiting a store, or being placed on hold on the phone provide opportunities to listen to music while shopping or waiting. Many toys have music programmed in, commercials have catchy tunes, and computer applications incorporate music in the background. Children learn how to play musical instruments at school or lessons, and marching bands perform at football games and in competitions. Throughout history, music has played an integral part and continues to fulfill a specific purpose in special occasions, such as weddings, funerals, presidential inaugurations, graduation commencements, theatrical entertainment, or expressions of personal feelings. Wearing earbuds and streaming music has become a popular way to individualize choices and allow for easy access to music. Music is everywhere, and it allows one to experience life in a more meaningful way. Throughout history, music has been used as a learning tool. Some songs help children learn numbers, alphabets, animals, and basic knowledge of the world. Songs help people pass down history from one generation to the next. Consider the national anthem of each country; they all have vivid

stories behind them. In some cultures, music is considered a representation of friendship. In Native American cultures, to build friendship between trips, they usually choose a song or a dance to exchange with others (Share the Music, 1998).

Music education is rooted in the singing schools of the early days. Many music education pioneers, such as Lowell Masson and William Billings responded to the desire for organized music instruction in music fundamentals and note reading in addition to church singing. They also saw that music education in the United States is an expression of the needs of the people rather than a product of artistic elites (Nye & Nye, 1985). The term music education was an invention of the early National Education Association which reveals that music is a part of general education.

Music as one of the subjects began to be offered officially in schools in the 1850s, but it was not until 1964 that music instruction was approved and financed in Boston's primary grades (Nye & Nye, 1985). Since then, music education has become an essential subject in American public schools. Throughout the decades of learning music, it has been noted that music education not only has direct musical outcomes, such as singing and instrumental performance, but it also has nonmusical outcomes such as the development of literacy, numeracy, and verbal memory skills. In addition, music education is likely to be a promising intervention for "at-risk" students (Rickard et al., 2012). In school settings, studies show that students who participated in school performing arts attained higher academic achievement, which is demonstrated by grade point averages (GPA; Kelly, 2012) and standard assessment scores (Holmes & Hallam, 2017; Holochwost et al., 2017).

The impact of participation in music education on academic achievement has been the central focus of research for many years, as evidenced in the review of the literature. For example, Hodges and O'Connell (2014) observed that a few studies have argued that education in music can boost test scores, attendance, attitudes toward school, and overall academic achievement. According to the Music Educators National Conference (NAfME), there are many personal benefits to participating in music education including confidence, self-esteem, and a sense of accomplishment. Research from the National Association for Music Education states that schools that have music programs have an attendance rate of 93.3% compared to 84.9% in schools without music programs (The National Association for Music Education, 2014).

I chose this study because I benefited from learning music in my life, and I wanted to find concrete evidence of the benefits of music education so I could encourage others to pursue its study. Music education, along with other education in schools, provides our kids a high-quality education and a meaningful learning experience. To solidify that music is a vital part of everyone's education (Palubinski, 2019), this study explored the impact of music education on students' academic success and school attendance.

**Statement of The Problem**

Throughout history, decision makers in public schools have encountered all kinds of challenges when making curriculum adjustments, and this is especially true during economic downtimes. Music is often viewed as a lesser value subject compared to core subjects because it is not a tested subject. In recent years, students' standard test scores have become more and more important for school districts, because they are one

of the major measurements for students' learning (Alzhanova et al., 2017; Bergee & Weingarten, 2021). Music as a non-tested subject has often been viewed only in its use as entertainment or as an unnecessary elective class. People may believe that music education can only provide entertainment benefits, or that students may take music courses only to learn how to play an instrument or sing songs. When society has this perspective of music education, music programs are more likely to be cut under financial pressure. Though standardized test scores are an important part of the assessment of students' learning, the purpose of education is not just about test scores. The mission statement of the U.S. Department of Education posted on their website states: "Our *mission* is to promote student achievement and preparation for global competitiveness by fostering educational excellence and ensuring equal access" (U.S. Department of Education, 2021, para. 8). Yes, musical skills, such as playing an instrument or singing songs are the direct benefits of learning music (Brown, 2012), and they are also the obvious results which people can see directly. However, there are many non-musical benefits of studying music that are only seen after a long period of time. According to the National Association for Music Education (NAfME, 2014), music helps students improve their memorization, increase coordination, learn pattern recognition, and stay engaged in school. All these nonmusical benefits help students perform better in and out of school.

Music as a part of school curriculum carries the function to promote students' achievement not only academically, but beyond that. Though the federal Every Student Succeeds Act (ESSA) has been touted as a more flexible approach to student testing and school accountability, many school districts are still struggling to keep the balance, due to

increased budget cuts, stringent state standards of learning, and requirements of the higher student and teacher accountability (Slaton, 2012).

Generally, the combination of local, state, and federal funding is the financial resource for public school districts and public charter schools. Among the three, the state and local communities provide the bulk of school funding, and federal funding makes up less than 10% of total school funding, usually given through federal programs funded by federal agencies, such as the Department of Education, the Department of Health and Human Services, and the Department of Agriculture (U.S. Department of Education, 2021).

The local funding comes more directly from the property taxes of the surrounding community. The state funding comes from general state revenues, such as income tax, sales tax, gaming, and lottery, etc. (Shuls, 2012). School districts with higher property values have the potential to receive more local revenue than school districts with lower property values. Finance policy and funding formulas serve as the foundation of equalization among poor and rich communities. There are 46 states that adjust their funding formula to bring equity and adequacy into school funding (Kohl, 2013). Without these adjustments, low social-economic status groups could face the potential for educational funding inequity.

When America experiences a recession, the economy takes a nosedive, and local governments cannot support all the programs they currently have, which means they will need to make choices about where to make sacrifices in their budgets. Unfortunately, over the last few years, our local school systems have faced increased budget cuts. Following the 2008 economic crisis, eight out of ten Missouri school districts cut staff in

2010 (Missouri Budget Project, 2012). Currently, with a lack of federal funding and the COVID 19 pandemic, once more education is put in a difficult situation. According to a St. Louis Post-Dispatch 2020 report, Governor Mike Parson announced an additional $209 million in budget cuts with most cuts hitting the Department of Elementary and Secondary education. Of the $209 million cuts, more than $131 million will come from K-12 education (Parson announces, 2020). When school administrations have reduced funding, they need to make decisions about program cuts; if a school does not recognize the value of music education, fine arts programs and music education are usually at the risk of suffering serious budget cuts. In the 2012 article, "Music Education Budget Crisis," Slaton (2012) stated, "Music programs nationwide are in danger. State and local legislators are attempting to make up for funding shortfalls in this difficult economy by cutting education budgets which can place school music at risk" (p. 33). In the 2014 book *Music Education is in Crisis,* Pergola concluded:

> In the current state of economic recession, public schools are losing a significant portion of their funding. This forces school districts to make serious choices about program funding. A loss in funding too often translates into less money to support elective music courses. Program cuts of this nature are usually accompanied by layoffs and job cuts. (p. 33)

Besides the financial challenge, schools are also facing the problem of chronic student absence. According to Missouri Compulsory Attendance Law Section 167.031, RSMo:

> Any parent, guardian or other person having custody or control of a child between the ages of seven and the compulsory attendance age for the

> district, must ensure that the child is enrolled in and regularly attends public, private, parochial, home school or a combination of schools for the full term of the school year. (Missouri Revised of Statues, 2009, para. 3)

Accumulating evidence indicates that attendance is directly and positively tied to students' academic achievement, and it has a significant impact on student learning (Kim et al., 2020; Stanca, 2017; Westerman et al., 2011). According to the *Washington Post*, millions of students are chronically absent each school year, and many schools are struggling with their attendance rate (The Washington Post, 2016). Under the ESSA, schools are held accountable for their students' attendance (Balu & Ehrlich, 2018).

**Purpose of The Study**

The purpose of this study was to investigate the impact music programs have on student academic achievement and attendance rate. It also illustrated that music education has nonmusical benefits, which help students perform better in middle school settings. Between students who participated in music classes (band, choir, and orchestra) and students who did not participate in music classes, the data of Missouri standardized test (MAP) scores were used to determine the differences in academic achievement and attendance rate between the two groups. This study used students' attendance data to investigate the relationship between music education and school attendance rate. It also provides information for school officials and practitioners to consider when creating attendance incentives.

This research provided a statistical result for music teachers, administrators, and school districts. The researcher hopes that they can make decisions based on the data and find ways to encourage student learning and to improve the attendance rate. Much

research has shown that music education has an impact on student academic achievement. Not only did participating in a music program improve students' skills in many academic subjects, such as Reading, Mathematics (Math), and English Language Arts (ELA); it also encouraged students to attend school and to be engaged with more school activities (Alzhanova-Ericsson et al., 2017; Broussard & Garrison, 2004; Heller, 2001). There are a great number of related studies on such topics, some of them showing significant differences and some of them not finding any differences at all. Beyond the scope of the focused school district, this study could also provide guidance for other school officials, education policymakers, and music educators in related decision makings.

**Limitations of The Study**

A student's academic achievement and attendance rate may be impacted by many factors. Music education may have a huge positive impact on one person's learning and may not have any impact on another person's learning at all. There are more factors involved in student learning, such as family situation, teaching and learning styles, relationship with other schoolmates, and parent support (Balu & Ehrlich, 2018; Kassarnig et al., 2017). On the other hand, music classes are usually one of the electives in most public schools, students can select one elective class among several provided electives. If a student likes art, he or she may choose art class instead of music class. Therefore, those who take music classes are not representative of the entire student body. This research mainly focused on the differences in standardized test scores in Math and ELA, as well as the differences in the attendance rate between music students and non-music students.

## Methods

This study was a mixed-method study with a major focus on quantitative research. The data was collected from the focused school district, and the qualitative component included a survey about middle school music educators' perceptions correlated with the study question. The data consisted of student MAP scores on Math and ELA, as well attendance data from 2017-2018, 2018-2019, and 2020-2021 school years. There was no MAP data provided from the 2019-2020 school year, because the MAP test was canceled due to the Covid pandemic. In the focused middle school setting, the research population (over 900 students) included grade levels of sixth through eighth. Students were divided into two groups. One group included the students who enrolled in vocal (choir) and instrumental (band and orchestra) music programs, and students that may have been enrolled in a combination of vocal and instrumental music. Another group included students who did not enroll in any music program.

To compare the differences between the two groups, the researcher ran a *t*-test and an ANOVA test to analyze collected data of standardized examination results (Math and ELA) and to measure student academic achievement. Student attendance rates were analyzed as well. The subgroup information, such as students' gender, race, and free/reduced lunch status is also being explored in this study. The qualitative part of the study utilized a survey for middle school music teachers (band, choir, and orchestra), which collected their perspectives on music education's effect on students' overall academic achievement. The survey was designed to align with the research questions. Eight middle school music teachers were invited to respond to open-ended questions. The answers were compared between the music teachers in different subjects, and common

opinions and differing views were discovered from the analysis of the survey questions. This study examined the impact of participation in music on standardized test performance and the number of days those students attended school in grades six through eight. All findings were derived from data analysis to determine the long-term effects of music on attendance and student achievement.

**Research Questions and Hypotheses**

Research Question: What are middle school music educators' perceptions of music education's impact on academic achievement?

Alternate Hypotheses:

1). Students who take music classes perform higher academically than those who do not take music classes.

2). There are differences in academic performance between students who take Band, Orchestra, and Choir classes.

3). Students who take music classes have a higher attendance rate than those who do not take music classes.

4). There are differences in attendance between students who take Band, Orchestra, and Choir classes.

**Definitions**

*Attendance rate:* The ratio of attendance hours to the number of attendance and absence hours for a school district K-12 submitted by districts to the Missouri department of elementary and secondary education (DESE; Kohl, 2013).

*Formal Music Education:* Formal music education: the practice of teaching music in public schools using established criteria and curricula; usually teacher-directed (Jaffers, 2006).

*Instrumental Music:* comprised of music composed for or performed on a musical instrument. Instrumental music is intended to be performed by a musical instrument or group of instruments. Instrumental music is music produced by playing a musical instrument (National Association for Music Education, 2004).

*MAP scores.* The results from the annual Missouri Assessment Program exams were administered to public schools in the spring. Exams include third, fourth, fifth, sixth, seventh, and eighth grade for Math and ELA (ELA), fifth and eighth-grade science, and End of Course (EOC) exams after English I, English II, Algebra I, Algebra II, Geometry, American History and Government (Kohl, 2013).

*Missouri Assessment Program (MAP)* - The Missouri Assessment Program manages test development, ongoing test maintenance, and oversees the test administration for statewide, large-scale assessments. The MAP assessments test students' progress toward mastery of the Missouri Show-Me Standards (Missouri Department of Elementary and Secondary Education, 2021).

*Music Education***:** Music education is a vital component of K-12 education today and is an essential avenue for fostering meaning in life, growing in understanding of the self and others, as well as affording opportunities for self-expression (Missouri Department of Elementary and Secondary Education, 2021).

*Vocal Music:* comprised of music composed or arranged for or sung by the human

voice. Vocal music is intended to be performed by one or more singers, usually with instrumental accompaniment. A vocal selection is a music selection that is vocalized (as contrasted with instrumental music). A vocal selection is a music intended for performance mainly by singers or other vocalists. Other musical instruments may be involved, but the choir is the main focus of the piece. Examples of vocal music include choral music, yodeling, Sacred Harp, and Barbershop (National Association for Music Education, 2004).

**Summary**

As a music teacher, I have strongly believed that music education develops powerful and unique ways to improve students' understanding of themselves and the world. It also helps student engagement in the learning process (Johnson & Emont, 2006.) Through music experiences, students have opportunities to explore new ideas, express feelings, and develop their social and cultural identities. These experiences also provide opportunities for students to think creatively and imaginatively. Music education not only encourages students to be cooperative and collaborative, it also exposes students to diverse cultures. It helps them to understand more about people and enhances their individual well-being. As the statement of problems indicated earlier, tough economic circumstances could be a threat for decreased funding or cutting of art programs, and it is the biggest concern among music educators. Because of this concern, and for the survival of music programs, many educators actively advocate the importance of music education in schools. Much research discussed the benefits children receive from learning music. This positive relationship between music education and academic achievement is also demonstrated through decades of music studies (Holmes & Hallam, 2017; Holochwost et

al., 2017; Norgaard et al., 2019; Palubinski, 2019; Rogers & Hallam, 2017). This research was conducted to illustrate the relationship between music education participation and academic achievement, as well as to show the relationship between music education participation and school attendance rate.

## Chapter Two: Review of Literature

In this chapter, literature sources were utilized to introduce background information about American music education, the association between music education and students' academic performance, and attendance rate. Research questions and the hypotheses for this study were developed based on this literature review. The literature search was conducted in several databases including ERIC, Academic Premier, and PubMed. The reference lists of selected studies were evaluated and searched again. Federal, state, and local governments' websites were explored also. The sources included print and online peer-reviewed journal articles, theses, dissertations, as well as government agencies and school districts' websites.

This literature review covered four areas: (1) the fundamental theory of music education - Piaget's cognitive interactionist theory, (2) the impact of music on human behavior, (3) music education in core subjects' academic achievement, and (4) effective music education programs' impact on students' academic achievement at school. The first focus in this literature review was a review of Piaget's cognitive development theory, which is considered the most influential theory of modern education (Nye & Nye, 1985). This cognitive development theory was the guide for developing music curriculum in American public schools for the 20th century. The second component of the review will examine the association between music education and brain development. The last two portions will review music education programs in a range of grade levels, and the role they played on students' academic achievement.

In Music in the Elementary School, Nye and Nye (1985) introduced background knowledge and presented theories including Piaget's cognitive development theory and

how they influenced American music education. Before planning for teaching, knowing children's developmental stages, how they grow, and how they learn is very important to teachers. Some teachers may know the subject well but have a hard time teaching the content successfully. A better understanding of children's mental and physical growth will help teachers to connect with students and to engage students. This better understanding will also help develop effective teaching plans and improve teaching techniques. In this book, some prominent educational psychologists' theories were reviewed, including Piaget's cognitive development theory and Bruner's human cognitive psychology and cognitive learning theory. Both theories are the foundations of general education, including music education.

**Cognitive-Interactionist Theory**

Cognitive learning theory is a theory that shows the foundation of music education, and enlightenment of music courses and teaching theories. In a study about music curriculum design and cognitive psychology-based teaching theory, Feng (2020) mentioned that as an important component of a quality education is music education to cultivate students' music literacy. Feng also pointed out that learning is a main component of human development. The knowledge of human development in different ages becomes the foundation for the design of the music curriculum; it is also a key component for music teachers in their teaching practices. In modern music education, the most influential cognitive theory is the cognitive development theory of Piaget.

Swiss biologist and psychologist, Jean Piaget, was the most influential figure in today's early childhood education (as cited in Nye & Nye, 1985). He was the leading advocate of the cognitive-development theory. According to him, "intelligence has a

biological base in that all organisms respond and adjust to environmental stimuli. This interaction with the environment takes place on both physical and mental levels" (as cited in Nye & Nye, 1985, p. 24).

**Main Features of Piaget's Cognitive Theory**

There are two major aspects of Piaget's Cognitive Theory: the process of cognitive development, and stages of cognitive development. For the process of cognitive development, Piaget described assimilation and accommodation as the two processes. They are usually attempted to be adapted by the individuals. Assimilation is the process of using the environment so that it can be placed in preexisting cognitive structures. Accommodation is the process of changing cognitive structures to accept something from the environment. Huitt and Hummel (2003) discussed that both processes of Piaget's theory of cognitive development are used throughout life as the person increasingly adapts to the environment in a more complex manner.

Piaget's theory provides the descriptions of human development from infancy to adulthood. There are four stages of cognitive development: sensorimotor or preverbal stage, preoperational stage, concrete operational stage, and formal operational stage. The first stage, the sensorimotor or preverbal stage, covers children from newborn to two years old. In this stage, children respond to numerous activities with objects and situations (Bart, 2004). They experiment with objects using the senses such as listening, smelling, touching, and looking. Before the development of formalized language, infants think based on their sensory and psychomotor of the objects and the world. They are usually unable to process representation thoughts and act out what is in their minds (Barrouillet, 2015).

Between age two and seven is the preoperational stage. In this stage, the children will fill in the gap between the sensorimotor activities of the infant and the internal mental activities of the school-aged children. The language will gradually replace the sensorimotor activities of infancy. Mental images are developed too. Instead of getting things directly, they start requesting. Through dramatic movement, the children are assimilating symbolically the ideas, roles, and experiences of the surrounding environment. Meanwhile, accommodation plays a role to balance assimilation; it is the primary function of imitation (Flavell, 1996). Young children can accommodate different experiences through imitation so that they can expand their concepts. In this phase, children are not able to combine parts into a whole, or to arrange parts in alternating ways. Symbols as a type of concept formation are used to represent objects, and labels and names are acquired for experiences (Ahmad et al., 2016).

The third stage is the concrete operations stage. Children aged seven through 11 are counted towards this stage. In this stage, children can think about concrete objects or their presentations. They can differentiate, extend, subdivide, or combine the knowledge they know into new relationships and groupings. They can think logically instead of accepting surface appearances (Gakhar & Kaur, 1985). Compared to the earlier stage, children at the concrete operations stage acquire and assimilate information and data from their actions. They convert the structure in their mind into new knowledge; thus, the process of thinking changes. Most children at this stage of cognition can usually use logic, and the mental ability for the combining of different elements is developed usually toward the end of this stage. Repeating a concept in different ways, children can transfer it mentally to a new experience, therefore, the learning happens. Children from age 11

through adulthood are at the stage of formal operations. Starting in early adolescence, the period of cognition appears. Children can think based on hypothesis and the abstract instead of the basis of objects or the concrete. They can analyze the thoughts of others, identify variables in problems, and criticize information they receive. This is the highest level of intellectual thought.

In the early days, music education in the United States had two objectives: reading music, and singing acceptably (Humphreys, 1998). Later on, music education added emphasis on the performances of vocal and instrumental. Soon after, music appreciation and concept understanding became important goals of instruction. More recently, the achievement of musical responsiveness through the learning of music has been the focus as an academic discipline (Heller, 2001). Nye and Nye (1985) wrote in their book that "Music is an effective art, based upon feelings that cannot be accurately assessed" (p. 24). They pointed out that music is learned through the integration of cognitive, affective, and psychomotor. Music involves intellectual and physical experiences of learning. Together, all the factors made learning music a successful experience. Since music is hard to be accurately assessed, its indirect benefits from the development of cognitive, affective, and psychomotor contribute to effective learning in other subject areas.

Based on Piaget's Stages of cognitive development, educators crafted curriculums to fulfill the needs of children of different ages (Huitt & Hummel, 2003). Two European composers, Kodaly and Orff created two well-known music teaching methods, Kodaly Method and Orff Method. which became almost universally realized (Shehan, 1986,

Sheridan, 2019). These methods have been largely adapted into music education in primary and secondary schools worldwide.

**The Impact of Music on the Human Brain**

Several studies have shown the beneficial effects of music education (Bergee & Weingarten, 2021; Broussard & Garrison, 2004; Foley, 2017; Geist et al., 2012; Guion, 2017; Holmes & Hallam, 2017). Children's brain development can be impacted intensely by the learning of music. Therefore, researchers believe that children who had music training benefitted from enhanced brain activity. Music training was also proved to increase students' abilities to perform other academic assignments and practical life tasks. In the following paragraphs, the literature review demonstrated the benefits of music education and its impact on children's brain development.

Scientific literature claimed that music was part of humans' biological heritage. For example, babies automatically move to the beat when they hear music; parents sing lullabies to put infants to sleep (Trainor et al., 2012). Studies show that infants can differentiate between two notes and remember melodies by breaking them into smaller phrases like what adults do. Thus, the brains of children can understand music. Theoretically, children's development of expression, communication, and cognitive skills will be enhanced through the reinforcement of their music reactions (Yoon, 2000). Our brain has the right and left cerebral hemispheres. The left side performs tasks related to logic, such as science and math and the right side performs tasks related to creativity and arts. When both halves of the brain are stimulated equally, both halves can be developed equally. If one side of the brain is developed more than the other side, one's potential intelligence can be underdeveloped. Therefore, in addition to learning science and math,

learning music and art would optimize full brain development and increase children's intelligence (Lehr, 1998).

**Music and Executive Function**

According to the National Association for Music Education (2014), music learning has many benefits for children. It enhances children's brain function, which in turn improves their language skills and math skills. Some supporters of music education agree that the study of music can help the development of the brain and enhance academic performance (Norgaard et al., 2019; Palubinski, 2019). Winter (2016) strongly supported that children will see improvement in other areas of their education through the study of music. Winter argues that "Individuals with musical training tend to score better than their nonmusical counterparts on a test measuring the ability to remember lists of words and prose" (p. 14).

In the study, Winter (2016) sought to determine if the executive function had an impact on the increased cognitive ability. Executive function can be interchanged with other terms including executive control, cognitive control, or the supervisory attentional system. Executive function is a set of cognitive skills that are needed for self-control and managing behaviors (Low, 2020). If the executive function is impaired, a person would not be able to follow directions, focus on tasks, control emotions, or sustain goals. Winter's study found that students in music lessons showed better academic performance in school than nonmusical students. Because of this, Winter concluded that enriched executive functioning could improve nearly all performances of cognitive tasks, so it could be the mediator between music lessons and cognitive improvement. Unlike IQ, executive function is highly modifiable, particularly in childhood (Winter, 2016).

Music-making often needs executive function-related processes, such as planning, anticipation, memory, and cooperating with other musicians. Playing an instrument requires the skill of shifting between mental and physical tasks. For instance, one needs to rearrange fingers to perform the same musical patterns. When playing a piece of music on the stage, not only does one need to memorize the musical notes, but one also needs to be able to play it expressively. Whether be it vocal music or instrumental music, to play fluently, the skill of anticipation is needed. When a note is being played, the next note should be anticipated. The anticipation requires the coordination of performing both mental tasks and physical tasks simultaneously (Guhn et al., 2020).

**Benefits of Music**

In general, music is often viewed as an enjoyable, pleasurable, entertainable aesthetic subject. It is the vehicle to create a certain mood and it gives people ways to express themselves. Through the joy of music, one can relax and leave stress and tension behind (Silverstone, 2018). Music improves children's social and emotional skills since singing and playing instruments together require children to collaborate with and support each other. Learning to work together as a team develops a sense of empathy for others, researchers found that children were more sensitive to others' feelings when they have experience playing music together in ensembles (Foley, 2017).

According to NAFME (2014), music improves coordination, gives a sense of achievement, and helps kids stay engaged in school. The ability to play an instrument requires a great deal of resilient practice, it teaches children to work towards both short-term and long-term goals (Degé & Schwarzer, 2017). Practicing also helps children establish a routine and develop self-discipline. Setting up a daily practice schedule

develops commitment and patience. Mastering a new piece of music creates a sense of pride and achievement. It has been proven that the value of self-discipline can be learned (Kim et al., 2020). Improvisation is a major part of music, especially in jazz music. Through improvisation, children use their creativity to make up music in the moment. Gill, Artistic Director of the Sydney Symphony's Education Program, defended music as "Sound organized in some way, passing through time" (Gill, TED Talk, 2010). Gill mentioned that children begin to learn music through imitation. It requires listening, and as a result of the listening they repeat, then it requires focus. Focus is not only necessary for learning music, but it also is the key for all learning (Asmus, 1999).

**Music and Academic Achievement**

As the brain optimally developed from learning music and arts, the benefits can be seen in the area of academics (Brown, 2012). Many studies suggested the correlation between music and students' academic achievements. Evidence could be found in students' test scores and academic achievements. A project was implemented on student transitions in British Columbia. The study measured students' academic achievement from K-12 to post-secondary institutions. The study tracked the student transition rates to post-secondary education, student mobility among post-secondary institutions, post-secondary education completion, and retention rates. The results indicated that students with music experiences consistently achieved higher GPA scores, on average, than students without music experiences (Broussard & Garrison, 2004). Nevertheless, among students who transitioned to post-secondary education, students with music experiences were more likely than non-music students to first enroll in research-intensive universities and visual and performing arts post-secondary programs. Students with music

experiences achieved higher credential completion rates than students without music experiences. The results of this research supported the importance of offering music courses in schools. It should motivate school administrators, teachers, and parents to utilize all the available resources to encourage students to participate in music programs in the K-12 education system (STP, 2019).

### *Music and Math*

Research showed that learning music has many benefits for children. These benefits include enhanced language capabilities, improved memory, strengthened hand-eye coordination, heightened mental processing, and problem-solving skills (Silverstone, 2018). These benefits can also help students improve their academic performances at school (Bergee & Weingarten, 2021; Guhn et al., 2020; Rogers & Hallam, 2017). A group of researchers discovered that randomly selected students from grades one through eight who participated in an out-of-school music program scored higher on standardized tests. This group of students also had better grades in ELA and Math compared to the control group (Holochwost et al., 2017). Music psychologists mentioned that the improvement of intellectual performance could be stimulated and enhanced by some forms of musical activity (Holmes & Hallam, 2017). There is a profound connection between music and Math. For example, the study of rhythm starts with knowing the value of each note. There is a similar connection between notes' patterns and number patterns. Many music teachers use "musical math" to reinforce the understanding of the concept. A child can learn basic fraction pattern recognition and problem-solving by listening to musical beats. In the practice of making music, the basic counting of the notes has been used to increase the accuracy. Improved spatial intelligence and ability are important for

more advanced mathematics (Geist et al., 2012). A study revealed that children who experience learning the piano keyboard improved their performance on spatial-temporal reasoning tasks, which is the ability to mentally move objects in space and time to solve multi-step problems (Hetland, 2000). As spatial-temporal skills are higher-level mathematical abilities, many studies focused on children's spatial-temporal skills. There is strong evidence showing that among different musical activities, rhythm training can improve spatial-temporal reasoning most effectively. Further, children can improve their intelligence by actively engaging in music. In 2017, Holmes and Hallam researched children aged four through seven. The research focused on a group of children who had participated in a music program that contained a variety of musical activities, and a controlled group of children who had not participated in music programs. Both groups' proficiency in mathematics and spatial-temporal reasoning was recorded and compared throughout the intervention. The results showed that the music group performed better than the controlled group in spatial-temporal tests. Another study by Santone (2018) from Wilmington University was conducted at a mid-sized public charter school in New Jersey. Scores from students who took instrumental music lessons were compared to the scores of non-music students. The study found that the students who began instrumental music lessons at an early stage scored significantly higher in sixth, seventh, and eighth grade in mathematics.

***Music and ELA***

Music stimulates all areas of children's mental development. Besides the development of spatial-temporal skills, which helps improve the study of Math, music also helps the development of intellect, language, and overall literacy. Children benefited

more from learning sounds and words if they are exposed to music during early ages (Sharman, 1981). Music helps the body and the mind work together. Musical skills such as steady beat, pattern, and rhythm are all parts of basic music learning through various musical activities.

The common core standards of the ELA increased the level of integration between studies of different subjects. They also increase the focus on nonfiction reading and writing. Therefore, more incorporation of other content, such as music, has been happening with the ELA classes. Critical thinking and cross-curricular learning are elements of the National Standards of Music Education. The common core standards of ELA emphasize speaking and writing across the curriculum. The standards require music students to develop their skills to communicate about music subjects. Aspects of ELA common core instruction can be easily built into music programs. They can be used to enrich music programs and to help students achieve their musical goals. By incorporating ELA into music teaching and learning, students can develop a deeper understanding of music; therefore, it makes them better musicians. Constructively, when students had greater abilities to communicate their musical insights, their speaking and writing skills in ELA are enhanced (Smith, 2014).

Studies established that music can be a tool to improve ELA skills. Furthermore, reading can be improved through singing songs, and writing can be enriched by creating lyrics (Bergee & Weingarten, 2021). Music is often described as a universal language. However, there are still different ways to interpret musical notes in many cultures. Western musical notation has become the main language of music throughout the world. Music can be viewed as a universal language because it is understood by people across

countries and cultures. Regardless of what native language people speak, music learning allows people to be able to understand the meaning of notes written on staff. The common thing is that English as a Second Language (ESL) students start schools speaking little or no English. They have difficulty learning the content in many classes. However, when ESL students learn to sing songs and to play instruments in music class, they usually pick it up quickly (Tarbert, 2012). The musical notes most ESL students learned in their native countries are the same as in the United States (Hansen et al., 2004).

Music as a universal language involves the visual decoding process. This process was similar to reading and writing. The decoding process of music is to translate musical notes into sounds. The eye coordination of reading music is the same eye coordination of regular reading. Both reading processes include the structure of letters, words, and sentences. In music, the basic notes can be viewed as "letters," different rhythm patterns can be viewed as "words," and musical phrases are "sentences." The skills of reading these music elements help to build the skills for reading. Through reading, students understand the functions of letters and how to put them together to make meaningful words. Then they can make sentences with these words (Tarbert, 2012). When reading music, students understand the function of each note, interval, and location on staff. Then they have a better understanding of how the musical elements come together to form measures and phrases (Tarbert, 2012).

In addition, visual focus and visual memory are two skills needed in reading and learning music (Hansen et al., 2004). When reading an article or a piece of music, the ability to follow lines, and visually decode text without distraction are the basic skills needed for content comprehension. The process of music composing is also similar to the

process of writing. There are five stages of writing: prewriting, drafting, revising, editing, and publishing (Gromko, 2005). During the prewriting stage, students brainstormed ideas and documented their thoughts. Then students composed the ideas and thoughts into a draft. After writing the first draft, students started to add and organize information. They then made corrections to the grammar and punctuations. Finally, a clear and well-constructed work could be published (Hansen et al., 2004).

Like writing a paper, composing a piece of music has a similar process from brainstorming to publishing. Composers understand that writing music is a process. The process starts with ideas and an initial draft; then it moves on to rehearsal and editing until the final piece is ready to be published. The process of writing a paper or creating a piece of music allows students to work collaboratively and to improve their writing skills (Eaton, 2006).

**Gardner's Multiple Intelligences Theory**

Howard Gardner, the noted developmental psychologist, defined intelligence as "the capacity to solve problems or to fashion products that are valued in one or more cultural settings" (Brualdi, 1996). Though Gardner developed his multiple intelligences theory to challenge academic psychologists, it has been used widely in education fields. Gardner did not present many suggestions for educational settings; however, many educators took his theory and applied it as they saw fit.

Gardner first introduced eight bits of intelligence in his 1983 book *Frames of Mind*. The eight types of human intelligence consist of Logical/Mathematical, Spatial, Bodily-Kinesthetic, Musical, Interpersonal, Intrapersonal, and Naturalist. Gardner noted that linguistic and logical-mathematical intelligence are most valued in school and

society (Gardner, 1983). Linguistic intelligence deals with sensitivity to the spoken and written language. It gives people the ability to analyze information and to express themselves orally or in written language (Gardner, 2000). Logical/mathematical intelligence refers to the capacity to analyze problems logically. People with logical-mathematical intelligence are most likely to have the ability to develop equations and solve proofs. This intelligence is often related to scientific and mathematical thinking. Spatial intelligence features the ability to recognize and manipulate patterns and allows people to have the ability to create mental images to solve problems. Bodily-kinesthetic intelligence gives people the ability to coordinate mentally with one's own body's movement to solve problems or to fashion products. This intelligence creates the connections between mental and physical activities. Musical intelligence refers to ability in the performance, composition, and understanding of musical patterns. It includes the capability to recognize musical pitches, rhythms, and tones (Helding, 2010). Interpersonal intelligence is the ability to recognize and understand other people's moods, desires, motivations, and intentions. Interpersonal intelligence also gives the ability to understand one's feelings, desires, fears, and capacities. People with this intelligence can regulate their own life effectively. Naturalist intelligence provides the ability to identify and classify the numerous species of his or her environment. People with naturalist intelligence can identify and distinguish different types of plants and animals (Gardner, 1983).

Though it has been described as eight different bits of intelligence, Gardner noted that they are interrelated and rarely operated independently. In most situations, intelligences have complemented each other and are used concurrently when people learn

skills or solve problems (Gardner, 1983). For example, a doctor can excel at his work if he has strong spatial intelligence, interpersonal intelligence, logical-mathematic intelligence, and linguistic intelligence. Spatial intelligence provides a doctor with the ability to accurately operate the surgery; interpersonal intelligence creates the capacity to understand others' feelings, it allows a doctor to communicate well with patients (CBC, 2018); logical-mathematic intelligence allows a doctor to solve problems and conduct scientific experiments; and linguistic intelligence enables a doctor to put the research in writing and present it in front of others. Thus, with the development of different bits of intelligence simultaneously, an individual could be extremely successful.

Nearly two decades later, Gardner (2000) offered a more refined definition of intelligence: "A biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (p. 28). This modest change in wording suggested that intelligence is potentials-presumably, they are not things that can be seen or counted. Some of the intelligence may or may not be activated but depends upon the values of a particular culture, personal decisions, opportunity availabilities, and other elements (Helding, 2010).

Though Gardner's (2010) theory was developed to challenge academic psychologists, it has been widely used in North American schools. Because each person differs from others, the most important educational implication for multiple intelligences theory can be used through individuation and pluralization. Students with different bits of intelligence learn differently. Presenting a variety of activities would provide students with different opportunities to think about the subjects, and to have a deeper understanding of the content (Gardner, 2010).

According to Gardner (1983), linguistic intelligence includes the ability to learn languages, the capacity to analyze information, and to create products orally or in writing. Linguistic intelligence gives an individual the ability to express oneself stylistically or lyrically. It also allows the individual to use language to remember information. Musical intelligence is the ability to read and compose musical notes, pitches, and tones (Lukács & Honbolygó, 2019). Auditory functions are required for developing this intelligence that is related to pitches and tones. In Gardner's 1983 book, *Frames of Mind*, he claimed that learning occurs when synaptic connections are made between cells in the brain. The brain's function reacts in the corresponding location when learning occurred in a certain way. For example, if a person studies art as a profession, the art or creative part of the brain will be more developed. Likewise, in a person who studies mathematics or science, the logical part of the brain will be more developed (Gardner, 1983).

When intelligence is combined while learning, beneficial synaptic connections are made between cells in different parts of the brain. Different parts of the brain perform different tasks. Some brain parts, connections may not exist, ordinarily, if certain activities are not performed (Moreno & Lee, 2015). According to the University of California San Francisco, Broca's area in our brain is associated with speech production and articulation. It is in the left hemisphere, and it controls our ability to articulate ideas and utilize accurate words in spoken and written language (Speech & Language, 2021). University of Central Florida's study indicated the recognition and understanding of pitch, melody, speed, and valium is mainly handled by the auditory cortex. In the article, "Music and Language are Processed by the Same Brain Systems," Georgetown University researchers suggested that two different aspects of both music and language

depend on the same two memory systems in the brain. One system, based on temporal lobes, helps memorize information in both language and music, such as words in language and melodies in music. The other system, based on the frontal lobes, helps unconsciously learn and use the rules that underlie both language and music, such as the rules of writing a sentence, or rules of composition in music (Georgetown University Medical Center, 2007). Thus, linguistic intelligence and music intelligence improve both reading and writing abilities. Linguistic intelligence allows one to operate one's thoughts orally or in writing; it also promotes expressive and critical thinking. Musical intelligence gives one the ability to read, compose, and perform a piece of music. It also promotes creativity (Norgaard et al., 2019). When students constantly exercise both bits of intelligence together, their brain function can be improved.

ELA classes also benefit from the use of Gardner's Multiple Intelligence Theory. The process of learning to read and to write is the same as the process of learning to follow the lyrics and to compose music (Herholz & Zatorre, 2012). The use of musical intelligence simultaneously with linguistic intelligence improved student phonemic awareness, fluency, and comprehension skills (Palubinski, 2019). Not only can music benefit students in the learning process, but it can also elevate the level of engagement in ELA classrooms.

**Music and School Attendance**

According to the Missouri compulsory attendance law, "Missouri Law Chapter 167 states that every child between the ages of 7 and 17 shall attend a public school regularly during the entire school year unless otherwise enrolled in private school or home school that meets the state's requirements" (Missouri Department of Elementary

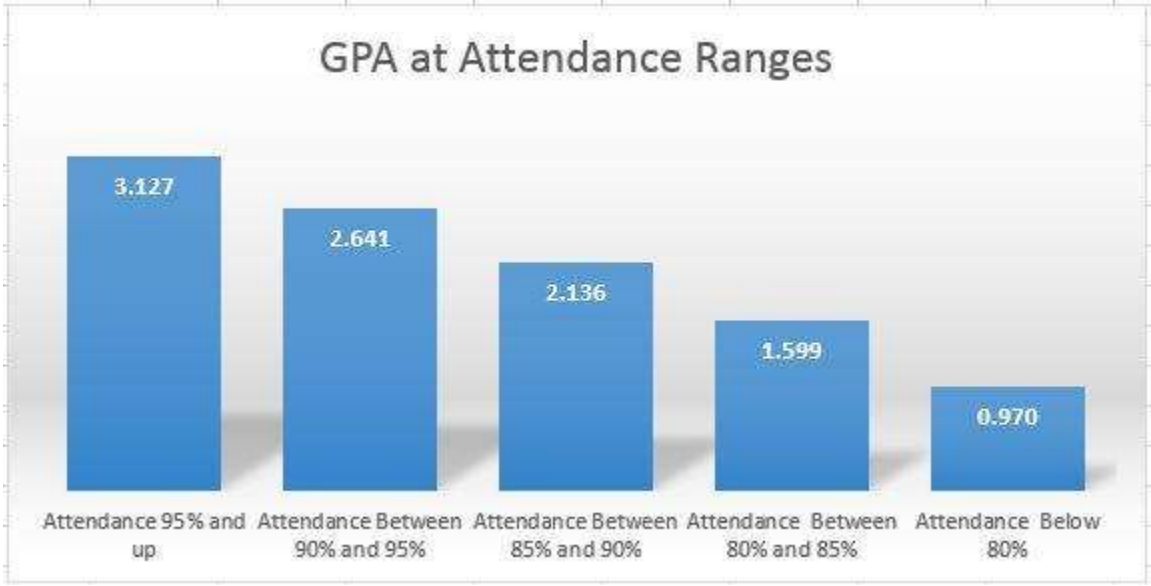
and Secondary Education, 2009, para. 2). Attending school regularly shows a commitment to learning. Numerous studies have demonstrated that attendance has a significant impact on academic achievement (Alzhanova-Ericsson et al., 2017; Westerman, et al., 2011). A study developed through the National Cooperative Education Statistics System and funded by the National Center for Education Statistics (2009) of the U.S. Department of Education identified that there was strong relationship between students' attendance and academic achievements. “A missing school day is a lost opportunity for students to learn” (National Center for Education Statistics, 2009, para. 3). Researchers found that students who attended school regularly have shown a higher level of achievement than students who do not attend school regularly (Adelman, 2006). Romero and Lee (2007) discovered that the negative relationship between attendance and academic achievement can appear in a child’s early school years. If the child is absent for an extended period of time in kindergarten, a negative first-grade outcome could be associated with lower achievement in math and reading (Romero & Lee, 2007). For later outcomes, poor attendance has serious implications for high school students. The absent rates for those students who dropped out of high school can be traced as early as kindergarten. These students missed significantly more days in first grade than other students who graduated from high school (Stanca, 2010). Once more, in eighth grade and ninth grade, attendance has shown to be an important indicator that is related to high school graduation rate (Allensworth & Easton, 2005).

Figure 1 shows the Grade Point Average (GPA) for a Missouri high school in 2020 and its corresponding attendance ranges. According to the school website, if a

student has a 90% attendance rate, he/she missed an average of 17 school days. The chart has clearly shown that the higher the attendance rate the higher the GPA.

Figure 1

*GPA at Attendance Ranges*




*Note*: Fort Zumwalt School District's East High School in 2020

Research from the National Association for Music Education (2014) stated that schools that have music programs had an attendance rate of 93.3% compared to 84.9% in schools without music programs. After analyzing 12 available years of SAT data from 1987-1998, Vaughn and Winner presented that students who took at least one music course in high school had significantly higher SAT math and verbal (Butzlaff, 2000) scores. A study conducted by Texas Coalition for Quality Arts Education (TCQAE) declared that schools that had higher levels of student participation in fine arts also had higher academic ratings and lower dropout rates (TCQAE, 2006). Floyd (2007), chair of the coalition and executive director of Texas Music Educators Association. affirmed:

> There is a connection between involvement in arts courses and higher academic achievement. These findings are consistent with decades of research revealing that studying music and other arts disciplines improves cognitive abilities that are used in other academic areas such as mathematics, reading, and science. Other studies have shown that fine arts courses keep students involved in school, thus reducing the dropout rate. (p. 8)

Many factors can cause students' absence from school, such as bad grades, illness, mental or emotional health issues, family situations, and so on. Chronic absence is a problem in all types of communities. According to the research video from the Institute of Education Sciences, 6.5 million students miss nearly a month of school each year (Regional Education Laboratory, 2012). A statewide study in Utah showed that one in seven students is chronically absent each year, and these chronically absent students had lower test scores, lower grades, and lower graduation rates than students who are not chronically absent (Research Brief, 2012). According to Attendance Works (2016), "Across the country, more than 8 million students missing so many days of school that they are academically at risk" (The problem paragraph). The director of Attendance Works, Hedy Chang, argued that if we know the reason that kids aren't learning, we could achieve better outcomes (The Washington Post, 2016). Though students may have different reasons to miss school, generally speaking, two factors are involved. Motivation (Lai, 2011) and parental involvement (McConnell & Kubina 2014) serve as these factors.

Motivation is defined as “the attribute that moves us to do or not to do something” (Broussard & Garrison, 2004, p. 106). In Lai’s (2011) research about motivation

> Motivation refers to reasons that underlie behavior that is characterized by willingness and volition. Intrinsic motivation is animated by personal enjoyment, interest, or pleasure, whereas extrinsic motivation is governed by reinforcement contingencies. Motivation involves a constellation of closely related beliefs, perceptions, values, interests, and actions. (p. 2)

Music learning requires a great deal of effort and dedication. Learning the skills to be a musician requires strong and lasting motivation to go through the whole process. The motivation for learning music is complex. An individual’s behavior is determined by the commitment and energy of the integrated systems of internal and external. Intrinsic motivations have been described as the motivation that is stimulated by personal interest, enjoyment, and pleasure. The study found that intrinsic motivation provides sustained endurance through spontaneous satisfaction that is related to effective volitional action (Deci et al., 1999). Learning a musical skill, such as playing an instrument or singing a song, effective volitional action plays an important role to achieve a goal or feeling satisfied (Van Ryzin, 2018). In contrast to intrinsic motivation, extrinsic motivation is being observed as a motivation energized by reinforcement contingencies, such as powerful others, rules, directives, or social norms. Traditionally, intrinsic motivation is being viewed to be more desirable and it often leads to better learning outcomes than extrinsic motivation (Deci et al., 1999).

In the research about Self-determination Theory and motivation for music, researchers investigated how different aspects of motivational features interact to affect the motivation of musicians. One-hundred and eighty-eight musicians from all around the world participated in an online survey. With the utilization of Self-Determination Theory (Deci et al., 2000; Ryan & Guay, 2013) and other motivational constructs, such as the desire to learn, willingness to play, and musical self-esteem, researchers found that the intrinsic motives played a major role in the maintenance of the motivational system (Maclntyre et al., 2018). Moreover, the process of music training often includes a commitment to the solitude of practice. Intrinsic motivation helps individuals stay on task, and extrinsic motivation such as high grades and competition awards may provide a sense of achievement. With both intrinsic and extrinsic motivations, an individual may have a sense of self-efficacy (Degé & Schwarzer, 2017). With self-efficacy, a person may develop a function of learning music, and this function could generalize to other areas of learning. The mastery and self-efficacy (Zelenak, 2020) are codeveloped in an interactive, mutually reinforcing manner (McPherson & Renwich, 2011). Self-esteem and self-concept-related studies discovered a positive relationship between music education and motivation-related characteristics. Students engaged in music programs were found with heightened motivation in education and a more positive attitude toward learning in general (QA Research, 2012). Similar characteristics such as self-esteem, confidence, and discipline are also found to be improved through music-based intervention programs (Creech et al., 2013). Among youth music students, intrinsic motivation advanced their musical competence and practice enthusiasm (Schmidt, 2005). Studies showed that stronger academic self-concept, such as the cognitive appraisal of one’s academic ability,

both in cross-sectional work and longitudinal work are found among the children who participated in an extended music curriculum compared to those who did not (Guhn, et al., 2020). Therefore, higher music engagement has a positive impact on students' academic self-concept (Guhn, et al., 2020).

Parental involvement is another key factor that affects the attendance rate besides motivation (McConnell & Kubina 2014). Parents and guardians have a great deal of influence on students' aspirations to attend school and participate in school activities including music. Research has demonstrated that parental involvement is found to be significantly related to affective, cognitive, and performance outcomes (McFerran et al., 2017). Culp and Clauhs, 2020 stated:

> Music programs promote strong parental involvement through attending concerts, recording performances, or giving support for materials. Based on the results of a study, children who had more previous music experience also valued music more and developed better musical self-concepts. Naturally, these children's parents also exhibited higher levels of musicianship and supported musical study. (p. 43)

Many schools have developed strategies to increase students' attendance rates. A common strategy is to build a schoolwide culture of good attendance. Student engagement and parents support are important factors in achieving high attendance rate. Consistent communication between schools and parents makes a difference (Research Brief, 2012). School music programs often play a key role in attracting students and parents. They create a sense of community, promote teamwork, and fulfill satisfaction which helps to improve attendance rates at schools (Culp & Clauhs, 2020).

**Summary**

In summary, through the history of music education, kids benefit not only from the pleasure of the sound of music but also from learning many skills that they could use in areas other than music. Former first lady Michelle Obama, in 2014, gave the keynote speech at a Grammy Museum event to salute music teachers. According to *Los Angeles Times*, Mrs. Obama stressed that music and other forms of art often connected with students and enhanced their interest in core subjects such as math, science, and history (*Los Angeles Times*, 2014).

> For so many young people, arts education is the only reason they get up out of bed in the morning… they go to school each day because there's an instrument they want to play, a musical they want to perform in, a painting they are dying to finish. So then once they arrive in those classrooms, that's when we can teach them something else, like math and writing and science. That is the power of the arts for so many of our young people. (*Los Angeles Times*, 2014, para. 23)

Music is considered the fundamental component of human culture and behavior (Harvey, 2018). Researchers, school officials, and medical professionals have agreed that music has a positive influence on academic achievements and intellectual advancement (Canadian Broadcasting Corporation, 2018). Music can build human relations and a healthy and effective work environment. Music can also increase language skills, critical thinking skills, and social skills. Additionally, music helps an individual's emotional wellbeing and improves all-around brain function (Guion, 2017; Guhn et al., 2020).

Overall, music education enables success not only in the art itself but in all areas academically and socially (Foley, 2017).

# Chapter Three: Methodology

## Purpose Statement

The purpose of this study was to investigate the impact music classes had on academic achievement and attendance days. This study identified whether there was a statistically significant difference on MAP test results in the areas of ELA and Math. and attendance rate between two groups of students: those students who took music classes (band, choir, and orchestra – Music Attended) and those students who did not take music classes (Non-Music Attended). Between the two groups, the data of MAP scores and Performance Levels (Below Basic, Basic, Proficient and Advanced) were used to determine the differences in academic achievement, and the number of days the students attended school were used to determine the differences in attendance days. Further investigation among the music students was conducted to identify whether different music classes-band, choir, and orchestra have differing impacts on academic achievement and attendance days. Besides finding the results through analysis of data, this study also discovered the perceptions of middle school music teachers on music education and overall academic achievement.

## Research Question and Null Hypotheses

### *Research Question*

After the review of the literature and careful examination of the issues related to music education programs, the study formulated this research question: What are middle school music educators' perceptions of music education's impact on academic achievement?

### *Null Hypotheses*

The following four null hypotheses guided the quantitative portion of this study:

1). Students who take music classes do not perform higher academically than those who do not take music classes.

2). There are no differences in academic performance between students who take Band, Orchestra, and Choir classes.

3). Students who take music classes do not have a higher attendance rate than those who do not take music classes.

4). There are no differences in attendance between students who take Band, Orchestra, and Choir classes.

## Research Design

A quantitative method was used to assess all data collected. The findings were used to reject or accept the null hypotheses. Academic achievement was measured by MAP test scores in ELA and Math, and attendance days were measured by the number of days the students attend school in a school year. A qualitative design was used to answer the proposed research question, and a survey of open-ended questions was developed to align with this component.

### *Setting*

The study takes place in a middle school that is part of a large suburban school district located in the eastern area of Missouri. The district has 25 schools and one early childhood center. Sixteen of these schools are elementary schools, four are middle schools and five are high schools. The average student population in the school district is 18,000 with 48% female, 52% male, 78.3% White, 6.3% African American, 5.9%

Hispanic, 5.6% multiracial, 3.6% Asian, and 0.2% Native American and Pacific Islander. The student-teacher ratio is 13:1.

***Population***

Though there is a wide range of students in the district, the study was only focused on students in one middle school in the district. The research middle school includes sixth grade, seventh grade, and eighth grade, for a total of three grade levels. The Table 1 includes gender information and the ethnic structure of the research school for school years 2017-2018, 2018-2019 and 2020-2021. As Table 1 shows, the research school has an average of 872 students in total with 53% male and 47% female students. In addition, 83% of these students are White, 10% are African American, 4% are Hispanic, 3% are Asian or Pacific Islander and 0.3% are American Indian.

Table 1

*Gender, Race and Ethnicity in the Research School for Three School Years and Averages*

| | School Year 2017-2018 | | School Year 2018-2019 | | School Year 2020-2021 | | Average | |
|---|---|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % | Number | % |
| **Gender:** Female | 384 | 45.34 | 410 | 45.76 | 442 | 50.63 | 412 | 47.24 |
| Male | 463 | 54.66 | 486 | 54.24 | 431 | 49.37 | 460 | 52.76 |
| **Ethnicity:** American Indian | 4 | 0.47 | 3 | 0.33 | 1 | 0.11 | 3 | 0.30 |
| Asian and Pacific Islander | 27 | 3.19 | 26 | 2.90 | 13 | 1.49 | 22 | 2.53 |
| Black (not Hispanic) | 85 | 10.04 | 92 | 10.27 | 81 | 9.28 | 86 | 9.86 |
| Hispanic | 34 | 4.01 | 36 | 4.02 | 36 | 4.12 | 35 | 4.05 |
| White (not Hispanic) | 697 | 82.29 | 739 | 82.48 | 742 | 84.99 | 726 | 83.25 |
| **Total Students** | 847 | | 896 | | 873 | | 872 | |

Table 2

*Free/Reduced Lunch Status and IEP Status Information in the Research School for Three School Years*

| | School Year 2017-2018 | | School Year 2018-2019 | | School Year 2020-2021 | | Average | |
|---|---|---|---|---|---|---|---|---|
| **Lunch Status** | Number | % | Number | % | Number | % | Number | % |
| Free and Reduced | 261 | 30.81 | 285 | 31.81 | 179 | 20.50 | 242 | 27.71 |
| Standard | 586 | 69.19 | 611 | 68.19 | 694 | 79.50 | 630 | 72.29 |
| **IEP Status** No | 687 | 81.11 | 730 | 81.47 | 722 | 82.70 | 713 | 81.76 |
| Yes | 160 | 18.89 | 166 | 18.53 | 151 | 17.30 | 159 | 18.24 |
| **Total Students** | 847 | | 896 | | 873 | | 872 | |

The study also collected data information of free lunch, reduced lunch, and the Individual Education Program (IEP) status in the research school (see Table 2). The table indicates free or reduced lunch status and IEP status among students for three school years and averages this data. Among all students, on average there are 28% that are free or discounted lunch recipients, and 73% pay full price. Regarding IEP status, around 18% of students have IEPs.

The music classes for all three grade levels were electives. They were instrumental and vocal music classes. The instrumental music classes focused on were Band and Orchestra. The vocal music class was Choir. Each music class was a year-long course which met every day. Students enrolled in these music programs in grade six were likely to continue the program throughout the middle school years.

Table 3 displays the enrollment information of each music class as well as non-music classes for 2017-2018, 2018-2019 and 2020-2021 school years. Because of the pandemic, Missouri Department of Education canceled the MAP test in 2019-2020 school year. Therefore, the data of that year was not collected. In the research school, the percentage of students who attended music classes varied slightly from year to year. On average, among all students in the three school years, around 54% are identified as Non-Music Attended, and 46% are identified as Music Attended (see Table 3). Of the Music Attended group, Band, Choir, and Orchestra account for 22%, 12% and 12% of the school population respectively. Figure 2 shows student percentage of music class type: Band, Orchestra, and Choir - for each school year 2017-2018, 2018-2019 and 2020-2021.

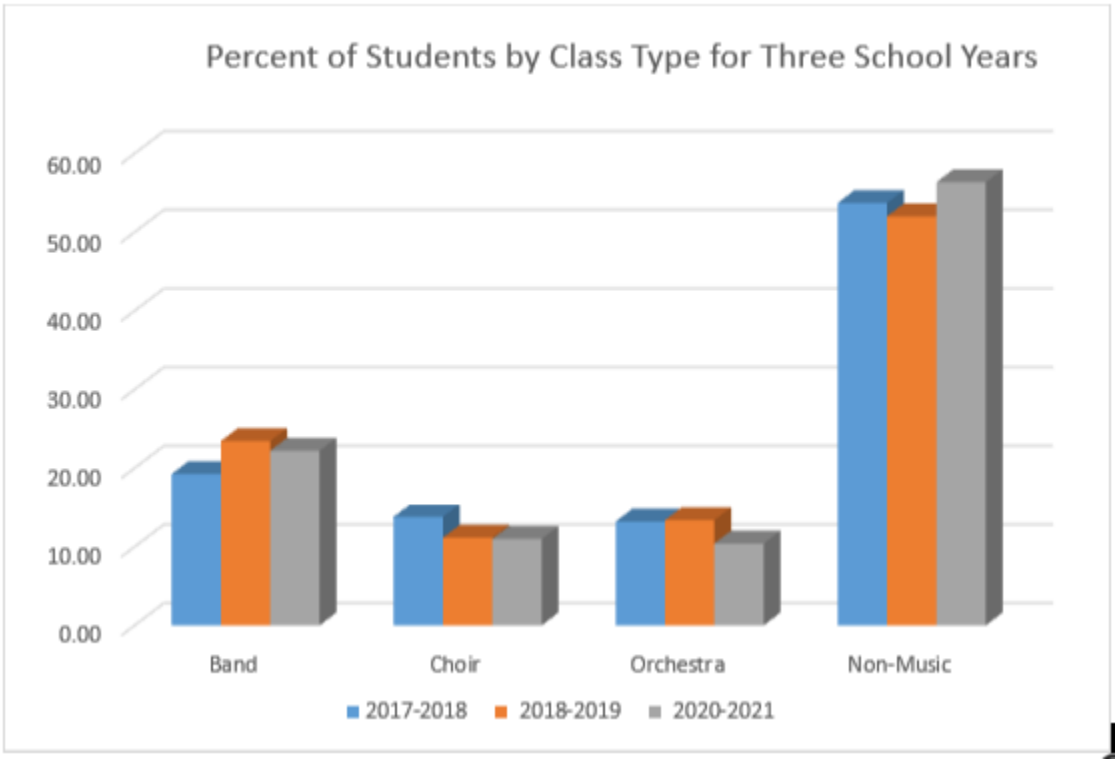
Table 3

*Music and Non-Music Class Student Number and Percentages for Three School Years and Averages*

| | **School Year 2017-2018** | | **School Year 2018-2019** | | **School Year 2020-2021** | | **Average** | |
|---|---|---|---|---|---|---|---|---|
| **Class** | Number | % | Number | % | Number | % | Number | % |
| **Music** | **392** | **46.28** | **430** | **47.99** | **381** | **43.64** | **401** | **45.97** |
| Band | 163 | 19.24 | 210 | 23.44 | 194 | 22.22 | 189 | 21.63 |
| Choir | 117 | 13.81 | 100 | 11.16 | 96 | 11.00 | 104 | 11.99 |
| Orchestra | 112 | 13.22 | 120 | 13.39 | 91 | 10.42 | 108 | 12.34 |
| **Non-Music** | **455** | **53.72** | **466** | **52.01** | **492** | **56.36** | **471** | **54.03** |
| **Total Students** | 847 | | 896 | | 873 | | 872 | |

Figure 2

*Percent of Students by Class Type for Three School Years*




Music class types - Band, Orchestra, Choir - Music Attended and Non-Music attended number and percentage of students in each grade is presented for three school years in Table 4 and Figure 2.

Table 4

*Band, Orchestra, Choir and Non-Music Student Numbers and Percentages by School Year – Grade 6*

| Grade | Music Attended Group | School Year 2017-2018 | | School Year 2018-2019 | | School Year 2020-2021 | | All 3 School Years | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | % * | Number | % * | Number | % * | Number | % * |
| **6th** | Music Class | 158 | 54.67 | 180 | 57.32 | 153 | 56.46 | 491 | 56.18 |
| | Band | 74 | 25.61 | 89 | 28.34 | 82 | 30.26 | 245 | 28.03 |
| | Choir | 39 | 13.49 | 41 | 13.06 | 34 | 12.55 | 114 | 13.04 |
| | Orchestra | 45 | 15.57 | 50 | 15.92 | 37 | 13.65 | 132 | 15.10 |
| | Non-Music | 131 | 45.33 | 134 | 42.68 | 118 | 43.54 | 383 | 43.82 |
| | ***Total*** | *289* | *100.00* | *314* | *100.00* | *271* | *100.00* | *874* | *100.00* |

*Note:* Percentage is calculated within the grade and school

Table 5

*Band, Orchestra, Choir and Non-Music Student Numbers and Percentages by School Year – Grade 7*

| Grade | Music Attended Group | School Year 2017-2018 | | School Year 2018-2019 | | School Year 2020-2021 | | All 3 School Years | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | % * | Number | % * | Number | % * | Number | % * |
| **7th** | Music Class | 137 | 48.41 | 127 | 43.79 | 117 | 38.61 | 381 | 43.49 |
| | Band | 56 | 19.79 | 65 | 22.41 | 65 | 21.45 | 186 | 21.23 |
| | Choir | 44 | 15.55 | 27 | 9.31 | 27 | 8.91 | 98 | 11.19 |
| | Orchestra | 37 | 13.07 | 35 | 12.07 | 25 | 8.25 | 97 | 11.07 |
| | Non-Music | 146 | 51.59 | 163 | 56.21 | 186 | 61.39 | 495 | 56.51 |
| | ***Total*** | *283* | *100.00* | *290* | *100.00* | *303* | *100.00* | *876* | *100.00* |

*Note:* Percentage is calculated within the grade and school year

Table 6

*Band, Orchestra, Choir and Non-Music Student Numbers and Percentages by School Year – Grade 8*

| Grade | Music Attended Group | School Year 2017-2018 | | School Year 2018-2019 | | School Year 2020-2021 | | All 3 School Years | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | % * | Number | % * | Number | % * | Number | % * |
| 8th | Music | 97 | 35.27 | 123 | 42.12 | 111 | 37.12 | 331 | 38.22 |
| | Band | 33 | 12.00 | 56 | 19.18 | 47 | 15.72 | 136 | 15.70 |
| | Choir | 34 | 12.36 | 32 | 10.96 | 35 | 11.71 | 101 | 11.66 |
| | Orchestra | 30 | 10.91 | 35 | 11.99 | 29 | 9.70 | 94 | 10.85 |
| | Non-Music | 178 | 64.73 | 169 | 57.88 | 188 | 62.88 | 535 | 61.78 |
| | Total | 275 | 100.00 | 292 | 100.00 | 299 | 100.00 | 866 | 100.00 |

Note: Percentage is calculated within the grade and school

Table 7

*Band, Orchestra, Choir and Non-Music Student Numbers and Percentages by School Year – All Grades Compiled*

| Grade | Music Attended Group | School Year 2017-2018 | | School Year 2018-2019 | | School Year 2020-2021 | | All 3 School Years | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | % * | Number | % * | Number | % * | Number | % * |
| **All 3 Grades** | Music | 392 | 46.28 | 430 | 47.99 | 381 | 43.64 | 1203 | 45.99 |
| | Band | 163 | 19.24 | 210 | 23.44 | 194 | 22.22 | 567 | 21.67 |
| | Choir | 117 | 13.81 | 100 | 11.16 | 96 | 11.00 | 313 | 11.96 |
| | Orchestra | 112 | 13.22 | 120 | 13.39 | 91 | 10.42 | 323 | 12.35 |
| | Non-Music | 455 | 53.72 | 466 | 52.01 | 492 | 56.36 | 1413 | 54.01 |
| | ***Total*** | *847* | *100.00* | *896* | *100.00* | *873* | *100.00* | *2616* | *100.00* |

*Note*: Percentage is calculated within the grade and school year

## Data Collection

After completing training in the CITI Program course, permission was requested and approved from Lindenwood University's Institutional Review Board. Upon university approval, a request for a data release to conduct the study was submitted and approved by the Research Committee and the Superintendent of the research school district. The school district's student information database was used to collect pertinent information. The sixth, seventh, and eighth grade student data from 2017-2018, 2018-2019, and 2020-2021 school years were collected. For each of these school years, students' MAP test scores in ELA and Math, and attendance information were tracked separately by grade levels. Data were analyzed for MAP test scores and the attendance days between music classes and non-music classes, as well as music class types - Band, Orchestra, and Choir.

Besides collected data, a survey was sent to eight middle school music teachers. Among these survey recipients, there were three choir teachers, three band teachers and two orchestra teachers. Questions on the survey are open-ended questions which are aligned with the research question. After comparing and analyzing collected surveys, common themes were drawn from all the responses.

## Instrumentation

The following instrumentation was employed in the research design: MAP test scores on ELA and Math to measure academic achievement, and the number of days students attended school in a school year to measure attendance days. In addition, demographic information, such as gender and race were also included the data collection.

These data were collected from the research school district's electronic student information system with assistance from the technology department.

### *MAP Test*

According to Missouri Department of Elementary and Secondary Education (DESE):

> Missouri Assessment Program (MAP) is designed to measure how well students acquire the skills and knowledge described in the Missouri Learning Standards (MLS). The assessments yield information on academic achievement at the student, class, school, district, and state levels. This information is used to diagnose individual student strengths and weaknesses in relation to the instruction of the MLS, and to gauge the overall quality of education throughout Missouri. Grade-level assessments in ELA and Math are given at Grade 3-8 and Science in Grades 5 and 8. (DESE, 2022, para. 2)

This study used students' MAP ELA and Math scores to measure students' academic achievement. Students were divided into two groups: Music Attended and Non-Music Attended. As per MAP, based on the student's test scale score, academic achievement is classified into four performance levels: (1) below basic, (2) basic, (3) proficient, and (4) advanced. Each subject at each grade level has its own descriptors but different score ranges. Table 8 illustrates sixth, seventh, and eighth grade ELA and Math performance level descriptors and different MAP test score ranges.

Table 8

*Missouri MAP Test Performance Levels and Test Score Ranges*

| | ELA | | | Mathematics | | | Science |
|---|---|---|---|---|---|---|---|
| **Performance level** | **Grade 6** | **Grade 7** | **Grade 8** | **Grade 6** | **Grade 7** | **Grade 8** | **Grade 8** |
| **Below Basic** | 230–370 | 240–383 | 250–392 | 260–387 | 270–393 | 310-419 | 285–467 |
| **Basic** | 371–412 | 384–434 | 393–442 | 388–416 | 394–434 | 420-467 | 468–509 |
| **Proficient** | 413–437 | 435–455 | 443–475 | 417–437 | 435–461 | 468-505 | 510–536 |
| **Advanced** | 438–620 | 456–630 | 476–650 | 438–580 | 462-600 | 506-660 | 537–710 |

*Note*: Source: Missouri Assessment Program Grade-Level Assessments

(*https://www.cpsk12.org/cms/lib/MO01909752/Centricity/Domain/4889/Interpreting%20MAP%2-0Results.pdf)*

MAP reports that each school district receives from DESE includes several categories, such as grade levels, gender, race, etc. In this study, MAP scores of ELA and Math were compared between music students and non-music students within the whole school, as well as compared separately by each grade level, each school year and, compiled for three school year. Among music students, there are three subgroups - Band, Orchestra, and Choir. The MAP data for ELA and Math were also compared and analyzed among these music subgroups.

***Attendance***

The data of student attendance rate in 2017-2018, 2018-2019 and 2020-2021 school years were collected from the research school technology department. The attendance data came in percentage form, and the researcher converted the percentages into number of days. Attendance rates are calculated based on the number of days a student attends school. Each year students need to attend school for certain number of days; consequences for certain number of absences are applied in the research school district. The policy was adopted from DESE. Many studies suggested that student attendance is related to student achievement; poor attendance has serious implications for students' outcomes (Romero, 2007). Students are categorized into three attendance levels: good attendance, warning, and chronic absences. In this study, the days students attended school are compared between Music Attended and Non-Music Attended groups, as well as compared among the music students' subgroups. Furthermore, attendance levels are classified into two groups: good and poor attendant. Good attendance was defined as a student with nine days or fewer absences in a school year, and a poor

attendant is defined as one with ten or more absent days in a school year. Attendance levels were also analyzed between Music Attended and Non-Music Attended groups.

***Survey***

A survey was developed to align with the research question: What are middle school music educators' perceptions of music education's impact on academic achievement? According to a requirement of the university, a consent form needs to be completed before conducting the survey. The survey consisted of several open-ended questions focused on perceptions of middle school Band, Orchestra, and Choir teachers. The survey was sent to eight middle school music teachers at the research school district. Among these music teachers, there are three band teachers, three choir teachers and two orchestra teachers (Table 9). The survey was distributed by email and had six teachers' responses. Of the seven respondents, most of them answered all open-ended questions, and one teacher answered some of the survey questions. All survey participant identities remained completely anonymous.

Table 9

*Survey Participation*

| | Band | Orchestra | Choir |
|---|---|---|---|
| Number of surveys sent | 3 | 2 | 3 |
| Number of respondents | 1 | 2 | 3 |
| Respondents of each question | | | |
| Question 1 | 1 | 2 | 3 |
| Question 2 | 1 | 2 | 3 |
| Question 3 | 1 | 2 | 3 |
| Question 4 | 1 | 2 | 2 |
| Question 5 | 1 | 2 | 2 |
| Question 6 | 1 | 2 | 2 |

**Data Analysis Methods**

In this study, the researcher used descriptive and inferential statistical procedures – *t*-test, analysis of Variance (ANOVA) and Chi-square ($\chi 2$) tests to examine data for study purposes. Analysis of Variance (ANOVA) is closely related to the t test where differences are measured between means of two groups. The ANOVA tests the differences that are measured between means of two or more groups. It examines data that was classified on multiple independent variables. Therefore, whether there is a significant main effect of the independent variables and whether there are significant interaction effects within and between independent variables in a set of data can be discovered by the ANOVA. In Walker's book, *Common Statistical Methods for Clinical Research with SAS Examples,* it indicates:

> One-way ANOVA (analysis of variance) is used to simultaneously compare two or more group means based on independent samples from each group. The bigger the variation among sample group means relative to the variation of individual measurements within the groups, the greater the evidence that the hypothesis of equal group means is untrue. (p.77)

A Chi-square ($\chi 2$) test is a statistical test used to compare observed results with expected results and used to determine if there is a relationship between categorical variables. In this study, the Chi-square ($\chi 2$) is used for analysis MAP test ELA and MATH performance levels, as well as attendance level (good and poor attendant) association with Music Attended and Non-Music Attended students. In this study, SAS® statistical software (SAS® Institute Inc, Cary, NC, USA) was used for all statistical data analyses.

Besides the use of quantitative research methods, a survey was collected from eight middle school music teachers. The questions are open-ended questions, and their different and common opinions were identified and grouped. The survey result was to help answering the research question.

**Summary**

The purpose of this research study was to discover the impact of music education on students' academic achievement and attendance days. Academic achievement was measured by ELA and Math scores of MAP and attendance was measured by the number

of days students attended school. This measurement was conducted between students who participated in public school music programs (vocal and instrumental music) and students who didn't participate in music programs. Setting and population descriptions were established. The research design included the identification of a music group and a non-music group, and subgroups in the music group. There is one research question and four null hypotheses. Quantitative research methods included a *t*-test, ANOVA and Chi-Square ($\chi 2$) test for data analysis, and a qualitative research method was used to analyze a survey from eight middle school music educators. The steps of data collection included the training in human subject protection (CITI program) by Lindenwood University; the process of study approval by the Research Committee, and the Lindenwood University Institutional Review Board (IRB); and the data request letter for the study and approval from the research school district.

After gathering all the needed information and data, ANOVA, *t*-test statistical procedures, and Chi-Square ($\chi 2$) test were employed in various combinations. Along with the analysis of the survey results, this study was to determine the impact of music education on middle school students' academic achievement and attendance days.

# Chapter Four: Analysis of Data

## Purpose of the Chapter

The purpose of the chapter was to present the data collected relative to the hypothesis using statistical procedures described in Chapter Three to do statistical analyses and hypothesis tests. The hypotheses were: (1) The students who attended music classes will have statistically significant higher mean MAP test scores, higher performance than those who did not music classes; (2) The students who attended music classes will have statistically significant higher mean attendance days, better attendance than those who did not music classes.

To test the hypotheses and determine the impact of music attendance and participation on academic achievement and school attendance, multiple assessments – the Missouri MAP test for ELA and Mathematics, as well as ELA and math performance levels, Attendance Days– in three school years (2017-2018, 2018-2019, 2020-2021) and three grades (sixth, seventh, eighth), were analyzed. The student ELA and math performance levels grouped into High (Professional + Advanced) and Low performance (Basic + Below Basic) were analyzed for this research. Those assessment data were analyzed and compared from each grade in each school year and compiled into three school years for each grade.

## Data Description of the Independent Variable – Music, and Non-Music Attended

The independent variable was the number of music and non-music student as well as music class type - class Band, Orchestra, Choir - in the research school. The music and non-music attended students had differences among school years. Among the grade, on average in three school years, the sixth grade had the largest students number attended

music class (56%), while the eighth grade had the smallest student number attended music class (38%) and the seventh grade has the second largest student attended music class (43%). The data indicates the higher the grade, the smaller number of students attended a music class. The attended and not attended music class is relatively stable during the school year. Table 10 and Figure 3 show student number and percent by grade for music and non-music attended in the school year 2017-2018, 2018-2019, and 2020-2021 (referred to as the year 2017, 2018, and 2020 here after).

Table 10

*Music Class and Non-Music Class Participation: Student Number and Percent by Grade and School Year*

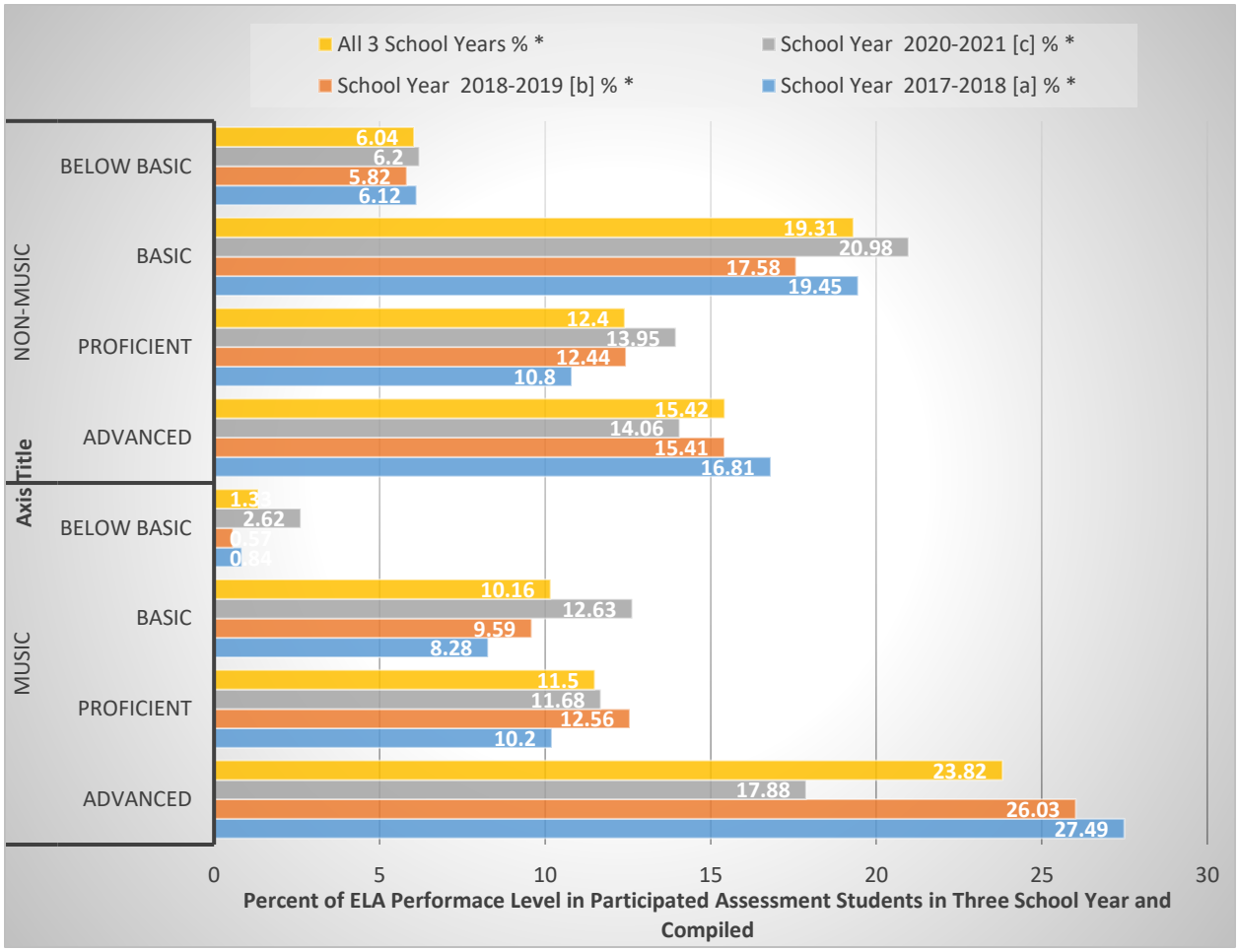
| Grade | Music Attended Group | School Year 2017-2018 | | School Year 2018-2019 | | School Year 2020-2021 | | All 3 School Years | |
|---|---|---|---|---|---|---|---|---|---|
| | | No. | % * | No. | % * | No. | % * | No. | % * |
| **6th** | Music | 158 | 54.67 | 180 | 57.32 | 153 | 56.46 | 491 | 56.18 |
| | Non-Music | 131 | 45.33 | 134 | 42.68 | 118 | 43.54 | 383 | 43.82 |
| | ***Total*** | *289* | *100.00* | *314* | *100.00* | *271* | *100.00* | *874* | *100.00* |
| **7th** | Music | 137 | 48.41 | 127 | 43.79 | 117 | 38.61 | 381 | 43.49 |
| | Non-Music | 146 | 51.59 | 163 | 56.21 | 186 | 61.39 | 495 | 56.51 |
| | ***Total*** | *283* | *100.00* | *290* | *100.00* | *303* | *100.00* | *876* | *100.00* |
| **8th** | Music | 97 | 35.27 | 123 | 42.12 | 111 | 37.12 | 331 | 38.22 |
| | Non-Music | 178 | 64.73 | 169 | 57.88 | 188 | 62.88 | 535 | 61.78 |
| | Total | 275 | 100.00 | 292 | 100.00 | 299 | 100.00 | 866 | 100.00 |
| **All 3 Grades** | Music | 392 | 46.28 | 430 | 47.99 | 381 | 43.64 | 1203 | 45.99 |
| | Non-Music | 455 | 53.72 | 466 | 52.01 | 492 | 56.36 | 1413 | 54.01 |
| | ***Total*** | *847* | *100.00* | *896* | *100.00* | *873* | *100.00* | *2616* | *100.00* |

*Note:* Percentage is calculated within the grade and school year.

Music class types - class Band, Orchestra, Choir - student attendance, and percent in each grade of each school year, and all grades and all three school years were presented in Table 1-8 in Chapter 3.

Figure 3

*MAP ELA Test Performance, Attendance Among Music and Non-music Attended Students at Each Grade, and School Years, Number and Percentage*




**Data Description of the Dependent Variable – MAP Tests Score and Attendance**

The purpose of this study was to investigate the impact of music classes on students' academic achievement and attendance days. It was to identify whether there is a statistically significant difference on Missouri Standard Test (MAP) of English Language Arts (ELA), Mathematics (Math), on Attendance Days between music and non-music attended, whether there was a positive association between ELA, Math high and low

performance, good and poor school attendance (all these are related to hypotheses 1, 2, 3 and 4 described in Chapter Three).

**ELA Scores Data Analysis Results**

To determine the impact of music attendance on ELA scores, the two-sample *t*-test was used to analyze and compare music and non-music attended students. The *t*-test was conducted for multiple data analyses: a compiled sixth, seventh, and eighth grade of three school years (i.e., 2017-2018, 2018-2019, and 2020-2021) and each grade in each school year. For readability, instead of identifying the school year as spanning two calendar years (that is, 2017-2018, 2018-2019, and 2020-2021), the study was referred to the school year based on when the MAP was administered to students during the school (i.e., 2017, 2018 and 2020). A "compiled nth grade of three school years" was referred to as the "compiled nth grade," and the "three school years" was referred to the "compiled nth grade," and the "three the school year 2017-2018, 2018-2019, and 2020-2021" was referred to the "all school years."

*Null Hypothesis 1:* Students who take music classes do not perform higher academically than those who do not take music classes.

The *significance level* is alpha =.05 which is the threshold used to decide whether a test result is significant.

***The Compiled Sixth Grade at All School Years:***

To use a *t*-test, the data are required to meet these criteria: (1) the dependent variable (i.e., MAP test score in the study) should be normally or approximately normally distributed in both groups (i.e., music and non-music attended students in the study), especially when the sample size is less than 30; (2) The variance of the dependent

variable should be the same in both groups (Pooled *t*-test value), when it is not the same, the alternate version of the test statistic (Satterthwaite *t*-test value) should be used.

The compiled sixth grade ELA scores descriptive statistical results – mean, standard deviation, standard error, observation sample size, effective sample size, minimum and maximum scores for music and non-music attended students present in Table 11.

Table 11

*Compiled Sixth Grade ELA Score Descriptive Statistics*

| | Obs N | N | Mean | Std Dev | Std Err | Min | Max |
|---|---|---|---|---|---|---|---|
| Music Attended | 491 | 488 | 443.7 | 39.69 | 1.7967 | 318.0 | 574.0 |
| Non-Music Attended | 383 | 367 | 423.1 | 41.92 | 2.1881 | 330.0 | 587.0 |
| Diff (Music vs. Non-music) | | | 20.55 | 40.66 | 2.8095 | | |

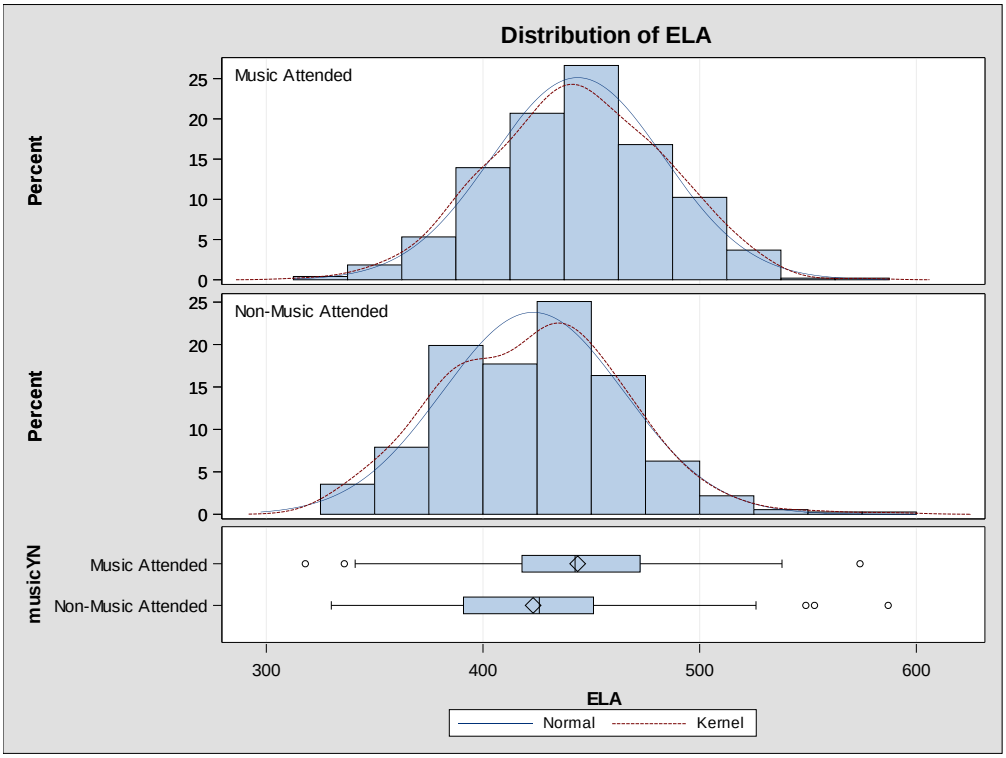
The table exhibited that: First, the sixth grade ELA scores effective sample size for this *t*-test is 488+367= 855, which is less than the total number in the sample dataset (491+383=874, also See Table 10 Music Class and Non-music class participation: Student Number and Percent by Grade and School Year. Since some students did not participate in the ELA assessment and ELA score is not available). Second, the mean ELA score for music attended is 443.7, while the mean ELA score for non-music attended is 423.1 This is a difference of more than 20.55 points. Third, the standard deviations for music and non-music ELA scores are very similar: 39.69 for music and 41.92 for non-music. Fourth, the standard error is 1.7967 and 2.1881 for music and non-music attended students, respectively.

To examine the dependent variable ELA score's normality in music and non-music student population, the SAS statistical software was used to produce the

distribution histograms of ELA score in the two groups (Figure 4). The graph contains histograms (top two panels) and boxplots (bottom panel) comparing the distributions of ELA scores for music and non-music attended students. The histograms show that the distribution of ELA scores for both the music and the non-music is roughly symmetric, but the distribution of non-music ELA scores is "shifted" slightly to the left of the music. The boxplots show that the total length of the boxplots and the inter-quartile range (distance between the 1st and 3rd quartiles, i.e., the edges of the boxes) is similar for music and non-music attended students. This indicates that the two groups had the same variance. By contrast, when looking at the center lines in the boxplot (which represents the median score), it exhibits that they did not line up: the centerline in the music's box plot is to the right of the center line in the non-music's boxplot. Additionally, the diamond shape in each boxplot represents the ELA mean score in each group; it suggests that the ELA mean score for the music attended students is to the right (i.e., bigger) of the mean score for the non-music attended student.

Figure 4

*The ELA Scores Histograms and Boxplot for Music and the Non-Music Students*

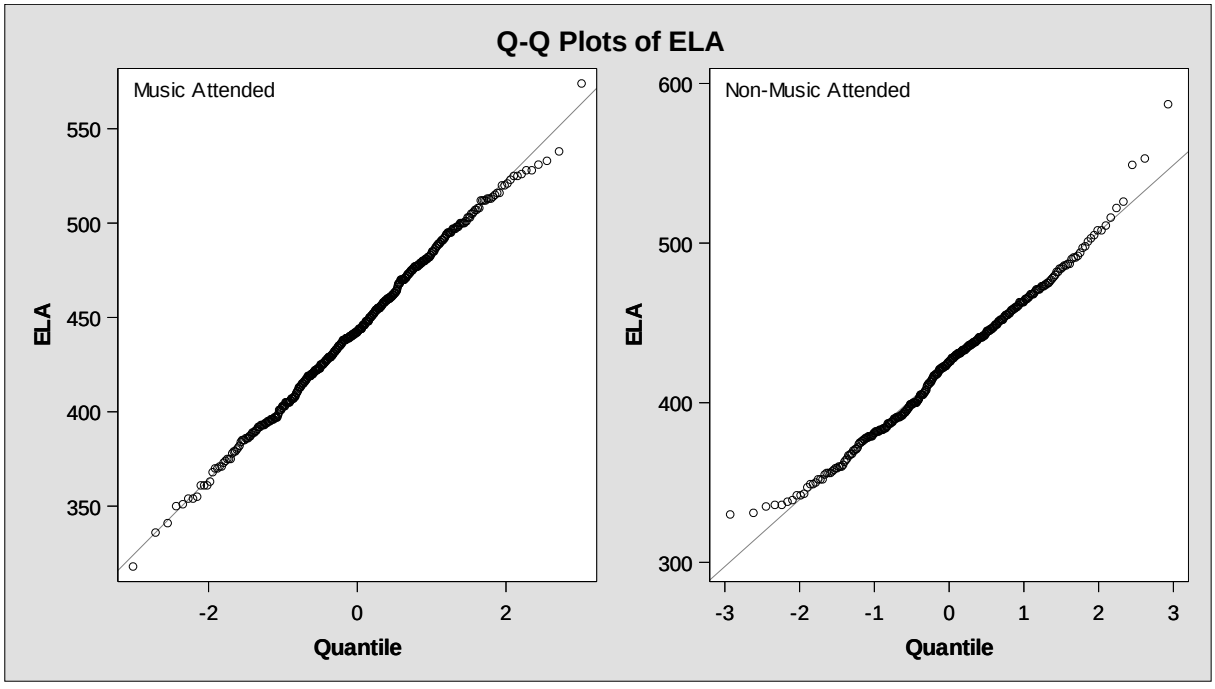



The Q-Q plots (Figure 5) were also produced to examine ELA score normality in the two groups. The figure contains two Q-Q plots of the ELA scores for music attended (left panel) versus non-music attended (right panel). (The Q-Q plots can be used to check if ELA scores are consistent with the variable if it was truly normally distributed. To read a Q-Q plot, look to see if the dots [the observed values] match up with the expected values for a normal distribution [the diagonal line]. When the points fall along the line, then the values are consistent with what would expect them to be if the data were truly normally distributed.) From Figure 5, the ELA Q-Q plot showed that the values in the middle of the range are consistent with a normal distribution in both music and non-music attended students. Both groups have slight deviations from normality in the tails.

In the conclusion, as indicated from histograms and Q-Q plot, it was a suggestion that the ELA scores in both two groups meet the normality assumption required for the independent samples *t*-test. As mentioned above the variable of the two groups was very close. Folded *F*-test for the "Equality of Variances" result suggested that there was an equal variance of the music and non-music attended students (folder *F*-value=1.12 and p=0.22615). Thus, the Pooled version of the independent samples *t*-test method was used to determine statistical significance.

Figure 5

*The ELA Scores Q-Q Plots for Music and the Non-Music Students*




From the *t-test* for sixth grade ELA score, and the confidence limits of mean score difference calculation and analysis, it can be concluded that the compiled sixth grade has a statistically significant difference in mean ELA scores between music and non-music attended at the significant level alpha =0.05 (actual df=853, *t*-value = 7.31 and

p<0.0001). The music group's mean ELA score is 20.55 points higher than the non-music group with a 95% CI is 15.03 to 26.06 (See Table 12).

***The Sixth Grade at School Year 2017***

The sixth grade ELA scores in the school year 2017 variance F- test indicated that it was not equal variance (folder *F*-value =1.60 and p=0.0052, suggesting reject the variance equality). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student groups (unequal df=238.72, *t*-value=5.86, and p<0.0001) at alpha =0.05. The music group ELA score is 26.55 higher than non-music with a 95% CI is 17.63 to 35.48. 06 (See Table 12).

Table 12

*The Sixth Grade ELA Scores Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| N | 158 | 178 | 152 | 488 |
| Min, Max | 354, 533 | 318, 538 | 336, 574 | 318, 574 |
| Mean (95% CI) | 449.8 (444.7, 455.0) | 458.7 (452.7, 464.7) | 419.7 (414.3, 425.2) | 443.7 (440.2,447.2) |
| Standard Deviation | 33.0338 | 40.4962 | 33.7878 | 39.69 |
| **Non-music attended** | | | | |
| N | 128 | 127 | 112 | 367 |
| Min, Max | 336, 587 | 330, 553 | 335, 477 | 330, 587 |
| Mean (95% CI) | 423.3 (416.0, 430.6) | 434.3 (426.2, 442.3) | 410.3 (404.1, 416.6) | 423.1 (418.8, 427.4) |
| Standard Deviation | 41.7714 | 45.713 | 33.4415 | 41.92 |
| **Mean Difference (Music vs. Non-music) (95% CI)** | 26.55 (17.63, 35.48) | 24.41 (14.64, 34.18) | 9.39 (1.14, 17.64) | 20.55 (15.03, 26.06) |
| t-value (p-value) (alpha = 0.05) | 5.86 (<.0001) | 4.92 (<.0001) | 2.24 (0.0259) | 7.31 (<.0001) |

***The Sixth Grade at The School Year 2018***

The sixth grade ELA scores in the school year 2018 variance F- test indicated that it was equal variance (folder *F*-value =1.27 and p=0.1375, the research failed to reject the variance equality). The Pooled *t*-test result indicated that there was a significant difference between music and non-music attended student groups (equal df=303, *t*-value=4.92, and p<0.0001) at alpha =0.05. The music group ELA scores are 24.41 higher than non-music with 95% CI is 14.64 to 34.18 06 (See Table 12).

***The Sixth Grade at The School Year 2020***

The sixth grade ELA scores in the school year 2020 variance F- test indicated that it was equal variance (folder *F*-value =1.02 and p=0.9146, the research failed to reject the variance equality). The Pooled *t*-test result indicated that there was a significant difference between music and non-music attended student group (equal df=262, *t*-value=2.24, and p=0.0259) at alpha =0.05. The music group ELA scores are 9.39 higher than non-music with 95% CI is 1.14 to 17.64 06 (See Table 12).

In summary for sixth grade ELA scores, over a period of three school years, or each school year, the data indicates that music students had significantly higher scores than non-music students. The mean ELA score of music students is 26.55, 24.41, 9.39, and 20.55 points higher in the school year 2017, 2018, 2020, and compiled three school years, respectively than non-music students' ELA score. The author concluded that data analysis from the sixth grade ELA test scores suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at a significant level alpha = 0.05.

***The Compiled Seventh Grade at All Three-School Year:***

All school years seventh grade ELA scores data analysis suggested that null hypothesis was rejected, and the alternative hypothesis was accepted at significant level alpha = 0.05 (actual df=846.94, *t*-value = 8.31 and p<0.0001), that was, the mean ELA scores in music attended students was significantly higher 21.56 point than non-music attended with 95% CI is 16.47 to 26.67.

The seventh grade ELA score in the school year 2017 variance F- test indicated that it was not equal variance (folder *F*-value =1.97 and p<.0001, suggested reject the variance equality) (Table 13). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student group (unequal df=255.33, *t*-value=3.90, and p=0.0001) at alpha =0.05. The music group ELA score was 18.85 higher than non-music with 95% CI is 9.33 to 28.37.

Table 13

*The Seventh Grade ELA Score Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| n | 135 | 127 | 114 | 376 |
| Min, Max | 385, 542 | 372, 533 | 357, 507 | 357, 542 |
| Mean (95% CI) | 461.8 (456.2, 467.5) | 454.0 (448.5, 459.5) | 445.6 (439.3, 451.8) | 454.2 (450.9, 457.6) |
| Standard Deviation | 33.1577 | 31.4836 | 33.6310 | 33.322 |
| **Non-music attended** | | | | |
| n | 142 | 158 | 173 | 473 |
| Min, Max | 271, 568 | 332, 516 | 340, 546 | 271, 568 |
| Mean (95% CI) | 443.0 (435.3, 450.7) | 424.9 (418.8, 431.1) | 431.3 (425.3, 437.3) | 432.7 (428.9, 436.5) |
| Standard Deviation | 46.491 | 39.1890 | 39.8536 | 42.2833 |
| **Mean Difference (Music vs. Non-music) (95% CI)** | 18.85 (9.33, 28.37) | 29.06 (20.82, 37.30) | 14.23 (5.32, 23.14) | 21.56 (16.47, 26.67) |
| t-value (p-value) (alpha = 0.05) | 3.90 (0.0001) | 6.94 (<.0001) | 3.14 (0.0018) | 8.31 (<.0001) |

### *The Seventh Grade at The School Year 2018*

The seventh grade ELA scores in the school year 2018 variance *F*-test indicated that it was unequal variance (folder *F*-value =1.55 and p=0.0108, the researcher failed to reject the variance equality) (Table 13). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student groups (unequal df=283, *t*-value=6.94, and p<0.0001) at alpha =0.05. The music group ELA scores were 29.06 higher than non-music with a 95% CI is 20.82 to 37.30.

The Seventh Grade at The School Year 2020

The seventh grade ELA scores in the school year 2020 variance F- test indicated that it was equal variance (folder *F*-value =1.40 and p=0.0524, suggested fail to reject the

variance equality) (Table 13). The Pooled *t*-test result indicated that there was a significant difference between music and non-music attended student group (equal df=285, *t*-value=3.14, and p=0.0018) at alpha =0.05. The music group ELA scores were 14.23 higher than non-music with 95% CI is 5.32 to 23.14.

In summary, seventh grade ELA scores, over three school years, or each school year, the data indicates that music students had significantly higher scores than non-music students. The mean ELA scores were higher 18.85, 29.06, 14.23, and 21.56 points in the school year 2017, 2018, 2020, and compiled three school years, respectively than non-music students. The author concluded that data analysis from the 7th grade ELA test scores suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at a significant level alpha = 0.05.

***The Compiled Eighth Grade at All Three-School Years***

The compiled eighth grade ELA score analysis suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at significant level alpha = 0.05 (actual df=771.9, *t*-value = 7.76 and p<0.0001, it indicated extremely statistical significance) (Table 14), that is, the mean ELA scores in music attended students is significantly different than the mean ELA scores in non-music attended students. The music group's mean ELA score was 21.23 higher than the non-music group with a 95% CI is 15.86 to 26.59.

Table 14

*The Eighth Grade ELA Score Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| n | 97 | 122 | 110 | 329 |
| Min, Max | 317, 549 | 385, 542 | 386, 538 | 317, 549 |
| Mean | 460.1 | 461.5 | 469.1 | 463.6 |
| (95% CI) | (452.1, 468.0) | (455.4, 467.5) | (462.3, 475.9) | (459.7, 467.5) |
| Standard Deviation | 39.3069 | 33.7292 | | |
| **Non-music attended** | | | | |
| n | 173 | 164 | 178 | 515 |
| Min, Max | 310, 544 | 271, 568 | 330, 553 | 271, 568 |
| Mean | 437.8 | 444.4 | 445.0 | 442.4 |
| (95% CI) | (431.4, 444.1) | (437.7, 451.1) | (438.9, 451.1) | (438.7, 446.0) |
| Standard Deviation | 42.2030 | 43.3656 | | |
| **Mean Difference (Music vs. Non-music) (95% CI)** | 22.28 (11.99, 32.56) | 17.07 (8.10, 26.05) | 24.11 (15.01, 33.21) | 21.23 (15.86, 26.59) |
| *t*-value (*p*-value) (alpha = 0.05) | 4.26 (<.0001) | 3.74 (0.0002) | 5.22 (<.0001) | 7.76 (<.0001) |

### *The Eighth Grade at The School Year 2017*

The eighth grade ELA scores in the school year 2017 variance F- test indicated that it was equal variance (folder *F*-value =1.15 and p=0.4442, which suggested failing to reject the variance equality) (Table 14). The Pooled *t-test* result indicated that there was a significant difference between music and non-music attended student groups (equal df=268, *t*-value=4.26, and p<0.0001) at alpha =0.05. The music group ELA scores were 22.28 higher than non-music with a 95% CI is 11.99 to 32.56.

***The Eighth Grade at The School Year 2018***

The eighth grade ELA scores in the school year 2018 variance F- test indicated that it was unequal variance (folder *F*-value =1.65 and p=0.0038, the research failed to reject the variance equality) (Table 14). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student group (unequal df=283.42, *t*-value=3.74, and p=0.0002) at alpha =0.05. The music group ELA scores were 17.07 higher than non-music with 95% CI is 8.10 to 26.05.

***The Eighth Grade at The School Year 2020***

The eighth grade ELA scores in the school year 2020 variance F- test indicated that it was unequal variance (folder *F*-value =1.30 and p=0.1384, suggested reject variance equality) (Table 14). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student groups (equal df=253.55, *t*-value=5.22, and p<0.0001) at alpha =0.05. The music group ELA scores were 24.11 higher than non-music with a 95% CI is 15.01 to 33.21.

In summary, for eighth grade, ELA scores, over three school years, or each school year, the data indicates that music students had significantly higher scores than non-music students. The mean ELA scores were 22.28, 17.07, 24.11, and 21.23 higher in the school year 2017, 2018, 2020, and compiled three school years, respectively, than non-music attended students ELA scores. The author concluded that data analysis from the 8th grade ELA test scores suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at a significant level alpha = 0.05.

## ELA Score Data Analysis Results Among Music Class Type

Music class types include Band, Orchestra, and Choir. To test whether there was any difference in academic performance and Attendance Days among the music class type, the one-way ANOVA was utilized to compare mean ELA scores among Band, Orchestra, and Choir attended the group.

*Null Hypothesis 2:* There are no differences in academic performance between students who take Band, Orchestra, and Choir classes.

*The significance level* is alpha =.05 which is the threshold used to decide whether a test result is significant.

### *The Compiled Sixth Grade at All Three-School Years*

The ANOVA analysis for sixth grade music attendance showed *p*-value = 0.0279, suggesting there was a significant difference of mean ELA score among music class types (df=2, *F*-value =3.61, p=0.0279) at significant level alpha =0.05 (Table 15). The multiple comparisons were conducted by using pairwise *t*-tests (LSD) for the mean ELA score difference. The comparison result can be concluded as follows: the means of the Orchestra students (446.66) and the Band students (446.14) were significantly higher than the mean of the Choir students (434.96).

### *The Sixth Grade at The School Year 2017*

Data from ELA scores among music class data resulted indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value =2.01, p=0.1380) (Table 4.6). The effective sample size (n), standard deviation, standard error for Orchestra was n=45, mean=453.89, SD=32.30 and SE=4.82, respectively; for Band is n=74, mean=452.15, SD=34.26 and SE=3.98, respectively; for Choir is n=39,

mean=440.79, SD=30.53 and SE=4.89, respectively. The mean ELA scores from high to low was Orchestra, Band, and Choir.

Table 15

*The Sixth Grade ELA Score ANVOA Analysis Among Music Class Type*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| N | 74 | 88 | 81 | 243 |
| Mean (SD) | 452.15 (34.26) | 460.95 (41.65) | 424.56 (34.64) | 446.14 (40.26) |
| **Orchestra** | | | | |
| N | 45 | 50 | 37 | 132 |
| Mean (SD) | 453.89 (32.30) | 462.40 (42.99) | 416.59 (33.25) | 446.66 (41.39) |
| **Choir** | | | | |
| N | 39 | 40 | 34 | 113 |
| Mean (SD) | 440.79 (30.53) | 449.05 (33.60) | 411.68 (31.21) | 434.96 (35.27) |
| **F-value (p-value) (alpha = 0.05)** | 2.01 (0.1380) | 1.49 (0. 2285) | 1.98 (0.1422) | 3.61 (0.0279) |

***The Sixth Grade at The School Year 2018***

Data from ELA scores among music class data analysis results indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.49, p=0. 2285) (Table 15).

The effective sample size (n), standard deviation, standard error for Orchestra was n=50, mean=462.40, SD=42.99 and SE=6.08, respectively; for Band, n=88, mean=460.95, SD=41.65 and SE=4.44, respectively; for Choir, n=40, mean=449.05, SD=33.60 and SE=5.31, respectively. The mean ELA score from high to low was Orchestra, Band, and Choir.

***The Sixth Grade at The School Year 2020***

Data from ELA scores among music class data analysis results indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.98, p=0.1422) (Table 15). The effective sample size (n), standard deviation, standard error for Orchestra was n=37, mean=416.59, SD=33.25 and SE=5.47, respectively; for Band, n=81, mean=424.56, SD=34.64 and SE=3.85, respectively; for Choir, n=34, mean=411.68, SD=31.21 and SE=5.35, respectively. The mean ELA scores from high to low were Band, Orchestra, and Choir.

In summary, for sixth grade ELA scores among music class type, there was no significant mean difference at alpha=0.05 in each school year but compiled school year data showed a significant difference between Orchestra and Choir, as well as Band and Choir, and no difference

between Orchestra and Band. Though there was no significant difference in each school year, Orchestra or Band had the highest mean score, while Choir had the lowest score.

The author concluded that data analysis from the sixth grade ELA test scores among music class type suggested that the null hypothesis was failed to reject for each school year, and the alternative hypothesis was rejected at a significant level alpha = 0.05. However, the null hypothesis was rejected for compile school year, and alternative hypothesis was accepted.

***The Compiled Seventh Grade at All Three-School Years***

Data analysis from ELA scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 2.26, p=0.1058) (Table 16). The effective sample size (n), standard deviation, standard error for Orchestra was n=96, mean=452.82, SD=34.72 and SE=3.54, respectively; for Band, n=184, mean=457.70, SD=33.89 and SE=2.50, respectively; for Choir, n=96, mean=449.04, SD=30.22 and SE=3.08, respectively. The mean ELA score from high to low was Band, Orchestra, and Choir.

***The Seventh Grade at The School Year 2017***

Data analysis from ELA scores among music classes indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value =3.76, p=0. 0257) (Table 16). *T*-tests (LSD) multiple pairwise comparison shows that Band class (effective sample size n=56, mean=470.89, SD=32.36, SE=4.32) significantly higher than Orchestra (n=36, mean=456.33, SD=33.02, SE=5.50) and Choir (n=43, mean=454.58, SD=32.23, SE=4.91), however, there was no difference between Orchestra and Choir.

Table 16

*The Seventh Grade ELA Score ANVOA Analysis Among Music Class Type*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| N | 56 | 65 | 63 | 184 |
| Mean (SD) | 470.89(32.36) | 454.48 (34.02) | 449.29 (32.03) | 457.70 (33.89) |
| **Orchestra** | | | | |
| N | 36 | 35 | 25 | 96 |
| Mean (SD) | 456.33 (33.02) | 454.29 (32.04) | 445.72 (40.65) | 452.82 (34.72) |
| **Choir** | | | | |
| N | 43 | 27 | 26 | 96 |
| Mean (SD) | 454.58 (32.23) | 452.44 (24.69) | 436.35 (29.31) | 449.04 (30.22) |
| **F-value (p-value) (alpha = 0.05)** | 3.76 (0. 0257) | 0.04 (0.9596) | 1.37 (0.2580) | 2.26 (0.1058) |

***The Seventh Grade at The School Year 2018***

Data analysis from ELA scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 0.04, p=0.9596) (Table 16). The effective sample size (n), standard deviation, standard error for Band was n=65, mean=454.48, SD=34.02 and SE=4.22, respectively; for Orchestra, n=35, mean=454.29, SD=32.04 and SE=5.42, respectively; for Choir, n=27, mean=452.44, SD=24.69 and SE=4.75, respectively. The mean ELA score from high to low was Band, Orchestra, and Choir.

***The Seventh Grade at The School Year 2020***

Data analysis from ELA scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.37, p= 0.2580) (Table 16). The effective sample size (n), standard deviation, standard error for Band was n= 63, mean=449.29, SD=32.03 and SE=4.03, respectively; for Orchestra, n=25, mean=445.72, SD=40.65 and SE=8.13, respectively; for Choir, n=26, mean=436.35, SD=29.31 and SE=5.75, respectively. The mean ELA score from high to low was Band, Orchestra, and Choir.

In summary, for seventh grade ELA scores among music classes, in 2017, Band significantly higher than Orchestra and Choir but no difference between Orchestra and Choir. There was no significant difference in 2018, 2020, and compiled school year but the mean highest score was Band, and lowest was Choir, Orchestra was middle over the school year and compiled year. The author concluded that data analysis from the seventh grade ELA test scores among music suggested that the null hypothesis was failed to

rejected, and the alternative hypothesis was rejected at a significant level alpha = 0.05 in 2018, 2020 and compiled school year. Only in 2017 the null hypothesis is rejected.

***The Compiled Eighth Grade at All Three-School Years***

Data analysis from ELA scores among music classes indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 8.39, p= 0.0003) (Table 17). *T*-tests (LSD) multiple pairwise comparison shows that Orchestra class (effective sample size n=94, mean=469.86, SD=34.18, SE=3.53) and Band class (n=136, mean=468.15, SD=36.38, SE=3.12) significantly higher than Choir (n=99, mean=451.41, SD=35.65, SE=3.58), however, there was no difference between Orchestra and Band. It concluded that null hypotheses - the mean ELA score is identical among Band, Orchestra, and Choir students attended - was rejected for compiled eighth grade at all 3-school years.

***The Eighth Grade at The School Year 2017***

Data analysis from ELA scores among music classes indicated there was a significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 4.73, p= 0.0110) (Table 4.8). *T*-tests (LSD) multiple pairwise comparisons show that Orchestra class (effective sample size n=30, mean=476.2, SD=28.15, SE=5.14) was significantly higher than Choir (n=34, mean=447.18, SD=41.43, SE=7.11), however, there was no significant difference between Orchestra and Band class (n=33, mean=458.61, SD=41.50, SE=7.22), as well as Band and Choir.

***The Eighth Grade at The School Year 2018***

Data analysis from ELA scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 2.69, p= 0.0723) (Table 17).

The effective sample size (n), standard deviation, standard error for Band was n=56, mean=469.02, SD=33.66, SE=4.50, respectively; for Choir, n=31, mean=456.06, SD=31.99, SE=5.75, respectively; for Orchestra, n= 35, mean=454.20, SD=33.74, SE=5.70, respectively. The mean ELA score from high to low was Band, Choir, and Orchestra.

Table 17

*The Eighth Grade ELA Score ANVOA Analysis Among Music Class Type*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| n | 33 | 56 | 47 | 136 |
| Mean (SD) | 458.61 (41.50) | 469.02 (33.66) | 473.81 (35.11) | 468.15 (36.38) |
| **Orchestra** | | | | |
| n | 30 | 35 | 29 | 94 |
| Mean (SD) | 476.2 (28.15) | 454.20 (33.74) | 482.17 (34.22) | 469.86 (34.18) |
| **Choir** | | | | |
| n | 34 | 31 | 34 | 99 |
| Mean (SD) | 447.18 (41.43) | 456.06 (31.99) | 451.41 (32.99) | 451.41 (5.65) |
| **F-value (p-value) (alpha = 0.05)** | 4.73 (0.0110) | 2.69 (0.0723) | 7.10 (0.0013) | 8.39 (0.0003) |

***The Eighth Grade at The School Year 2020***

Data analysis from ELA scores among music classes indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 7.10, p= 0.0013) (Table 17). *T*-tests (LSD) multiple pairwise comparison shows that Orchestra class (effective sample size n=29, mean=482.17, SD=34.22, SE=6.35) and Band class (n=47, mean=473.81, SD=35.11, SE=5.12) was significantly higher than Choir (n=34, mean=451.41, SD=32.99, SE=5.66), however, there was no significant difference between Orchestra and Band.

In summary, for eighth grade ELA score among music class, in the school year 2020 and compiled three school year, Orchestra and Band class significantly higher than Choir but no difference between Orchestra and Band. In 2017, the Orchestra class was significantly higher than Choir, but there was no significant difference between Orchestra and Band class, as well as Band and Choir. In 2018, there was no significant difference, and ELA scores from high to low were Band, Choir, and Orchestra. The author concluded that data analysis from the eighth grade ELA test scores among music class type suggested that the null hypothesis was rejected in 2017, 2020 and compiled school year, and the alternative hypothesis was accepted at a significant level alpha = 0.05. However, the researcher failed to reject the null hypothesis in 2018.

**MATH Scores Data Analysis Results**

Data analysis from the sixth grade Math test scores suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at a significant level alpha = 0.05 (actual unequal df=725.38, *t*-value = 7.27 and p<0.0001, it indicated extremely statistical significance) (Table 18), that was, the mean MATH scores in the

population of music attended students was significantly different than the mean MATH score in the population of non-music attended students. The music attended students had scored 20.33 points higher than non-music with 95% CI from 14.85 to 25.82.

***The Sixth Grade at The School Year 2017***

Data analysis from the sixth-grade MATH scores in the school year 2017 variance F- test indicated that it was not equal variance (folder *F*-value =1.58 and p= 0.0065, suggested reject hypothesis the equal variance) (Table 18). Therefore, the Satterthwaite *t*-test value was used. The result indicated that there was a significant difference between music and non-music attended student groups (unequal df= 239.67, *t*-value= 6.65, and p<0.0001) at alpha =0.05. The music group MATH scores were 29.86 higher than non-music with a 95% CI is 21.00 to 38.69.

***The Sixth Grade at The School Year 2018***

Data analysis from the sixth-grade MATH scores in the school year 2018 variance F- test indicated that it was equal variance (folder *F*-value =1.28 and p=0.1345 and failed to reject variance equality) (Table 18). Therefore, the Pooled *t*-test value is used. The result indicated that there was a significant difference between music and non-music attended student groups (equal df=303, *t*-value=3.60, and p=0.0004) at alpha = 0.05. The music group MATH scores were17.47 higher than non-music with a 95% CI is 7.927 to 27.01.

Table 18

*The Sixth Grade Math Score Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| n | 158 | 178 | 152 | 488 |
| Min, Max | 346, 540 | 260, 575 | 339, 500 | 260, 575 |
| Mean | 449.5 | 451.3 | 419.2 | 440.7 |
| (95% CI) | (444.3, 454.7) | (445.4, 457.1) | (414.6, 423.7) | (437.4, 444.0) |
| Standard Deviation | 32.8689 | 39.5315 | 28.1920 | 37.0633 |
| **Non-music attended** | | | | |
| n | 128 | 127 | 114 | 369 |
| Min, Max | 340, 519 | 260, 535 | 260, 473 | 260, 535 |
| Mean | 419.6 | 433.8 | 406.2 | 420.4 |
| (95% CI) | (412.4, 426.9) | (426.0, 441.7) | (399.1, 413.3) | (416.0, 424.8) |
| Standard Deviation | 41.3113 | 44.6647 | 38.1604 | 42.9450 |
| **Mean Difference (Music vs. Non-music) (95% CI)** | 29.85 (21.00, 38.69) | 17.47 (7.927, 27.01) | 12.98 (4.61, 21.34) | 20.33 (14.85, 25.82) |
| t-value (p-value) (alpha = 0.05) | 6.65(<.0001) | 3.60 (0.0004) | 3.06 (0.0025) | 7.27 (<.0001) |

***The Sixth Grade at The School Year 2020***

Data analysis from the sixth-grade MATH scores in the school year 2020 variance F- test indicated that it was unequal variance (folder *F*-value =1.83 and p=0.0005, suggested to reject variance equality) (Table 18). Therefore, the Satterthwaite *t*-test value was used. The result indicated that there was a significant difference between music and non-music attended student group (unequal df=199.44, *t*-value=3.06, and p=0.0025) at alpha =0.05. The music group MATH scores were12.98 higher than non-music with a 95% CI is 4.61 to 21.34.

In summary, for sixth-grade MATH scores, over three school years, and each school year, the data indicates that music students had significantly higher scores than non-music students. The mean MATH scores difference of music and non-music attended groups was 29.85, 17.47, 12.98, and 20.33 for 2017, 2018, 2020, and compiled three school years, respectively. The author concluded that data analysis from the sixth grade MATH test scores suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at a significant level alpha = 0.05.

***The Compiled Seventh Grade at All Three-School Years***

Data analysis from all school years seventh-grade MATH analysis, the *t*-test data analysis suggested that null hypothesis was rejected, and the alternative hypothesis was accepted at significant level alpha = 0.05 (actual df=845.46, *t*-value = 9.44 and p<0.0001, it indicated extremely statistical significance) (Table 19), that was, the mean MATH scores in the population of music attended students was significantly different than the mean MATH score in the population of non-music attended students. The music group's

mean MATH scores were 24.05 higher than the non-music group with a 95% CI is 19.05 to 29.05.

***The Seventh Grade at The School Year 2017***

Data analysis from the seventh-grade MATH scores in the school year 2017 variance F- test indicated that it was not equal variance (folder *F*-value =1.88 and p=0.0003, suggesting reject the variance equality) (Table 19). Therefore, the Satterthwaite *t*-test value was used. The result indicated that there was a significant difference between music and non-music attended student groups (unequal df=257.89, *t*-value=3.96, and p<0.0001) at alpha =0.05. The music group MATH scores was16.23 higher than non-music with 95% CI is 8.16 to 24.30.

***The Seventh Grade at The School Year 2018***

Data analysis from the seventh-grade MATH scores in the school year 2018 variance F- test indicated that it was unequal variance (folder *F*-value =1.88 and p=0.0003, suggested fail to reject the variance equality) (Table 19). Therefore, the Satterthwaite *t*-test value was used. The result indicated that there was a significant difference between music and non-music attended student groups (unequal df=281.79, *t*-value=7.30, and p<0.0001) at alpha =0.05. The music group MATH scores were 31.20 higher than non-music with a 95% CI is 22.80 to 39.60.

Table 19

*The Seventh Grade Math Score Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| n | 135 | 127 | 114 | 376 |
| Min, Max | 369, 565 | 349, 540 | 325, 498 | 325, 565 |
| Mean | 466.3 | 452.6 | 446.1 | 455.5 |
| (95% CI) | (461.5, 471.2) | (447.2, 457.9) | (440.0, 452.2) | (452.3, 458.8) |
| Standard Deviation | 28.5113 | 30.4283 | 32.9076 | 31.6222 |
| **Non-music attended** | | | | |
| n | 142 | 159 | 174 | 475 |
| Min, Max | 323, 528 | 336, 497 | 270, 517 | 270, 528 |
| Mean | 450.1 | 421.4 | 425.6 | 431.5 |
| (95% CI) | (443.6, 456.6) | (414.8, 427.9) | (419.3, 431.8) | (427.7, 435.3) |
| Standard Deviation | 39.1143 | 41.7293 | 41.6933 | 42.6731 |
| **Mean Difference (Music vs. Non-music)** | 16.23 | 31.2 | 20.52 | 24.05 |
| **(95% CI)** | (8.16, 24.30) | (22.80, 39.60) | (11.83, 29.22) | (19.05, 29.05) |
| t-value (p-value) (alpha = 0.05) | 3.96 (<.0001) | 7.30 (<.0001) | 4.65 (<.0001) | 9.44 (<.0001) |

***The Seventh Grade at The School Year 2020***

Data analysis from the seventh-grade MATH scores in the school year 2020 variance F- test indicated that it was unequal variance (folder *F*-value =1.61 and p=0.0071, suggesting reject the variance equality) (Table 19). Therefore, the Satterthwaite *t*-test value was used. *T*-test result indicated that there was a significant difference between music and non-music attended student group (equal df=276.16, *t*-value=1.61, and p=0.0071) at alpha =0.05. The music group MATH scores were 20.52 higher than non-music with 95% CI is 11.83 to 29.22.

From the above presents and analysis results, for seventh-grade MATH scores, over three school years, or each school year, data analyzed strongly suggested a positive relationship between music students and their MATH assessment scores in the average, which was significantly higher than their peer non-music students in MATH assessment scores. The mean MATH scores difference between music and non-music attended groups was 16.23, 31.20, 20.52 for 2017, 2018, 2020, and compiled three school years, respectively. The author concluded that data analysis from the seventh grade MATH test scores suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at a significant level alpha = 0.05.

***The Compiled Eighth Grade at All Three-School Years***

Data analysis from eighth grade MATH in all school years analysis, the *t*-test data analysis suggested that null hypothesis was rejected, and the alternative hypothesis was accepted at significant level alpha = 0.05 (actual df=837, *t*-value = 5.62 and p<0.0001, it indicated extremely statistical significance) (Table 20), that was, the mean MATH scores in the population of music attended students was significantly different than the mean

MATH score in the population of non-music attended students. The music group's mean MATH scores were 20.96 higher than the non-music group with a 95% CI is 13.63 to 28.28.

***The Eighth Grade at The School Year 2017***

Data analysis from the 8th-grade MATH scores in the school year 2017 variance F- test indicated that it was equal variance (folder *F*-value =1.11 and p=0.5751, suggested fail to reject variance equality) (Table 20). Therefore, the Pooled *t*-test value was used. The result indicated that there was a significant difference between music and non-music attended student groups (equal df=266, *t*-value=5.00, and p<0.0001) at alpha =0.05. The music group MATH scores were 44.34 higher than non-music with a 95% CI is 26.894 to 61.79.

Table 20

*The Eighth Grade Math Scores Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| N | 96 | 122 | 108 | 326 |
| Min, Max | 353, 628 | 349, 565 | 344, 593 | 344, 628 |
| Mean | 517.2 | 465 | 458.4 | 478.2 |
| (95% CI) | (503.6, 530.8) | (459.2, 470.8) | (451.8, 465.0) | (472.5, 483.9) |
| Standard Deviation | 67.1965 | 32.3647 | 34.469 | 52.3958 |
| **Non-music attended** | | | | |
| N | 172 | 164 | 177 | 513 |
| Min, Max | 310, 607 | 310, 528 | 310, 536 | 310, 607 |
| Mean | 472.8 | 452.4 | 446.6 | 457.2 |
| (95% CI) | (462.2, 483.5) | (446.5, 458.2) | (440.8, 452.4) | (452.7, 461.8) |
| Standard Deviation | 70.8303 | 38.0432 | 39.2291 | 52.8587 |
| **Mean Difference (Music vs. Non-music) (95% CI)** | 44.34 (26.89, 61.79) | 12.66 (4.25, 21.07) | 11.83 (2.82, 20.84) | 20.96 (13.63, 28.28) |
| t-value (p-value) (alpha = 0.05) | 5.00 (<.0001) | 2.96 (0.0033) | 2.58 (0.0103) | 5.62 (<.0001) |

***The Eighth Grade at The School Year 2018***

Data analysis from the eighth-grade MATH scores in the school year 2018 variance F- test indicated that it was equal variance (folder *F*-value =1.38 and p=0.0609, suggested fail to reject variance equality) (Table 20). Therefore, the Pooled *t*-test value was used. The result indicated that there was a significant difference between music and non-music attended student group (unequal df=284, *t*-value=2.96, and p=0.0033) at alpha =0.05. The music group MATH scores were12.66 higher than non-music with a 95% CI is 4.25 to 21.07.

***The Eighth Grade at The School Year 2020***

Data analysis from the eighth-grade MATH scores in the school year 2020 variance F- test indicated that it was equal variance (folder *F*-value =1.30 and p=0.1448, suggested fail to reject variance equality) (Table 20). Therefore, the Pooled *t*-test value was used. The result indicated that there was a significant difference between music and non-music attended student group (equal df=283, *t*-value=2.58, and p=0.0103) at alpha =0.05. The music group MATH scores were 11.83 higher than non-music with 95% CI is 2.82 to 20.84.

Data analysis from the above presented and analysis results, for 8th-grade MATH score, over three school years, or each school year, strongly suggested a positive relationship between music students and their MATH assessment scores in the average, which was significantly higher than their peer non-music students in MATH assessment scores. The mean MATH scores difference of music and non-music attended groups were 44.34, 12.66, 11.83, and 20.96 for the school year 2017, 2018, 2020, and compiled three school years, respectively. The author concluded that data analysis from the eighth grade

MATH test scores suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at a significant level alpha = 0.05.

## MATH Score Data Analysis Results Among Music Class Type

### *The Compiled Sixth Grade at All Three-School Years*

Data analysis from MATH scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value =1.30, p=0.2729) (Table 21). The effective sample size (n), standard deviation, standard error for Orchestra is n=132, mean=442.63, SD=38.71 and SE=3.367, respectively; for Band was n=243, mean=441.93, SD=37.16 and SE=2.38, respectively; for Choir, n=113, mean=435.80, SD=34.70 and SE=3.26, respectively. The mean MATH scores from high to low were orchestra, Band, and Choir.

Table 21

*The Sixth Grade Math Scores* ANOVA *Analysis Among Students Who Attended Music Class Type*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| N | 74 | 88 | 81 | 243 |
| Mean (SD) | 452.92 (30.29) | 448.67 (43.96) | 424.56 (27.79) | 441.93 (37.16) |
| **Orchestra** | | | | |
| N | 45 | 50 | 37 | 132 |
| Mean (SD) | 453.53 (34.71) | 453.76 (39.01) | 414.32 (27.65) | 442.63 (38.71) |
| **Choir** | | | | |
| N | 39 | 40 | 34 | 113 |
| Mean (SD) | 438.31 (33.69) | 453.98 (28.96) | 411.53 (27.81) | 435.80 (34.70) |
| **F-value (p-value) (alpha = 0.05)** | 3.08 (0.0488) | 0.38 (0.6842) | 3.38 (0.0368) | 1.30 (0.2729) |

***The Sixth Grade at The School Year 2017***

Data analysis from MATH scores among music classes indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 3.08, p= 0.0488) (Table 21). *T*-tests (LSD) multiple pairwise comparison shows that Orchestra (effective sample size n=45, mean=453.53, SD=34.71, SE=5.17) and Band class (n=74, mean=452.92, SD=30.29, SE=3.52) significantly higher than Choir (n=39, mean=438.31, SD=33.69, SE=5.40), however, there was no significant difference between Orchestra and Band.

***The Sixth Grade at The School Year 2018***

Data analysis from MATH scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 0.38, p=0.6842) (Table 21). The effective sample size (n), standard deviation, standard error for Choir was n= 40, mean=453.98, SD=28.96, and SE=4.58, respectively, Orchestra, n=50, mean=453.76, SD=39.01, and SE=5.51, respectively; for Band, n= 88, mean=448.67, SD=43.96, and SE=4.69, respectively. The mean MATH scores from high to low were Choir, Orchestra, and Band.

***The Sixth Grade at The School Year 2020***

Data analysis from MATH scores among music classes indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 3.38, p= 0.0368) (Table 21). *T*-tests (LSD) multiple pairwise comparison showed that Band class (effective sample size n=81, mean=424.56, SD=27.79, SE=3.09) significantly higher than Choir (n=34, mean=411.53, SD=27.81, SE=4.77), however, there was no difference

between Band and Orchestra (n=37, mean=414.32, SD=27.65, SE=4.54), as well as between Orchestra and Choir.

In summary, for the sixth grade Math scores among music class types, there was a significant difference in the school year 2017 and 2020, but no significant difference in 2018 and compiled school years. In 2017, Orchestra and Band were significantly higher than Choir but no significant difference between Orchestra and Band. In 2020, Band significantly higher than Choir but no significant difference between Band and Orchestra, as well as between Orchestra and Choir. The author concluded that data analysis from the sixth grade MATH test scores among music class type suggested that the null hypothesis was rejected in 2017 and 2020, and the alternative hypothesis was accepted at a significant level alpha = 0.05. However, the researcher failed to reject the null hypothesis in 2018 and the compiled school year.

### *The Compiled Seventh Grade at All Three-School Years*

Data analysis from MATH scores among music classes indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 3.38, p= 0.0351) (Table 22). *T*-tests (LSD) multiple pairwise comparison showed that Band class (effective sample size n=184, mean=458.90, SD=32.11, SE=2.37) significantly higher than Choir (n=96, means=448.64, SD=30.48, SE=3.11), however, there was no significant difference between Band and Orchestra (n=96, mean=456.04, SD=31.01, SE=3.17), as well as between Orchestra and Choir.

Table 22

*The Seventh Grade Math Scores* ANVOA *Analysis Among Students Who Attended Music Class Type*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| N | 56 | 65 | 63 | 184 |
| Mean (SD) | 473.54 (27.59) | 455.94 (29.80) | 448.94 (33.88) | 458.90 (32.11) |
| **Orchestra** | | | | |
| N | 36 | 35 | 25 | 96 |
| Mean (SD) | 464.47 (29.48) | 453.03 (32.51) | 448.12 (29.27) | 456.04 (31.01) |
| **Choir** | | | | |
| N | 43 | 27 | 26 | 96 |
| Mean (SD) | 458.51 (27.16) | 443.89 (28.49) | 437.23 (33.46) | 448.64 (30.48) |
| **F-value (p-value) (alpha = 0.05)** | 3.62 (0.0295) | 1.51 (0.2242) | 1.23 (0.2961) | 3.38 (0.0351) |

***The Seventh Grade at The School Year 2017***

Data analysis from MATH scores among music classes indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 3.62, p= 0.0295) (Table 22). *T*-tests (LSD) multiple pairwise comparison showed that Band class (effective sample size n=56, mean=473.54, SD=27.59, SE=3.69) significantly higher than Choir (n=43, mean=458.51, SD=27.16, SE=4.14), however, there was no significant difference between Band and Orchestra (n=36, means=464.47, SD=29.48, SE=4.91), as well as between Orchestra and Choir.

***The Seventh Grade at The School Year 2018***

Data analysis from MATH scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.51, p= 0.2242) (Table 22). The effective sample size (n), standard deviation, standard error for Band was n=65, mean=455.94, SD=29.80 and SE=3.70, respectively; for Orchestra, n=35, mean=453.03, SD=32.51 and SE=5.50, respectively; for Choir, n=27, mean=443.89, SD=28.49 and SE=5.48, respectively. The mean MATH score from high to low was Band, Orchestra, and Choir.

***The Seventh Grade at The School Year 2020***

Data analysis from MATH scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.23, p= 0.2961) (Table 22). The effective sample size (n), standard deviation, standard error for Band, n=63, mean=448.94, SD=33.88 and SE=4.27, respectively; for Orchestra was n=25, mean=448.12, SD=29.27 and SE=5.85, respectively; for Choir, n=26,

mean=437.23, SD=33.46 and SE=6.56, respectively. The mean MATH score from high to low was Band, Orchestra, and Choir.

In summary, for seventh grade Math scores among music classes, in the school year 2017 and compiled three school year, Band class significantly higher than Choir but no significant difference between Band and Orchestra, as well as between Orchestra and Choir. In 2018, 2020, there was no significant difference. The author concluded that data analysis from the seventh grade MATH test scores among music class type suggested that the null hypothesis was rejected in 2017 and compiled school year, and the alternative hypothesis was accepted at a significant level alpha = 0.05. However, null hypothesis was failed to reject in 2018 and 2020.

***The Compiled Eighth Grade at All Three-School Years***

Data analysis from MATH scores among music classes data analysis result indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 3.84, p= 0.0225) (Table 23). *T*-tests (LSD) multiple pairwise comparison showed that Orchestra class (effective sample size n=94, mean=490.67, SD=54.69, SE=5.64) significantly higher than Band class (n=135, mean=473.85, SD=50.80, SE=4.37) and Choir (n=97, mean=472.14, SD=50.78, SE=5.16), however, there was no significant difference between Band and Choir. It concluded that null hypotheses - the mean MATH score is identical among Band, Orchestra, and Choir students attended - was rejected for compiled eighth grade at all three-school years.

Table 23

*The Seventh Grade Math Scores ANVOA Analysis Among Students Who Attended Music Class Type*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| N | 32 | 56 | 47 | 135 |
| Mean (SD) | 505.25 (71.30) | 470.93 (33.75) | 455.96 (41.31) | 473.85 (50.80) |
| **Orchestra** | | | | |
| N | 30 | 35 | 29 | 94 |
| Mean (SD) | 547.80 (51.79) | 464.91 (30.91) | 462.66 929.29) | 490.67 (54.69) |
| **Choir** | | | | |
| N | 34 | 31 | 32 | 97 |
| Mean (SD) | 501.41 (67.96) | 454.45 (29.55) | 458.19 (27.72) | 472.14 (50.78) |
| **F-value (p-value) (alpha = 0.05)** | 4.93 (0.0092) | 2.66 (0.0743) | 1.49 (0. 2285) | 3.84 (0.0225) |

***The Eighth Grade at The School Year 2017***

Data analysis from MATH scores among music classes data analysis result indicated there was significant mean difference among class types at alpha =0.05 (df=2, *F*-value = 4.93, p= 0.0092) (Table 23). *T*-tests (LSD) multiple pairwise comparison showed that Orchestra class (effective sample size n=30, mean=547.80, SD=51.79, SE=9.46) was significantly higher than Band class (n=32, mean=505.25, SD=71.30, SE=12.60) and Choir (n=34, mean=501.41, SD=67.96, SE=11.66), however, there was no significant difference between Band and Choir.

***The Eighth Grade at The School Year 2018***

Data analysis from MATH scores among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 2.66, p= 0.0743) (Table 23). The effective sample size (n), standard deviation, standard error for Band was n=56, mean=470.93, SD=33.75, SE=4.51, respectively; for Orchestra, n=35, mean=464.91, SD=30.91, SE=5.22, respectively; for Choir is n=31, mean=454.45, SD=29.55, SE=5.31, respectively. The mean MATH score from high to low was Band, Orchestra, and Choir.

***The Eighth Grade at The School Year 2020***

Data analysis from MATH scores data among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.49, p=0. 2285) (Table 23). The effective sample size (n), standard deviation, standard error for Orchestra is n=29, mean=462.66, SD=29.29 and SE=5.44, respectively; for Choir was n=32, mean=458.19, SD=27.72 and SE=4.90, respectively; for Band, n=47,

mean=455.96, SD=41.31 and SE=6.02, respectively. The mean MATH score from high to low was Orchestra, Choir, and Band.

In summary, for eighth grade Math scores among music classes, in the school year 2017 and compiled three school year, Orchestra class was significantly higher than Band class and Choir but no significant difference between Band and Choir. In the school years 2018 and 2020, there was no significant difference. The author concluded that data analysis from the eighth grade MATH test scores among music class type suggested that the null hypothesis was rejected in 2017 and compiled school year, and the alternative hypothesis was accepted at a significant level alpha = 0.05. However, null hypothesis was failed to reject in 2018 and 2020.

**Attendance Days Analysis Results**

Like MAP score analyses, the Attendance Days were analyzed and compared using a two-sample *t*-test between music and non-music attended students. The *t*-test was also conducted for multiple data set analyses: a compiled sixth, seventh and eighth grade of three school years (i.e., compiled 2017, 2018, and 2020) and each school year.

*Null Hypothesis 3:* Students who take music classes do not have a higher attendance rate than those who do not take music classes.

The significance level is alpha = .05 which is the threshold used to decide whether a test result is significant.

***The Compiled Sixth Grade at All Three-School Years***

Data analysis from the sixth grade Attendance Days suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at significant level alpha = 0.05 (actual unequal df=585.65, *t*-value = 4.31 and $p<0.0001$, it indicated

statistical significance) (Table 24), that was, the mean Attendance Days in music attended students was significantly different than the mean Attendance Days in non-music attended students. The 95% confidence interval for the mean difference (2.91 days) in the Attendance Days was (1.59, 4.24).

***The Sixth Grade at The School Year 2017***

Data analysis from the sixth grade Attendance Days in the school year 2017 variance F- test indicated that it was unequal variance (folder *F*-value =2.86 and $p<0.0001$, suggested reject hypothesis the equal variance) (Table 24). Therefore, the Satterthwaite result indicated that there was no significant difference between music and non-music attended student group (unequal df= 202.22, *t*-value= 1.25, and p=0.2111) at alpha =0.05.

Table 24

*The Sixth Grade Attendance Days Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| N | 158 | 180 | 153 | 491 |
| Min, Max | 136, 174 | 137, 174 | 129, 174 | 129, 174 |
| Mean | 166.4 | 167.8 | 165.7 | 166.7 |
| (95% CI) | (165.2, 167.6) | (167.0, 168.6) | (164.4, 167.0) | (166.1, 167.3) |
| Standard Deviation | 7.3927 | 5.4564 | 7.8339 | 6.9406 |
| **Non-music attended** | | | | |
| N | 131 | 134 | 118 | 383 |
| Min, Max | 71, 174 | 106, 174 | 121, 174 | 71, 174 |
| Mean | 164.9 | 164.1 | 162.2 | 163.8 |
| (95% CI) | (162.7, 167.0) | (162.2, 165.9) | (160.1, 164.4) | (162.6, 164.9) |
| Standard Deviation | 12.503 | 10.7636 | 11.7805 | 11.7132 |
| **Mean Difference (Music vs. Non-music)** | 1.56 | 3.7 | 3.46 | 2.91 |
| **(95% CI)** | (-0.78, 3.89) | (1.70, 5.71) | (0.99, 5.94) | (1.59, 4.24) |
| t-value (p-value) (alpha = 0.05) | 1.25 (0.2111) | 3.65 (0.0003) | 2.76 (0.0064) | 4.31 (<.0001) |

***The Sixth Grade at The School Year 2018***

Data analysis from the sixth grade Attendance Days in the school year 2018 variance F- test indicated that it was unequal variance (folder *F*-value =3.89 and p<0.0001, suggested reject variance equality) (Table 24). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student group (unequal df=183.76, *t*-value=3.65, and p=0.0003) at alpha = 0.05. The music group Attendance Days was 3.70 higher

***The Sixth Grade at The School Year 2020***

Data analysis from the sixth grade Attendance Days in the school year 2020 variance *F*- test indicated that it was unequal variance (folder *F*-value =2.26 and p<0.0001, suggested to reject variance equality) (Table 24). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student group (unequal df=193.12, *t*-value=2.76, and p=0.0064) at alpha =0.05. The music group Attendance Days were 3.46 higher than non-music with a 95% CI is 0.99 to 5.94.

In the summary, for sixth grade Attendance Days, except the school year 2017, other school years and compiled data analyzed strongly suggested a positive relationship between music students and their Attendance Days in the average, which was significantly higher than their peer non-music students in Attendance Days.

The Compiled Seventh Grade at All Three-School Years

Data analysis from the compiled seventh grade Attendance Days suggested that the null hypothesis was rejected, and the alternative hypothesis was accepted at significant level alpha = 0.05 (actual unequal df=829.54, *t*-value = 2.97 and p=0.0031)

(Table 25), that is, the mean Attendance Days in music attended students was significantly different than the mean Attendance Days in non-music attended students. The 95% confidence interval for the mean difference (2.2 days) in the Attendance Days was (0.74, 3.65).

***The Seventh Grade at The School Year 2017***

Data analysis from the seventh grade Attendance Days in the school year 2017 variance F- test indicated that it was equal variance (folder *F*-value =1.17 and p=0.3555, suggested failed reject hypothesis the equal variance) (Table 25). The Pooled *t*-test result indicated that there was no significant difference between music and non-music attended student groups (unequal df= 280.94, *t*-value= -0.13, and p=0.8999) at alpha =0.05.

***The Seventh Grade at The School Year 2018***

Data analysis from the seventh grade Attendance Days in the school year 2018 variance F- test indicated that it was unequal variance (folder *F*-value =1.73 and p=0.0014, suggested reject variance equality) (Table 25). The Satterthwaite *t*-test result indicated that there was no significant difference between music and non-music attended student group (unequal df=287.84, *t*-value=1.47, and p=0.1436) at alpha = 0.05.

Table 25

*The Seventh Grade Attendance Days Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| n | 137 | 127 | 117 | 381 |
| Min, Max | 122, 174 | 127, 174 | 138, 174 | 122, 174 |
| Mean | 165.9 | 166.5 | 165.9 | 166.1 |
| (95% CI) | (165.2, 167.6) | (165.1, 167.9) | (164.4, 167.3) | (165.3, 166.9) |
| Standard Deviation | 8.6153 | 7.8678 | 8.0232 | 8.1746 |
| **Non-music attended** | | | | |
| n | 146 | 163 | 186 | 495 |
| Min, Max | 106, 174 | 80, 174 | 43, 174 | 43, 174 |
| Mean | 166.1 | 165 | 161.3 | 163.9 |
| (95% CI) | (162.7, 167.0) | (163.4, 166.6) | (158.7, 163.9) | (162.7, 165.1) |
| Standard Deviation | 9.3179 | 10.3481 | 17.8714 | 13.5821 |
| **Mean Difference (Music vs. Non-music)** | -0.13 | 1.57 | 4.55 | 2.2 |
| **(95% CI)** | (-0.13, -2.24) | (-0.54, 3.674) | (1.59, 7.52) | (0.74, 3.65) |
| t-value (p-value) (alpha = 0.05) | -0.13 (0.9002) | 1.47 (0.1436) | 3.02 (0.0027) | 2.97 (0.0031) |

***The Seventh Grade at The School Year 2020***

Data analysis from the seventh grade Attendance Days in the school year 2020 variance F- test indicated that it was unequal variance (folder *F*-value =4.96 and p<0.0001, suggested to reject variance equality) (Table 25). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student group (unequal df=277.16, *t*-value=3.02, and p=0.0027) at alpha =0.05. The music group Attendance Days were 4.55 higher than non-music with 95% CI is 1.59 to 7.52.

In the summary, for seventh grade Attendance Days, there was no significant difference between the school year 2017, and 2018; while in 2020 and compiled data analyzed strongly suggested a positive relationship between music students and their Attendance Days in the average, which was significantly higher than their peer non-music students in Attendance Days.

***The Compiled Eighth Grade at All Three-School Year***

Data analysis from the compiled eighth grade Attendance Days suggested that the null hypothesis was rejected, and the alternative hypothesis is accepted at significant level alpha = 0.05 (actual unequal df=860.99, *t*-value = 4.95 and p<0.0001) (Table 26), that was, the mean Attendance Days in music attended students was significantly different than the mean Attendance Days in non-music attended students. The 95% confidence interval for the mean difference (3.7 days) in the Attendance Days was (2.23, 5.16).

***The Eighth Grade at The School Year 2017***

Data analysis from the eighth grade Attendance Days in the school year 2017 variance F- test indicated that it was equal variance (folder *F*-value =1.28 and p=0.1805, suggested fail to reject hypothesis the equal variance) (Table 26). The Pooled *t*-test result indicated that there was a significant difference between music and non-music attended student group (equal df= 273, *t*-value= 3.29, and p=0.0011) at alpha =0.05. The 95% confidence interval for the mean difference (3.75 days) in the Attendance Days was (1.55, 5.99).

Table 26

*The Eighth Grade Attendance Days Differences in Students Who Attended Music Classes and Those Who Did Not Attend Music Class in the Research School*

| Student Music Attended or Not | School Year | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Music attended** | | | | |
| n | 97 | 123 | 111 | 331 |
| Min, Max | 121, 174 | 124, 174 | 106, 174 | 106, 174 |
| Mean | 167.4 | 166.3 | 165.2 | 166.2 |
| (95% CI) | (165.7, 169.1) | (165.1, 167.5) | (163.2, 167.2) | (165.3, 167.2) |
| Standard Deviation | 8.2921 | 6.8721 | 10.5958 | 8.6979 |
| **Non-music attended** | | | | |
| n | 178 | 169 | 188 | 535 |
| Min, Max | 120, 174 | 86, 174 | 33, 174 | 33, 174 |
| Mean | 163.6 | 161.8 | 162.1 | 162.5 |
| (95% CI) | (162.2, 165.0) | (159.5, 164.2) | (160.1, 164.2) | (161.4, 163.7) |
| Standard Deviation | 9.3818 | 15.3131 | 14.3314 | 13.2471 |
| **Mean Difference (Music vs. Non-music)** | 3.75 | 4.45 | 3.04 | 3.7 |
| **(95% CI)** | (1.55, 5.99) | (1.83, 7.07) | (0.18, 5.89) | (2.23, 5.16) |
| t-value (p-value) (alpha = 0.05) | 3.29 (0.0011) | 3.35 (0.0009) | 2.09 (0.0371) | 4.95 (<.0001) |

***The Eighth Grade at The School Year 2018***

Data analysis from the eighth grade Attendance Days in the school year 2018 variance F- test indicated that it was unequal variance (folder *F*-value =4.97 and p<0.0001, suggested reject variance equality) (Table 26). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student group (unequal df=247.72, *t*-value=3.35, and p=0.0009) at alpha = 0.05. The music group Attendance Days were 4.45 higher than non-music with a 95% CI is 1.83 to 7.07.

***The Eighth Grade at The School Year 2020***

Data analysis from the eighth grade Attendance Days in the school year 2020 variance F- test indicated that it was unequal variance (folder *F*-value =1.83 and p=0.0006, suggested to reject variance equality) (Table 26). The Satterthwaite *t*-test result indicated that there was a significant difference between music and non-music attended student group (unequal df=282.26, *t*-value=2.09, and p=0.0371) at alpha =0.05. The music group Attendance Days were 3.04 higher than non-music with a 95% CI is 0.18 to 5.89.

In the summary, for eighth grade Attendance Days, each school year and compiled data analyzed suggested a positive relationship between music students and their Attendance Days in the average, which was significantly higher than their peer's non-music students in Attendance Days.

Over the school year, except sixth grade in 2017, seventh grade in 2017 and 2018, all other years' data analyses exhibited there was significant mean Attendance Days

difference between music and non-music attended, and music attended was significantly higher than their peer non-music students in Attendance Days.

**Attendance Days Data Analysis Results Among Music Class Type**

*Null Hypothesis 4:* There are no differences in attendance between students who take Band, Orchestra, and Choir classes.

The significance level is alpha = .05 which is the threshold used to decide whether a test result is significant.

***The Compiled Sixth Grade at All Three-School Years***

Data analysis from Attendance Days among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.35, p= 0.2609) (Table 27). The null hypothesis was not rejected. The effective sample size (n), standard deviation, standard error for Band was n=245, mean=167.12, SD=6.45 and SE=0.41, respectively; for Choir, n=114, mean=166.65, SD=5.95 and SE=0.56, respectively; for Orchestra, n=132, mean=165.89, SD=8.44 and SE= 0.73, respectively. The mean Attendance Days from high to low were Band, Choir, and Orchestra.

Table 27

*The Sixth Grade Attendance Days ANVOA Analysis Among Students*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| n | 74 | 89 | 82 | 245 |
| Mean (SD) | 167.15 (7.16) | 167.65 (4.64) | 166.52 (7.42) | 167.12 (6.45) |
| **Orchestra** | | | | |
| n | 45 | 50 | 37 | 132 |
| Mean (SD) | 165.07 (8.71) | 168.06 (7.13) | 163.97 (9.30) | 165.89 (8.44 ) |
| **Choir** | | | | |
| n | 39 | 41 | 34 | 114 |
| Mean (SD) | 166.56 (6.03) | 167.61 (4.85) | 165.59 (6.95) | 166.65 (5.95) |
| **F-value (p-value) (alpha = 0.05)** | 1.12 (0.3281) | 0.11 (0.8981) | 1.36 (0.2590) | 1.35 (0.2609) |

***The Sixth Grade at The School Year 2017***

Data analysis from Attendance Days among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.12, p= 0.3281) (Table 27). The effective sample size (n), standard deviation, standard error for Band was n=74, mean=167.15, SD=7.16 and SE=0.83, respectively; for Choir, n=39, mean=166.56, SD=6.03 and SE=0.97 respectively; for Orchestra, n=45, mean=165.07, SD=8.71 and SE=1.30, respectively. The mean Attendance Days from high to low were Band, Choir, and Orchestra.

***The Sixth Grade at The School Year 2018***

Data analysis from Attendance Days data among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 0.11, p= 0.8981) (Table 27). The effective sample size (n), standard deviation, standard error for Orchestra was n=50, mean=168.06, SD=7.13 and Se=1.01, respectively; for Band, n=89, mean=167.65, SD=4.64 and SE=0.49, respectively; for

Choir, n=41, mean=167.61, SD=4.85 and SE=0.76, respectively. The mean Attendance Days from high to low were Orchestra, Band, and Choir.

***The Sixth Grade at The School Year 2020***

Data analysis from Attendance Days data among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.36, p= 0.2590). The effective sample size (n), standard deviation, standard error for Band was n=82, mean=166.52, SD=7.42 and SE=0.82, respectively; for Choir, n=34 mean=165.59, SD=6.95 and SE=1.19, respectively; for Orchestra, n=37, mean=163.97, SD=9.30 and SE=1.53, respectively. The mean Attendance Days from high to low were Band, Choir, and Orchestra.

In the summary, for sixth grade, either compiled three school years or each school year, there was no significant mean Attendance Days difference among all three music class types.

***The Compiled Seventh Grade at All Three-School Years***

Data analysis from Attendance Days among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 2.48, p= 0.0848) (Table 28). The effective sample size (n), standard deviation, standard error for Band was n=186, mean=166.99, SD=7.45 and SE=0.5, respectively; for Orchestra, n=97, mean=165.77, SD=9.36 and SE=0.95, respectively; for Choir, n=98, mean=164.78, SD=8.12 and SE=0.82, respectively. The mean Attendance Days from high to low were Band, Orchestra, and Choir.

Table 28

*The Seventh Grade Attendance Days ANVOA Analysis Among Students*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| N | 56 | 65 | 65 | 186 |
| Mean (SD) | 166.54 (8.30) | 167.12 (7.89) | 167.23 (6.21) | 166.99 (7.45) |
| **Orchestra** | | | | |
| N | 37 | 35 | 25 | 97 |
| Mean (SD) | 166.16 (9.50) | 167.14 (7.50) | 163.28(11.25) | 165.77 (9.36) |
| **Choir** | | | | |
| N | 44 | 27 | 27 | 98 |
| Mean (SD) | 164.98 (8.35) | 164.22 (8.15) | 165.00 (7.99) | 164.78 (8.12) |
| **F-value (p-value) (alpha = 0.05)** | 0.42 (0.6597) | 1.47 (0.2332) | 2.46 (0.0903) | 2.48 (0.0848) |

***The Seventh Grade at The School Year 2017***

Data analysis from Attendance Days among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 0.42, p= 0.6597) (Table 28). The effective sample size (n), standard deviation, standard error for Band was n=56, mean=166.54, SD=8.30 and SE=1.11, respectively; for Orchestra n=37, mean=166.16, SD=9.50 and SE=1.56, respectively; for Choir, n=44, mean=164.98, SD=8.35 and SE=1.26, respectively. The mean Attendance Days from high to low were Band, Orchestra, and Choir.

***The Seventh Grade at The School Year 2018***

Data analysis from Attendance Days among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.47, p= 0.2332) (Table 28).

The effective sample size (n), standard deviation, standard error for Orchestra was n=35, mean=167.14, SD=7.50 and SE=1.27, respectively; for Band, n=65, mean=167.12, SD=7.89 and SE=0.99, respectively; for Choir, n=27, mean=164.22, SD=8.15 and SE=1.57, respectively. The mean Attendance Days from high to low were Orchestra, Band, and Choir.

***The Seventh Grade at The School Year 2020***

Data analysis from Attendance Days among music class data analysis results indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 2.46, p= 0.0903) (Table 28).

The effective sample size (n), standard deviation, standard error for Band was n=65, mean=167.23, SD=6.21 and SE=0.77, respectively; for Choir, n=27, mean=165.00,

SD=7.99 and SE=1.54, respectively; for Orchestra, n=25, mean=163.28, SD=11.25 and SE=2.25, respectively. The mean Attendance Days from high to low were Band, Choir, and Orchestra.

In the summary, for seventh grade, either compiled all three school years or each school year, there was no significant mean Attendance Days difference among all three music class types.

***The Compiled Eighth Grade at All Three-School Years***

Data analysis from Attendance Days among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 0.11, p= 0.8950) (Table 29). The effective sample size (n), standard deviation, standard error for Orchestra was n=94, mean=166.57, SD=7.61 and SE=0.78, respectively; for Band, n=136, mean=166.17, SD=9.27 and SE=0.79; for Choir, n=101, mean=166.00, SD=8.93 and SE=0.89, respectively. The mean Attendance Days from high to low were Orchestra, Band, and Choir.

***The Eighth Grade at The School Year 2017***

Data analysis from Attendance Days among music class data analysis result indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 0.89, p= 0.4149) (Table 29). The effective sample size (n), standard deviation, standard error for Band was n=33, mean=168.70, SD=6.17 and SE=1.07; for Orchestra, n=30, mean=167.50, SD=7.71 and SE=1.41, respectively; for Choir, n=34, mean=166.00, SD=10.35 and SE=1.78, respectively. The mean Attendance Days from high to low were Band, Orchestra, and Choir.

Table 29

*The Eighth Grade Attendance Days ANVOA Analysis Among Music Students*

| **Music Class** | **School Year** | | | |
|---|---|---|---|---|
| | **2017** | **2018** | **2020** | **Compiled** |
| **Band** | | | | |
| N | 33 | 56 | 47 | 136 |
| Mean (SD) | 168.70 (6.17) | 165.80 (8.36) | 164.85 (1.63) | 166.17 (9.27) |
| **Orchestra** | | | | |
| N | 30 | 35 | 29 | 94 |
| Mean (SD) | 167.50 (7.71) | 165.40 (5.81) | 167.03 (9.32) | 166.57 (7.61) |
| **Choir** | | | | |
| N | 34 | 32 | 35 | 101 |
| Mean (SD) | 166.00 (10.35) | 168.13 (4.463) | 164.06 (10.21) | 166.00 (8.93) |
| **F-value (p-value) (alpha = 0.05)** | 0.89 (0.4149) | 1.59 (0.2082) | 0.66 (0.5193) | 0.11 (0.8950) |

***The Eighth Grade at The School Year 2018***

Data analysis from Attendance Days among music class data analysis result indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 1.59, p= 0.2082) (Table 29).

The effective sample size (n), standard deviation, standard error for Choir was n=32, mean=168.13, SD=4.463 and SE=0.79, respectively; for Band, n=56, mean=165.80, SD=8.36 and SE=1.12, respectively; for Orchestra, n=35, mean=165.40, SD=5.81 and SE=0.98, respectively. The mean Attendance Days from high to low were Choir, Band, and Orchestra.

***The Eighth Grade at The School Year 2020***

Data analysis from Attendance Days data among music classes indicated there was no significant mean difference among all three class types at alpha =0.05 (df=2, *F*-value = 0.66, p= 0.5193) (Table 29).

The effective sample size (n), standard deviation, standard error for Orchestra was n=29, mean=167.03, SD=9.32 and SE=1.73, respectively; for Band, n=47, mean=164.85, SD=1.63 and SE=1.70, respectively; for Choir, n=35, mean=164.06, SD=10.21 and SE= 1.73, respectively. The mean Attendance Days from high to low were Orchestra, Band, and Choir.

In the summary, for eighth grade, either compiled all three school years or each school year, there was no significant mean Attendance Days difference among all three music class types.

**MAP Test Performance Level Chi-square ($\chi 2$) Results Between Music and Non-Music Groups**

MO MAP system based on the student's test score, academic achievement can be classified into four performance levels map ELA and MATH: (1) below basic, (2) basic, (3) proficient, and (4) advanced. To further explore whether there is association between performance level with music attended or not, using the Chi-square ($\chi 2$) examined performance level whether dependent on music attended or not.

ELA performance level analyses and estimate: For all students in three school years and all grades, compared to music and non-music attended, MAP assessment for ELA revealing that most of the students in music fell into Advanced level among three school years, average 23.82% (in 2548 students), while the most of students in non-music fell into the Basic level, the average was 19.31% (in 2548 students). For music class attended students, the second high fell in the Proficient level (11.5%), and then Basic (10.16%), Below Basic (1.33%); while non-music class attended students, the 2nd high was Advanced level (15.42%), then Proficient (12.40%) and Below Basic (6.04%).

Chi-square ($\chi 2$) is used to test dependency between ELA performance level (high and low) and music attended or not. It also estimated the relative risks and computes confidence limits for the odds ratio. Chi-square ($\chi 2$) shows there was a strong statistical relationship between ELA performance level and whether students attended music class ($\chi 2$ (1) = 145.67, $p<0.0001$) (Table 30). High performance was more likely to be associated with music attended. The odd ratio estimate indicated that the odd of high performance was 2.80 times higher in the music group with 95% CI from 2.36 to 3.32. The narrow confidence limits indicated that this estimate has high precision.

Table 30

*Chi-square (χ2) and Odd Ratio (OR) for ELA Performance (High and Low)*

| Grade | | School Yea | | | |
|---|---|---|---|---|---|
| | | **2017** | **2018** | **2020** | **Compiled** |
| **6th** | χ2 (p value) | 30.5194 (<.0001) | 10.3279 (0.0013) | 2.8897 (0.0891) * | 33.6591 (<.0001) |
| | OR | 4.7606 | 2.5385 | 1.5333 | 2.4097 |
| | (95% CI) | (2.6710, 8.4852) | (1.4243, 4.5241) | (0.9366, 2.5102) | (1.7843, 3.2545) |
| **7th** | χ2 (p value) | 18.7324 (<.0001) | 28.7614 (<.0001) | 9.9658 (0.0016) | 57.3633 (<.0001) |
| | OR | 3.1899 | 3.962 | 2.1842 | 3.0556 |
| | (95% CI) | (1.8661, 5.4528) | (2.3657, 6.6353) | (1.3398, 3.5610) | (2.2780, 4.0985) |
| **8th** | χ2 (p value) | 17.7418 (<.0001) | 13.1439 (0.0003) | 9.9776 (0.0016) | 40.5185 (<.0001) |
| | OR | 3.0724 | 2.4857 | 2.2801 | 2.5861 |
| | (95% CI) | (1.8052, 5.2289) | (1.5113, 4.0884) | (1.3599, 3.8230) | (1.9229, 3.4780) |
| **All Grades** | χ2 (p value) | 74.8461 (<.0001) | 60.4364 (<.0001) | 19.6294 (<.0001) | 145.67 (<.0001) |
| | OR | 3.8262 | 3.1907 | 1.8798 | 2.7987 |
| | (95% CI) | (2.7999, 5.2286) | (2.3677, 4.2999) | (1.4200, 2.4885) | (2.3623, 3.3158) |

*Note:* grade at this year is not significant.

*MATH performance level analyses and estimate:* The result also indicated MAP math assessment also had similar findings as ELA performance between music and non-music class attended. From MAP math assessment, the highest percentage (19.61% in 2547 students) in music class was Advanced level, but non-music was fell in Basic level (15.98% in 2547 students). For music class attended students, the 2nd high fell in the Proficient level (13.35%), and then Basic (11.23%), Below Basic (2.51%); while non-music class attended students, the 2nd high was Proficient level (13.23%), then Advanced (12.41%) and Below Basic (11.66%). (See Appendix Table A.2).

Chi-square (χ2) shows there was a strong statistical relationship between Math performance level and whether or not students attended music class ($\chi 2\ (1) = 140.35$, $p<0.0001$) (Table 31). High performance was more likely to be associated with music attended. The odd ratio estimate indicated that the odd of high performance was 2.67

times higher in the music group with a 95% CI from 2.26 to 3.14. The narrow confidence limits indicated that this estimate had high precision.

Table 31

*Chi-square (χ2) and Odd Ratio (OR) Math Performance (High and Low)*

| Grade | | School Year | | | |
|---|---|---|---|---|---|
| | | **2017** | **2018** | **2020** | **Compiled** |
| **Sixth** | χ2 (p value) | 38.5345 (<.0001) | 13.3644 (0.0003) | 5.7756 (0.0162) | 46.3956 (<.0001) |
| | OR (95% CI) | 5.32 (3.0691, 9.2216) | 3.1206 (1.6649, 5.8490) | 1.8261 (1.1163, 2.9872) | 2.7471 (2.0457, 3.6890) |
| **Seventh** | χ2 (p value) | 18.7654 (<.0001) | 27.8128 (<.0001) | 19.8958 (<.0001) | 69.0579 (<.0001) |
| | OR (95% CI) | 4.0096 (2.0794, 7.7313) | 3.8383 (2.3013, 6.4018) | 3.1415 (1.8822, 5.2431) | 3.612 (2.6478, 4.9272) |
| **Eighth** | χ2 | 22.1463 (<.0001) | 3.5813 (0.0584) * | 0.0001(0.9933) * | 13.5286 (0.0002) |
| | OR (95% CI) | 3.5655 (2.0737, 6.1305) | 1.5813 (0.9826, 2.5447) | 1.0022 (0.5961, 1.6851) | 1.6934 (1.2777, 2.2442) |
| **All Grades** | χ2 (p value) | 85.2689 (<.0001) | 51.4069 (<.0001) | 917.8172 (<.0001) | 140.35 (<.0001) |
| | OR (95% CI) | 4.3907 (3.1713, 6.0791) | 2.7876 (2.0985, 3.7031) | 1.8066 (1.3713, 2.3801) | 2.6650 (2.2619, 3.1400) |

*Note:* grade at this year is not significant.

Performance levels were analyzed for each grade at each school year, and compiled school year for ELA and Math performance, Chi-square (χ2) results consistently indicated that there was a strong statistical relationship between performance level and students attending music. The high-performance level was more likely to be associated with music attended.

Overall, the data gathered and collected from three the school year 2017-2018, 2018-2019, 2020-2021 Missouri MAP test ELA and math assessments statistically indicated a clear view of the impact that music education on student academic success. Each school year at each grade all proved that proposed hypothesis and theory, that was, there was statistically significant data from the MO ELA and math assessments to show the positive impact music education can had on both ELA and math achievements over the non-music attended students. The students involved and enrolled in music education

courses greatly improved their ELA and mathematics assessment scores, and performance levels which strongly proved that music education was beneficial for students academically in both ELA and mathematics.

**Attendance Level Chi-square (χ2) Results Between Two Groups**

Chi-square (χ2) to compare the probability of attendance level (good and poor) for music attended or not. The Chi-square (χ2) shows there was no statistical relationship between attendance level and attended music class in most grades, most school years, or compiled. However, some grades, school year, or compiled showed a significant association. For example, the eighth grade in 2017 ($\chi2$ (1) = 15.5759, p<0.0001), and compiled eighth grade in all school year ($\chi2$ (1) = 15.5480, p<0.0001), compiled grades in 2017 ($\chi2$ (1) =85.267 p<.0001) and 2018 ($\chi2$ (1) =15.5759 p<.0001), has significant association (Table 32).

Table 32

*Chi-square (χ2) and Odd Ratio (OR) Attendance Level (Good and Poor)*

| Grade | | School Year | | | |
|---|---|---|---|---|---|
| | | **2017** | **2018** | **2020** | **Compiled** |
| **Sixth** | χ2 (p value) | 0.0666 (0.7964) | 0.0870 (0.7680) | 3.2262 (0.0725) | 12.1436 (0.0005) * |
| | OR | 1.0666 | 2.8248 | 1.5645 | 1.6512 |
| | (95% CI) | (0.6534, 1.7412) | (1.6911, 4.7187) | (0.9598, 2.5503) | (1.2444, 2.1912) |
| **Seventh** | χ2 (p value) | 0.2459 (0.6200) | 0.9575 (0.3278) | 1.8070 (0.1789) | 1.4809 (0.2236) |
| | OR | 0.8814 | 1.2801 | 1.3903 | 1.1908 |
| | (95% CI) | (0.5351, 1.4519) | (0.7810, 2.0982) | (0.8600, 2.2476) | (0.8989, 1.5777) |
| **Eighth** | χ2 (p value) | 15.3885 (<.0001) * | 1.8125 (0.1782) | 2.8383 (0.0920) | 15.5480 (<.0001) * |
| | OR | 3.0722 | 1.397 | 1.5185 | 1.7929 |
| | (95% CI) | (1.7306, 5.4539) | (0.8587, 2.2728) | (0.9337, 2.4698) | (1.3395, 2.3997) |
| **All Grades** | χ2 (p value) | 85.267 (<.0001) * | 15.5759 (<.0001) | 7.1224 (0.0076) * | 26.8520 (<.0001) * |
| | OR | 0.2614 | 1.7708 | 1.4545 | 1.5357 |
| | (95% CI) | (0.1645, 0.3153) | (1.3317, 2.3548) | (1.1043, 1.9158) | (1.3052, 1.8070) |

*Note*: grade at this year is statistical significance.

**Survey Analysis Results**

The survey was sent to eight middle school music teachers, including three choir teachers, three band teachers, and two orchestra teachers. Among these teachers, three choir teachers, one band teacher, and two orchestra teachers responded. The open-ended questions responses (N=6) were analyzed. The goal of creating this survey was to discover the similarity and differences of middle school music educators' perceptions of music education's impact on academic achievement. Content analysis began with the reading of the survey responses. A document was created for initial analysis and note-taking. From reading each response, the researcher marked details, and notated central ideas and comments, then sorted the notes into two categories, similarity, and difference. The research question: “What are middle school music educators' perceptions of music education's impact on academic achievement” could be answered from the result of the survey analysis. All the survey participants agreed that music education has a positive impact on students’ academic achievement. The findings indicated that even basic musical skills can provide students with the principal abilities to learn and to succeed in other core academic areas. The result also suggested that music education can help students develop discipline, teamwork, and social skills that are essential for academic achievement. Music skills such as symbol recall, counting, analysis, music reading, writing, and voice recognition can help students in learning Math, ELA, and Science. And music education can teach students discipline, teamwork, focus, respect, and social skills. Besides these common perspectives, 33% of participants believed that playing an instrument can help brain development and 16.5% of participants believed that more singing could help them live longer.

Table 33
*Survey Result Music Educators' Perceptions of Music Program*

| **Middle school music educators' perceptions of music education's impact on academic achievement** | Number of responses | | | Total Number of responses | |
|---|---|---|---|---|---|
| Theme | Choir | Band | Orchestra | Number | Percent (%) * |
| Music education can improve students' academic performance. | 3 | 1 | 2 | 6 | 100% |
| Music skills such as symbol recall, counting, analysis, music reading, writing, and voice recognition can help students in learning math, ELA, and science. | 3 | 1 | 2 | 6 | 100% |
| Music education can teach students discipline, teamwork, focus, respect, and social skills. | 3 | 1 | 2 | 6 | 100% |
| Music education provides a creative outlet and breaks from core curriculum studies. Music is the reason to come to school | 2 | 1 | 2 | 5 | 83% |
| Music education helps create Self-confidence and improves Self-evaluation, critical thinking skills. | 2 | 1 | 2 | 5 | 83% |
| Music education creates a sense of belonging. | 1 | 1 | 2 | 4 | 66% |
| Music education helps brain development. | 0 | 1 | 1 | 2 | 33% |
| Music is learning perseverance, learning from mistakes, learning collective success, and visible growth. | 1 | 1 | 0 | 2 | 33% |
| Singing more every day can live longer. The physical act of singing helps increase higher rates of dopamine, endorphin, oxytocin, and serotonin release. | 1 | 0 | 0 | 1 | 16.5% |
| Skills students learned in music class are more and more lost in "World of Today." | 0 | 1 | 0 | 1 | 16.5% |

**Summary**

This study primarily focused on students who took music classes (band, choir, and orchestra) and students who did not take music classes. The data of Missouri standard test (MAP) scores were used to determine the differences in academic achievement, and the number of days of the student attending school was used to determine students' attendance rate. A survey was conducted to align with the research question: "What are middle school music educators' perceptions of music education's impact on academic achievement?"

In this study, the research used descriptive and inferential statistical procedures – *t*-test, ANOVA, and Chi-square ($\chi 2$) test to examine data for study purposes. Analysis of Variance (ANOVA), it's also called the F test. It tested the differences that were measured between means of two or more groups. It examines data that was classified on multiple independent variables. The data collected and analyzed from three school years of 2017-2018, 2018-2019, 2020-2021 of Missouri MAP test ELA and math assessments significantly indicated a clear view of the impact that music education had on student academic success. Each school year at each grade together proved that proposed hypothesis and theory, that was, there was statistically significant data from the MO ELA and MATH assessments to show the positive impact music education could have on both ELA and MATH achievements over the non-music students. The students involved and enrolled in music education courses had higher ELA and mathematics assessment scores and performance levels. At the same time, in the continuous analysis of the data of the student's attendance days, the number of days students attend school out of music students was higher than non-music students. Among the music students, the number of

attendance days had no significant difference. Though the results of the students' attendance days were not as significant as the result of students' academic achievement, it still statistically showed that music education also had a positive effect on student attendance days. From the analysis of the survey, the finding indicated that all the survey participants agreed that music education has a positive impact on students' academic achievement. It also suggested that middle school music teachers believed that not only can music education help students improve their academic performances but also provide students with the principal abilities to learn and to succeed in other core academic areas.

# Chapter Five: Conclusions and Implications

According to the National Association for Music Education (2014), music helps students improve their memorization, increase coordination, learn pattern recognition, and stay engaged in school. Studies stated that these nonmusical benefits help students improve their academic performance and be more engaged in schools (Alzhanova-Ericsson et al., 2017). The purpose of this study was to investigate the impact music programs had on students' academic achievement and attendance rate. Further, to discover whether music education has nonmusical benefits that help students perform better in middle school settings. This study primarily focused on students who took music classes (band, choir, and orchestra) and students who did not take music classes. The data of Missouri standard test (MAP) scores were used to determine the differences in academic achievement, and the number of days of the student attending school was used to determine students' attendance rate. Moreover, learning more about music educators' perception of music education's impact on academic achievement could increase the level of our understanding of the research topic. Therefore, a survey was conducted to align with the research question: "What are middle school music educators' perceptions of music education's impact on academic achievement?"

## Findings

As for sixth grade ELA score for each school year and the combined three school years, analyzed data strongly suggested a positive relationship between music students and their ELA assessment scores in the average, which was significantly higher than their peer non-music students in ELA assessment scores. The mean ELA score difference is

26.55, 24.41, 9.39, and 20.55 for the school year 2017, 2018, 2020, and compiled three school years, respectively.

As for seventh grade ELA score for each year and the combined three school years, analyzed data strongly suggested a positive relationship between music students and their ELA assessment scores in the average, which was significantly higher than their peer non-music students in ELA assessment scores. The mean ELA score difference is 18.85, 29.06, 14.23, and 21.56 for school years 2017, 2018, 2020 and compiled three school years, respectively.

As for eighth grade ELA score for each year and the combined three school years, analyzed data strongly suggested a positive relationship between music students and their ELA assessment scores in the average, which was significantly higher than their peer non-music students in ELA assessment scores. The mean ELA score difference is 22.28, 17.07, 24.11, and 21.23 for the school year 2017, 2018, 2020, and compiled three school years, respectively.

***ELA Score Data Analysis Results Among Music Class Type:***

As for sixth grade ELA score among music class types, there is no significant mean difference at alpha=0.05 in each school year. But compiled school year data shows a significant difference between Orchestra and Choir as well as Band and Choir, but no difference between Orchestra and Band. Though there is no significant difference in each school year, Orchestra or Band has the highest mean score, while Choirs has the lowest score.

As for seventh grade ELA scores among music classes, in 2017, Band was significantly higher than Orchestra and Choir but there’s no difference between Orchestra

and Choir. There was no significant difference in 2018, 2020, and compiled school year; but the mean highest score is Band and lowest is Choir while Orchestra is middle over the school year and compiled year.

As for eighth grade ELA scores among music classes, in the school year 2020 and compiled three school year, Orchestra and Band class were significantly higher than Choir but there's no difference between Orchestra and Band. In 2017, the Orchestra class was significantly higher than the Choir but there's no significant difference between the Orchestra and Band class as well as Band and Choir. In 2018, there was no significant difference, and ELA scores from high to low is Band, Choir, and Orchestra.

Overall, most years and grades showed that Orchestra and Band had more positive impacts on ELA score across grades and school years. The students who attended Orchestra and Band classes tend to have higher ELA scores.

MATH Score Data Analysis Results Between Music and Non-Music

Sixth-grade MATH scores for each year and the combined three school years, analyzed data strongly suggested a positive relationship between music students and their MATH assessment scores in the average, which is significantly higher than their peer non-music students in MATH assessment scores. The mean MATH scores difference of music and non-music attended groups was 29.85, 17.47, 12.98, and 20.33 for 2017, 2018, 2020, and compiled three school years, respectively. Seventh-grade MATH scores for each year and the combined three school years, analyzed data strongly suggested a positive relationship between music students and their MATH assessment scores in the average, which is significantly higher than their peer non-music students in MATH assessment scores. The mean MATH scores difference between music and non-music

attended groups was 16.23, 31.20, 20.52 for 2017, 2018, 2020, and compiled three school years, respectively. Eighth-grade MATH scores for each year and the combined three school years, analyzed data strongly suggested a positive relationship between music students and their MATH assessment scores in the average, which means music students' math scores is significantly higher than their peer non-music students in MATH assessment scores. The mean MATH scores difference of music and non-music attended groups was 44.34, 12.66, 11.83, and 20.96 for the school year 2017, 2018, 2020, and compiled three school years, respectively.

**MATH Scores Data Analysis Results Among Music Class Type**

Sixth-grade Math scores among music class types, there was a significant difference in the school year 2017 and 2020, but there's no significant difference in 2018 and compiled school years. In 2017, Orchestra and Band were significantly higher than Choir but there's no significant difference between Orchestra and Band. In 2020, Band was significantly higher than Choir but there's no significant difference between Band and Orchestra as well as between Orchestra and Choir. Seventh-grade Math scores among music class for the school year 2017 and compiled three school year, Band class was significantly higher than Choir but there's no significant difference between Band and Orchestra as well as between Orchestra and Choir. Between 2018 and 2020, there was no significant difference. Eighth-grade Math scores among music class for the school year 2017 and compiled three school years, Orchestra class was significantly higher than Band class and Choir but there's no significant difference between Band and Choir. In the school years 2018 and 2020, there was no significant difference.

Overall, it seems to conclude that Orchestra and Band have more positive impacts on Math scores across grades and school years. The students who attended Orchestra and Band classes tend to have higher math scores.

MAP test performance level Chi-Square test results between music and non-music groups:

Chi-Square test results for both ELA and MATH show that there was a statistically significant difference between the high-performance level (Proficient + Advanced) in music attended and the low performance (Basic + Below Basic) in the non-music attended. The significant level is 0.05 with $p$-value<0.0001. From the findings of data analysis for the MAP scores on ELA and Math across grades and three school years between music and non-music students, the first null hypothesis of students who take music classes do not perform higher academically than those who do not take music classes was rejected. From the findings of data analysis for the MAP scores on ELA and Math across grades and three school years among the Choir, Band, and Orchestra students, the third null hypothesis of students who take band and orchestra classes do not perform higher academically than those who take choir classes was rejected.

**Attendance Day Data Analysis Results Between Music and Non-Music**

Sixth-grade Attendance Days except the school year 2017, the analyzed data of other school years and combined school years strongly suggested a positive relationship between music students and their Attendance Days in the average, which is significantly higher than their peer non-music students in Attendance Days. Seventh-grade Attendance Days, the analyzed data showed there is no significant difference between the school year 2017, and 2018; the analyzed data of 2020 and combined school years strongly suggested

a positive relationship between music students and their Attendance Days in the average, which is significantly higher than their peer non-music students in Attendance Days. Eighth-grade Attendance Days, the analyzed data of each school year and combined school years suggested a positive relationship between music students and their Attendance Days in the average, which is significantly higher than their peer non-music students in Attendance Days.

Apart from sixth grade in 2017, seventh grade in 2017 and 2018, all other years' data analyses exhibited significant mean Attendance Days difference between music students and non-music students. Music students had significantly higher attendance rate than non-music students. In line with the findings of data analysis for the attendance days across sixth,' seventh,' and eighth grades over three school years between music and non-music students, the second null hypothesis of students who take music classes do not have a higher attendance rate than those who do not take music classes was rejected.

**Attendance Days Analysis Results Among Music Class Type**

Remarkably for sixth, seventh, and eighth grade, analyzed data for either combined three school years or each school year showed no significant mean Attendance Days difference among all three music class types. According to the findings of data analysis for the attendance days across three grades and three school years among the Choir, Band, and Orchestra students, the fourth null hypothesis of students who take band and orchestra classes do not have a higher attendance rate than those who take choir classes was accepted. There is no significant difference in attendance days among the Choir, Band, and Orchestra students.

**Survey Analysis Result**

Aligning with the research question, what are middle school music educators' perceptions of music education's impact on academic achievement? Six survey questions were sent to eight middle school music teachers. Six respondents were collected. One choir teacher responded to the first three survey questions, while the other five music teachers responded to all questions. From summarizing all respondents, these music teachers have ten major themes:

1. Music education can improve students' academic performance.
2. Music skills such as symbol recall, counting, analysis, music reading, writing, and voice recognition can help students in learning Math, ELA, and Science.
3. Music education can teach students discipline, teamwork, focus, respect, and social skills.
4. Music education provides a creative outlet and breaks from core curriculum studies. Music is the reason to come to school.
5. Music education helps create Self-confidence and improves Self-evaluation, critical thinking skills.
6. Music education creates a sense of belonging.
7. Music education helps brain development.
8. Music is learning perseverance, learning from mistakes, learning collective success, and showing visible growth.
9. Singing more every day can live longer. The physical act of singing helps increase higher rates of dopamine, endorphin, oxytocin, and serotonin release.

10. Skills students learned in music class are more and more lost in the “World of Today.”

Among these opinions, all participants mentioned that music education can improve students’ academic performance. Music skills such as symbol recall, counting, analysis, music reading, writing, and voice recognition can help students in learning Math, ELA, and Science. And music education can teach students discipline, teamwork, focus, respect, and social skills. Besides these common perspectives, two orchestra teachers believed that playing an instrument can help brain development and a choir teacher believed that more singing could help people live longer.

**Discussion**

The data collected and analyzed from three school years of 2017-2018, 2018-2019, 2020-2021 of Missouri MAP test ELA and math assessments significantly indicated a clear view of the impact that music education had on student academic success. Each school year at each grade together proved that proposed hypothesis and theory, that is, there is statistically significant data from the MO ELA and math assessments to show the positive impact music education can have on both ELA and math achievements over the non-music attended students. The students involved and enrolled in music education courses greatly improved their ELA and mathematics assessment scores and performance levels which strongly proves that music education is beneficial for students academically in both ELA and mathematics.

At the same time, in the continuous analysis of the data of the student's attendance days, the number of days students attended school out of music students was higher than non-music students. Among the music students, the number of attendance days had no

significant difference. Though the results of the students' attendance days were not as significant as the result of students' academic achievement, it still statistically shows that music education also had a positive effect on student attendance days.

The research question was what are middle school music educators' perceptions of music education's impact on academic achievement? It was addressed by sorting out and analyzing the survey results. It is found that all respondents believe that music education can improve students' academic achievement, and at a certain level, music education provides students with opportunities and competencies not available in other subjects. Many music teachers interviewed believe that music education can not only cultivate students' creativity and self-discipline but also improve students' teamwork and social skills. Some music teachers also mentioned that they were told by students that music was the reason why they stayed in school and didn't drop out. This also reflects that music education has a positive effect on improving the school attendance of students.

Conversely, it might be argued that students who choose to study music have better personal qualities, more personal discipline, and more rigor of family education, so they perform better in school in terms of academic achievement and attendance. Such a possibility also exists, but why do such a high proportion of students with good quality choose to study music? This topic deserves further discussion and study. Research shows that students with good quality are more attentive and self-disciplined, they have higher expectations for themselves and are good at cooperating with others (Foley, 2017). Based on the previous literature review, it is precisely these abilities that music learning can provide. Therefore, the positive effect of music education in improving people's ability

and quality further shows that music education can help improve students' performance in schools, such as academic performance and attendance days.

**Implications for Practice**

In general, music is often viewed as a lesser valued subject compared to other core subjects. In recent years, students' standard test scores have become more and more important for school districts, because it is one of the major measurements for students' learning (Alzhanova et al., 2017; Bergee & Weingarten, 2021). Music as a non-tested subject and its natural function has often been viewed as entertainment or a class for relaxing. When society has this perspective over music education, resources for music education including recruiting of trained music educators and musical instruments are often eliminated or not available in public schools. People may think music education can only provide entertainment benefits, students may take music courses only learning how to play an instrument, sing songs. Through the analysis of the data, the results of this research provided strong evidence that music education has a positive impact on students' academic achievement, and it also encourages students to stay in school. A study published in the *Journal of Education Psychology* suggested that high-quality instrumental music learning in a band or orchestra and singing in a choir may improve all-around academic achievement and help students holistically perform better in school. The study also pointed out that multi-year engagement in music may have more benefit on academic achievement (Guhn et al., 2020).

The researcher hopes that the finding of this research is to bring attention to students, parents, teachers, and administrative decision-makers in education, that the music students have better grades in ELA and Math and better attendance rates than non-

music students. The researcher also hopes that this study could encourage school and district administrations to continue supporting the performing arts and related activities and improving the image of music education programs. By doing so, more students could see music education as a vital part of their education in conjunction with academic courses, therefore more students will be encouraged to enroll in the music programs at school and become involved in more music and other school activities.

The researcher also has some suggestions about how we can support school music programs in various ways. First, ensure that music lessons are offered in public schools, and there are enough instruments for students to play. These are the basics to ensure that students have access to music education. To meet the basic needs, schools need to make certain that professional music teachers are hired and able to teach on a long-term basis. Secondly, the school can actively promote and encourage students to enroll in music programs as well as before and after school musical activities by inviting other students and parents to school concerts. Furthermore, bringing school music ensembles (choir, band, and orchestra) to the community if possible, such as performing in nursing homes, kindergartens, commercial areas, and other places. Consequently, the community can learn more about school music education, and a partnership could be established.

**Recommendations for Future Research**

As the result shown in this study, students who enrolled in some type of music courses perform better academically and have better attendance. Students' academic achievement was measured by Missouri Assessment Program scores in English Language Art and Math, and attendance was measured by the number of days students attended school.

As officials consider canceling or reducing public school music programs in their districts, the researcher suggests that the results of this study, and related future research, can help determine whether these decisions are beneficial to all students and schools. The researcher also recommends that music educators and general classroom teachers can speak with validation and confidence about the findings of this research and the impact music education can have on students. All too often, educators lack statistics to back them up. Therefore, this study provides supporting data for educators to express their opinions with evidence.

After data analysis, the sixth-grade scores assessment on both ELA and MATH showed the mean scores difference decreased over school years, the highest difference is in 2017, then 2018, and 2020. The mean ELA scores difference is 26.55 in 2017, 24.4 in 2018, 19.39 in 2020. At the same time, mean Math scores difference is 29.85 in 2017, 17.47 in 2018, 12.98 in 2020. Therefore, more qualitative research is needed to help determine whether this phenomenon is an anomaly or a common occurrence, and to further analyze possible reasons.

Although music students significantly outperformed non-music students in terms of academic achievement, the analysis of different music classes showed that there were also differences between different music class types with the band and orchestra students being higher the magnitude of the output is significantly larger than that of the choir students. This finding can be used as a topic for further research in two aspects. First, the study can analyze the duration of time spent on music learning to see if the students who study instrumental music stay in the music program for a longer period than the students in the choir class. Second, for the perspective of the characteristics of the discipline,

future research should study the specific differences between singing and instrumental music in the cultivation of human ability.

In addition, the researcher also recommended expanding the study to include the entire pre-K through 12th grade as well as higher education. With larger data, the result will show a clear picture of how music education impacts the growth of an individual's academic performance and lifelong learning experiences. Correlations and other findings between music education and individual disciplines and students' performance in school have important implications for longitudinal studies, across multiple academic fields (Ryzin, 2018).

In the literature review, Culp and Clauhs (2020) mentioned that the factors affecting student attendance are not only the students themselves but may also include the teacher's teaching style and students learning style. The researcher suggests various qualitative research on the impact of teachers' teaching styles on student learning among both music students and non-music students. This type of research could investigate whether a teaching style can impact students' academic achievement and attendance rate. It could help teachers to increase their awareness of the importance of teaching styles and to improve their teaching performance in the classroom.

In addition, it would be constructive to survey parents and students for their opinions and suggestions on music education, such as what factors can help create an excellent music program that leads to academic success. A specific topic could be explored to discover the impact music education had on students' behavior. When and where are students negatively impacted in their daily lives? What factors at home and school could influence students' academic achievement, their attitudes toward school, and

attendance? Although this study used gender, ethnicity, and free and reduced lunch variables in the analysis, music students performed better than non-music students in terms of academic achievement and attendance. But the findings were not enough to demonstrate what music education could do to make a difference academically in a public-school setting. Again, as this study was not designed to and did not establish cause and effect, further research is needed to uncover more factors and variables that affect the relationship between music education and student performance. A meaningful topic to study in the future could be the impact of different teaching styles and learning styles and their relevance to the increased academic achievement and decreased absenteeism. Another consideration could be the impact individual teachers may have to increase success for both music and non-music students. Moreover, it would be constructive to investigate how parent and student beliefs about music education may impact student academic success. Finally, if the study is replicated, the data volume could be increased to study student attendance. This study used data from one middle school, three grades, and three years.

A future study could expand to five or ten years for the entire school district. The data can then be used to determine whether music students have higher attendance rates than their non-music peers. In addition, there is no difference in the data analysis results before the pandemic and after the pandemic from the study, and it could be more significant if future research can study whether there is a difference with the same group of students learning music before and after the pandemic. Furthermore, differences in future career choices for music and non-music students may be of interest to future researchers.

## Summary

This study was designed to investigate the impact of music participation on academic achievement and attendance rate. It examines the impact of participation in music on standard test performance (Math and ELA) and the number of absences in grades six through eight. This is a mixed-method study. The data for the quantitative study were collected from the research school district, and a survey was conducted to collect middle school music teachers' perceptions of music education's impact on academic achievement. The population of this study was about 900, it includes the sixth, seventh, and eighth-grade students in 2017-2018, 2018-2019, 2020-2021 school years, and six middle school music teachers. These student populations were divided into two groups, students who took music classes (Band, orchestra, and choir) and students who did not. Six survey questions were sent to eight middle school music teachers, and six responses were collected from three choir teachers, one band teacher, and two orchestra teachers. This study ran a *t*-test, ANOVA, and Chi-squared test to analyze collected data as standardized examination results (Math and ELA) to measure students' academic achievement, and the number of days students attended school to measure students' attendance rate. The survey for music teachers was to collect their perspectives of music education's overall academic achievement to answer the research questions.

Through the data analysis, the research found that there was a significant difference between music and non-music students on both ELA, Math, and days of attendance. Music students have higher MAP scores on ELA and Math and more days of attendance than non-music students. Among the music students, students who take band and orchestra classes have higher MAP scores on ELA and Math than those who take

choir classes, and no difference in attendance between the band, orchestra, and choir classes. Four null hypotheses were rejected. The major perceptions from survey participation were that music education helps student achieve academic success, and it unifies all core curricula as music is Math, Science, Social Studies, and Language.

As the key to the stage, music courses can bring educational value that cannot be replaced by other programs. Like many music teachers expressed in the survey, music education has an impact that reaches further than grades. Music is a unique discipline that improves so many other aspects of students' lives. Music is not just the "notes" or "scales" or "tone production" that improves students. Music is about learning perseverance; they learn by having to repeat something over and over and then over again to get it right. Music is the teamwork they develop as they realize their success relies on others. Music is the discipline they achieve by learning how to fail and continue to try. Music is the collective success they earn by creating music side by side with their peers. Music is the visible growth they see when they go back and play from their beginning books and realize how far they've come. Music is the teaching that is done every day by students as they listen for mistakes, and they help each other improve. Music is coming together to do something completely different than what students experience every day. Music is the respect they develop as they work toward a common goal. In the article "*Music and the meeting of human minds*," Harvey (2018) pointed out that music is considered the fundamental component of human culture and behavior. As education policies changes throughout the times, the researcher hopes that the importance of music education in developing well-rounded people is well known by the public and that

education policymakers take these benefits of music education into account when making decisions about music.

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## Appendix A

Survey Questions

1. What subject do you teach? (Choir, band, orchestra)
2. In your opinion, how does music education impact overall academic achievement?
3. What teaching methods have you used that impacted ELA and Math or classes in general?
4. How do you feel learning music has impacted ELA and Math or classes in general?
5. Do you feel any benefits of learning music? If you do, what are they?
6. Do you think the music skills apply to other classes? Please explain your answer.

# Vita

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## Education

- Master of Music (MM) in Music Education, Webster University, St. Louis, Missouri, May 2008
- Bachelor of Art in Music, Capital Normal University, Beijing, China, Oct 2001

## Certification

- Teaching Certificate: State of Missouri, Choral Music K-12, March 2008
- Orff Certification Level II (2017)
- World Music Drumming Level I (2009)
- Orff Certification Level I (2008)
- Teaching Certificate, Beijing, China (NO. 9901)
- Kodaly Certification Level III (2007)
- Kodaly Certification Level II (2006)
- Kodaly Certification Level I (2005)

## Experience

**Music Educator, General Music Teacher**

*Dubray Middle School, Fort Zumwalt School district, St. Peters, MO, Aug 2008 to present*

**Apprentice Teacher,** 2007

*Reed school, Ladue school district, St. Louis, MO**,** Oct-Dec 2007*

*Clayton High School, St. Louis, MO**,** Aug - Oct 2007*

**Music Educator, General Music Teacher, School Choir Director**

*Dongrongxian Elementary School, Beijing, China, 1996-2001*

## Professional Affiliation

- Member, the National Association for Music Education (NAfME)
- Member, Organization of American Kodaly Educators (OAKE)
- Member, St. Louis area Kodaly Educators (SLAKE)
- Served as assistant to the director of the Honor Choir for the Midwest Kodaly Music Educators Association (MKMEA) conference, St. Louis, MO, Oct 5-7, 2007

## Professional Achievements

### Workshop Clinician

"*American Music classroom*" workshop, Changsha, Hunan, China. 2016, 2019

"*Elementary and Secondary School Music Education*" workshop, HongHu, Hubei, China. 2018

"*American Music Classroom*" workshop, Xiamen, Fujian, China. 2016

"*American Music Education and Classroom Experiences*" workshop, Huangpu School District, Guangzhou, China. 2016

*"My Music Teaching Experiences in the US*," presentation, Guangzhou Vocational and Technical University of Science and Technology, Guangzhou, China 2016

"*International Music Education*" workshop, Beijing, China. 2015

## Publications

J. Wang. (2012). My experience of American music teacher education, *China Music Education Journal, 212*(2), 36

J. Wang. (2012). American music teacher certificate， China Music Education Journal, *219*(9), 41

J. Wang. (2012). My experience with graduate study in American music education， *China Music Education Journal, 221*(11), 25

J. Wang. (2012). About American music textbook and lesson materials (I), *China Music Education Journal, 224*(2), 4

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J. Wang. (2013). American music education-professional development, *China Music Education Journal, 235*(1), 37

J. Wang. (2012). Missouri music education conference, *China Music Education Journal, 238*(4), 46