

Intersections of Music and Health: Analyzing Music's Effects On Overall Well-Being And Its  
Distribution In Seattle Public Schools

Nicole Kuo Stankovic

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Committee:

Clarence Spigner

Paul Fishman

Anne Searcy

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Department of Health Systems and Population Health

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Nicole Kuo Stankovic

University of Washington

Abstract

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Chair of the Supervisory Committee:

Clarence Spigner

Department of Health Systems and Population Health

**Purpose:**

This study investigates the relationship between school demographics, financial resources, and the availability of music education in Seattle Public Schools. It aims to determine how these factors influence the accessibility of music programs across diverse student populations, focusing on identifying and addressing disparities that may affect equitable educational outcomes. The study also explores existing research on music education's effects on physical, social, and mental health to contextualize the importance of equitable access in fostering comprehensive student well-being.

**Background:**

Seattle, the fourth wealthiest city in the U.S., provides a useful context for examining how wealth and demographics intersect with educational opportunities, particularly in music education. This setting enables a study of whether the presence of music education in schools is influenced more by economic affluence or educational choices. The city's significant variations in racial and socioeconomic backgrounds across schools, coupled with existing music education initiatives like The Creative Advantage, further enhance its suitability as a model to explore these dynamics.

**Methods:**

Data from the 2019-2020 academic year were analyzed, including music class offerings, financial and staffing details from public school data, and student demographics from the Washington Office of Superintendent of Public Instruction. The study included all 114 general education schools, which were divided into elementary, middle, and high schools, categorized based on the availability of specific music classes. Descriptive statistics provided an overview of demographic and staffing characteristics, while hypothesis testing explored differences between schools with and without music programs. Statistical analyses included the Shapiro-Wilk test, Welch's T-test, Mann-Whitney U test, and Pearson correlation.

**Results:**

All 74 Seattle elementary schools offer an instrumental music program through a lottery system, yet about a quarter lack foundational music classes available to all students. Schools typically prioritize instrumental music such as band and orchestra over vocal music at all educational levels. However, even these instrumental programs tend to disappear at the high school level. Schools with higher populations of low-income and minority students often prioritize music education, yet they do not always receive proportionally more educational resources overall in terms of staff and funding despite communicated goals of equity. Limitations of the study include a lack of detailed data on the quality of music programs and the need for more granular socioeconomic categorization of students who are participating, pointing to areas for further research.

**Conclusion:**

The study reveals significant associations between school demographics, financial resources, and the availability of music education within Seattle Public Schools. It highlights the complex interplay between targeted funding and robust music programs, which do not consistently ensure accessible and comprehensive education for all students. This highlights the urgency for the state to develop a more robust and consistent funding mechanism for music education. It is crucial that schools begin to prioritize music education to bridge the existing gaps in access and address disparities, thus ensuring equitable educational opportunities and improved health outcomes for every student.

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# Introduction

## Research Questions

Considering the well-documented benefits (Budson 2020) of music for physical, mental, and social well-being, how does the availability of in-school music classes in Seattle Public Schools correlate with the distribution of finances, staff, and the socioeconomic and racial demographics of the students these schools serve? Additionally, how do these factors—finances, staff distribution, and student demographics—correlate with each other?

## Significance

Socioeconomic factors such as school district funding and parental financial resources influence access to music education in the United States, often leading to disparities in musical engagement among children. Students from economically disadvantaged backgrounds are particularly at risk of missing out on the benefits of music education if these programs are not available in their schools. Seattle presents a particularly interesting case due to its status as the fourth wealthiest city in the United States (Parkhurst 2015). To address the potential impact of disparities in access to music education, this study provides insights into whether and how the city's economic status translates into educational advantages, particularly within the realm of music education.

This research can serve as a blueprint for other school districts, using robust data analysis to evaluate and enhance music programs and potentially broaden their influence on children's health and development. Additionally, the initiative known as The Creative Advantage, initiated in 2008 by the City of Seattle's Office of Arts & Culture, Seattle Public Schools, and the Seattle

Foundation, focuses on increasing access to quality arts education in high-need schools as identified by a 2012 arts education assessment (“The Creative Advantage”, n.d.). This study can help evaluate the Creative Advantage initiative and identify schools that still require comprehensive arts education.

Amid increasing health challenges among youth, music interventions offer a promising, non-invasive, and enjoyable approach that is notable for its accessibility, safety, and engagement (Reynolds 2023). By examining the relationship between demographic factors and comparing schools with varying levels of music program availability, this study aims to reveal patterns that could inform more equitable educational policies and practices.

## Literature Review

### Perception and Treatment of Music in the United States

Josie Davis's thesis, titled "The Accessibility of Classical Music Education to Youth in the United States," critically examines the socioeconomic barriers that restrict access to classical music education, particularly for children from lower-income families (Davis 2014). Through the lens of sociological theories by Pierre Bourdieu (Bourdieu 1986) and others, Davis argues that classical music education is predominantly accessible to those from higher socioeconomic statuses, with cultural capital playing a crucial role in this exclusivity.

Davis employs a mix of quantitative and qualitative methods, including a survey component where she gathers data from parents who have enrolled their children in private music lessons at the Bay Chamber Music School in Rockport, Maine. Davis found that while private music lessons provide high-quality education, they reinforce class divisions due to their

high costs and the cultural prestige associated with classical music training. Interviews with music educators supplement these findings, highlighting the challenges and limited access faced by potential students outside the upper class.

Davis contrasts the U.S. experience with that of Panama and India. Relative to the U.S., community-driven support and smaller-scale funding initiatives make music education more accessible to all social classes in Panama and India. The U.S. also relies on private contributions and elite patronage. This disparity limits access for underprivileged communities. Davis found that in Panama, despite facing significant economic challenges, children displayed remarkable musical growth when given access to structured music education. Similarly, in India, music became a tool for social mobility and personal development in underprivileged areas, suggesting the transformative power of accessible music education.

Horsley and Woodford examine the impacts of neoliberalism on music education, emphasizing how this economic and social ideology shaped and continues to influence the availability and nature of music education in neoliberal-influenced nations like the United States and The United Kingdom (Horsley and Woodford 2015). Neoliberalism, defined as a policy model that transfers control of economic factors from the public to the private sector, emphasizes individual responsibility and market-driven competition. It champions the belief that personal welfare should be managed by individuals rather than guaranteed through government interventions, a principle known as negative justice. This philosophy was notably advanced by political figures like Margaret Thatcher, Ronald Reagan in the 1980s, and continued with Bill Clinton in the 1990s, promoting deregulation, privatization, and reduced government scale, foundational elements of neoliberal thought.

These leaders pushed for education systems that mirror market dynamics to enhance competitiveness and efficiency, advocating for standardized curricula and testing that emphasize quantifiable success over comprehensive educational goals like creativity or democratic participation. In both the U.S. and UK, such reforms stressed accountability and aligned closely with economic outcomes, often sidelining subjects like music unless they could be linked directly to economic utility. For instance, the No Child Left Behind policy under the Bush administration in the U.S. emphasized literacy and mathematics, contributing to music education being marginalized unless it served the economic agenda of producing competitive individuals.

Horsley and Woodford critique this approach, arguing that it fundamentally alters the potential of music education to contribute to a well-rounded democratic education by narrowing its scope to fit a framework that prioritizes economic outcomes over cultural, ethical, or social values. They argue that neoliberal education policies often lead to a standardized educational experience that stifles creativity and critical thinking. Furthermore, these policies can undermine the broader goals of education, such as fostering democratic engagement and equity.

## Music and Health

### Definition of Health and Well-Being

The World Health Organization's (WHO) constitution states that health encompasses not only physical well-being but also mental and social well-being (“Constitution of the World Health Organization | WHO | Regional Office for Africa”, n.d.). The document asserts the fundamental right of all individuals, regardless of race, religion, political belief, or socioeconomic status, to the highest achievable standard of health. It underscores the importance of healthy child development and the need for individuals to adapt harmoniously to their

changing environments. Furthermore, it highlights the significance of disseminating knowledge to all populations and emphasizes public involvement and cooperation in improving health outcomes. Lastly, it places the responsibility for public health on governments, stressing the necessity of adequate health and social measures to fulfill this obligation.

### Summary of Literature

Music education's impact on health and well-being has been extensively studied, revealing significant benefits across various health conditions and age groups. In older populations, music has been shown to alleviate symptoms of diseases like Parkinson's and dementia. Studies like those by Sakamoto et al. (2013) have demonstrated that music therapy can significantly reduce stress and improve emotional responses in Alzheimer's patients. Additionally, interactive music interventions have shown promise in enhancing the quality of life for these individuals. Similarly, music has been found to aid in the recovery processes of patients with Parkinson's disease, with studies like Spina et al. (2016) indicating improvements in cognitive functions and emotional well-being. For stroke recovery, music listening has proven beneficial for cognitive and language recovery, as shown in research by Sihvonen et al. (2020), which found that vocal music can enhance verbal memory and language skills more effectively than other auditory stimuli. Furthermore, engaging in music has shown potential in rehabilitating hand function in patients with multiple sclerosis, as per Gatti et al. (2015). These findings underscore the broad relevance of music education and appreciation, suggesting that early exposure could have protective benefits later in life and enhance overall quality of life.

## Mental Health

Mental health encompasses emotional, social, and behavioral well-being, playing a crucial role in how individuals handle stress, recognize their abilities, perform in educational and professional settings, and contribute to their communities. It is closely associated with numerous vital aspects of life, such as physical health, chronic illness, risky behaviors, social connections, and academic and occupational achievements (“Mental health” 2022). Data collected by federal systems from 2013 to 2019 indicate that mental disorders frequently begin in early childhood and impact a wide range of demographics. Notably, during this period, the most prevalent disorders among U.S. children aged 3–17 years were attention-deficit/hyperactivity disorder and anxiety. Additionally, about 21% of adolescents aged 12–17 years reported experiencing a major depressive episode, with a significant number also reporting persistent sadness or suicidal thoughts (Bitsko et al. 2013-2019).

Using 2001-2004 survey data, Merikangas et al. reported one-year prevalence rates of 8.6% for attention-deficit/hyperactivity disorder, 3.7% for mood disorders, 2.1% for conduct disorder, 0.7% for panic disorder or generalized anxiety disorder, and 0.1% for eating disorders, with only about half of those diagnosed seeking treatment from a mental health professional (Merikangas et al. 2010). Costello et al. found that the median prevalence estimate of functionally impairing psychiatric disorders in children and adolescents is 12%, with these disorders ranking high in the World Health Organization's global burden of disease. Houtrow et al. noted a 15.6% increase in childhood disability from 2001-2002 to 2010-2011, with nearly 6 million children considered disabled by the end of this period. The largest increase in disability rates (28.4%) was among children in households earning at least 400% above the federal poverty level (Costello, Egerq, and Angold 2005). The study also observed an 11.8% decrease in

disabilities related to physical health conditions, while those related to neurodevelopmental or mental health conditions increased by 20.9%. Lebrun-Harris et al.'s 2022 study highlighted a significant rise in anxiety and depression among children during the COVID-19 pandemic, with a notable year-over-year increase in behavior or conduct problems (Lebrun-Harris et al. 2022).

These studies emphasize the urgent need for early intervention and highlight the importance of reviewing the effects of music engagement on the most prevalent mental disorders affecting children in the United States.

### Music and ADHD

In a recent study, Zhu et al. demonstrated that combining music interventions with cognitive behavioral interventions significantly improves cognitive abilities in children with Attention Deficit Hyperactivity Disorder (ADHD) (Zhu 2022). With 120 total participants with ADHD, those who received musicotherapy demonstrated significant improvements on the numerical cross-attention test, the Wisconsin card sorting test, the combined Raven's test (CRT), the Wechsler intelligence scale for children test, and Conner's child behavioral scale for parents. In the intervention group, significant improvements were observed compared to the control group not receiving musicotherapy: the number of correctly crossed items and net scores increased, while errors, attention deficit, hyperactivity-impulsiveness, and total ADHD-RS-IV scores decreased dramatically post-intervention. The observation group also showed increases in the conceptual level percentage and completed classes, and sharp reductions in both discontinuous and continuous errors.

Wilde et al. explores the interaction between ADHD and music education through a detailed case study of two boys diagnosed with ADHD, one in primary and the other in

secondary school (Wilde and Welch 2022). The research involved structured observations and video analysis over several school terms, focusing on ADHD symptoms like inattention, hyperactivity, and impulsivity, and their variations during music sessions. Key findings suggest that ADHD symptoms can significantly diminish or even disappear during active musical engagement. The study indicates that ADHD does not hinder the ability to engage in and benefit from music education. Contrary to typical expectations, children and young people with ADHD can acquire musical skills, understand and respond to music, and interact musically with peers. The research highlights that the presence of ADHD symptoms can vary depending on the educational context and pedagogical approaches, suggesting that music education could be both therapeutic and educational.

In a study by Park et al., the efficacy of music therapy as a treatment for depression among children and adolescents with ADHD was tested (Park et al. 2023). The study employed a randomized control trial design to compare outcomes between a group receiving standard care and another group that received both standard care and music therapy. Music therapy involved both active improvisation and passive listening and was administered twice weekly for three months. The results highlighted significant physiological and psychological benefits in the music therapy group. There were marked increases in serotonin levels and reductions in cortisol levels, blood pressure, and heart rate, indicating reduced stress and depression. Furthermore, assessments using the Children's Depression Inventory (CDI) and Daily Hassles Questionnaire (DHQ) scales showed notable improvements in the music therapy group compared to the control group, underscoring the potential of music therapy to significantly enhance emotional well-being and stress management in this demographic.

## Music and Anxiety

The pilot study by Goldbeck and Ellerkamp evaluated the efficacy of Multimodal Music Therapy (MMT), which integrates music therapy and cognitive-behavioral therapy, in treating children with anxiety disorders (Goldbeck and Ellerkamp 2012). The study involved 36 children aged 8–12 years who were randomly assigned to either 15 sessions of MMT or to treatment as usual (TAU). The findings revealed that MMT had higher remission rates (67%) compared to TAU (33%) by the end of the treatment period, and these rates were maintained four months post-treatment. Although both treatments showed similar improvements in dimensional outcome measures, the results suggest that MMT could be a more effective treatment option for anxiety disorders in children. Further research with larger sample sizes and a comparison to standalone cognitive-behavioral therapy (CBT) is recommended to validate these findings.

The study by Kwok et al. evaluated the efficacy of an integrated program combining positive psychology elements with music therapy, targeting anxiety and happiness in adolescents (Kwok 2019). The intervention involved 36 participants and used established scales to assess hope, emotional competence, anxiety symptoms, and subjective happiness. Results indicated significant improvements in hope and emotional competence, with the experimental groups also showing notable reductions in anxiety symptoms and enhanced subjective happiness compared to the control groups. Statistical analysis confirmed that hope played a crucial mediating role in reducing anxiety and enhancing happiness. The intervention's positive impact was evident as it significantly elevated hope and emotional competence levels, decreased anxiety, and increased happiness among the participants.

## Music and Depression

Park et al. conducted a study to explore the impact of arts education on the cognitive functions, behavior, and brain structure of twenty-nine nonclinical children over a 15-week period (Park et al. 2015). Participants were engaged in either creative movement or musical arts programs and underwent assessments using the Wisconsin Card Sorting Test, clinical scales, and brain MRI scans both before and after the intervention. The results indicated significant improvements in executive functions as measured by the Wisconsin Card Sorting Test, reductions in scores on the Children's Depression Inventory, and better conduct disorder scores. Brain scans revealed thicker cortex areas in the left side of the brain and reduced diffusion, which refers to the movement of water molecules in the brain tissue, in specific right brain regions. This indicates changes in brain structure and connectivity. Additionally, positive correlations were found between cognitive improvements and changes in cortical thickness, suggesting that arts education positively affects executive functions through structural changes in the brain.

## Physical Health

Physical wellness involves preventing illness and injuries and effectively managing any long-term health conditions ("Physical Wellness Toolkit", n.d.). Research on music and physical health underscores the value of musical engagement across the human lifespan. This thesis, while focusing on music education in schools, includes a broad spectrum of studies, covering both pediatric and geriatric outcomes. This approach allows us to illustrate the comprehensive benefits of music, not only highlighting its immediate cognitive and emotional development benefits for children but also its potential long-term protective effects against age-related

disorders. Although there is a richer body of literature concerning music's impact on health outcomes in older patients, such as studies on diseases like Parkinson's and dementia, these findings are crucial in understanding the full scope of music's benefits. Moreover, the ability of music to alleviate symptoms of age-related diseases underscores the critical importance of integrating music into one's life from an early age, particularly through public school education. Early and consistent exposure to music in schools can engrain this therapeutic tool in daily life, equipping individuals with lifelong benefits. As access to public music education often diminishes after schooling, establishing a strong foundation during the formative years is essential ("Survival of musical activities. When do young people stop making music?" 2021).

### Music and Dementia

Dementia refers to a broad category of conditions characterized by significant impairments in memory, language, problem-solving, and other cognitive functions that are severe enough to disrupt daily activities. Alzheimer's disease is the most prevalent cause of dementia ("What Is Dementia? Symptoms, Types, and Diagnosis | National Institute on Aging" 2022).

Sakamoto et al.'s study evaluates the effectiveness of music therapy on severe Alzheimer's patients, comparing interactive and passive interventions against a no-music control (Sakamoto, Ando, and Tsutou 2013). Results indicate that music therapy, especially interactive, significantly reduces stress and improves emotional responses, thereby enhancing quality of life and reducing behavioral and psychological symptoms of dementia. These effects are more pronounced with interactive interventions, which engage patients more actively. The study underscores the necessity of continuous music therapy to maintain its benefits, highlighting its potential to alleviate caregiver burden and improve patient care.

Baird and Samson explore the preservation of musical memory in patients with Alzheimer's Disease (AD), differentiating between explicit and implicit musical memory and their susceptibility to AD pathology (Baird and Samson 2009). They review evidence suggesting that while explicit musical memory, particularly the recognition of familiar and unfamiliar melodies, often deteriorates in AD, implicit musical memory—such as the ability to play an instrument—may remain intact, especially in musicians. This dissociation indicates that different types of musical memory may be variably affected by AD, reflecting the specific neural degeneration patterns characteristic of the disease. Their analysis points to the temporal lobes as crucial in explicit musical memory, with potential sparing of brain regions associated with implicit musical memory functions in the earlier stages of AD. This nuanced understanding of musical memory in AD underscores the potential of music-based interventions to enhance quality of life and cognitive function in affected individuals.

### Music and Parkinson's Disease

Parkinson's disease is a degenerative condition impacting the nervous system and the body parts it controls. Symptoms develop gradually, often beginning with a slight tremor in one hand. While tremors are typical, the disease can also lead to stiffness or a reduction in movement speed (“Parkinson's disease - Symptoms and causes” 2024).

Spina et al. conducted a pilot study on 25 individuals with Parkinson's disease, examining the impact of a six-month music therapy program involving music production, singing, and dancing (Spina et al. 2016). The study assessed cognitive functions, motor symptoms, and quality of life at baseline, after the MT program, and six months later. Results indicated significant short-term improvements in frontal cognitive functions and emotional well-being,

suggesting that music engagement can temporarily enhance certain cognitive and emotional aspects for individuals with Parkinson's Disease.

### Music and Stroke Recovery

Sihvonen et al. investigated the rehabilitative effects of daily music listening on stroke recovery, focusing on how different types of auditory stimuli—vocal music, instrumental music, and audiobooks—affect cognitive and language recovery (Sihvonen et al. 2020). Utilizing data from 83 stroke patients, the study compared outcomes from these auditory interventions over the first three post-stroke months. The findings demonstrated that vocal music significantly enhanced verbal memory and language recovery, particularly in patients with aphasia, more effectively than the other tested modalities. Neuroimaging results revealed that vocal music listening led to increases in gray matter volume in the left temporal regions and improved functional connectivity within the default mode network. These results highlight the potential of vocal music as an accessible therapeutic tool that promotes cognitive and linguistic recovery after stroke through both structural and functional brain plasticity.

Särkämö et al. explore how listening to music can help stroke patients recover cognitively and emotionally, highlighting the brain processes involved (Särkämö et al. 2008). The study finds that enjoyable music can briefly improve the ability to notice visual stimuli in patients with attention deficits to visual input by connecting emotional and attention-related brain areas. Regularly listening to music also aids in recovering verbal and auditory memory, attention, and mood, while also causing physical changes in brain structure. These improvements are largely due to how music activates the brain's pleasure centers, enhancing mood and mental function. Music can also decrease stress and depression, which may protect against the negative effects of

high cortisol levels on brain function after a stroke. The study suggests that music's ability to promote brain flexibility and communication makes it a simple, effective way to support stroke recovery.

### Music and Multiple Sclerosis

Multiple sclerosis (MS) is a chronic condition affecting the central nervous system, believed to be an autoimmune disease where the body mistakenly attacks itself. The impact of MS varies widely among individuals; while some experience only mild symptoms, others may face significant challenges such as vision loss, difficulty writing, speaking, or walking due to disrupted communication between the brain and the body (“Multiple Sclerosis | National Institute of Neurological Disorders and Stroke”, n.d.).

Gatti et al. explore the potential of musical keyboard playing as a rehabilitation tool for hand function in patients with multiple sclerosis (MS) (Gatti et al. 2015). The study involved nineteen hospitalized MS patients randomized into two groups: one that played an active musical keyboard and another that used a turned-off keyboard, both engaging in finger movement exercises for thirty minutes daily over fifteen days. The effectiveness of the intervention was assessed primarily through the ABILHAND Questionnaire, which measures perceived hand functional use, and secondarily through tests for hand dexterity and strength. Results indicated a significant improvement in hand function for the group using the active keyboard, as measured by the ABILHAND Questionnaire, suggesting that musical training can facilitate neuroplasticity and enhance hand rehabilitation in MS patients.

## Social Health

Social health is defined as the ability to form and maintain meaningful relationships and adapt to different social situations (Killam 2023). It significantly influences mental and physical health, as well as mortality risk. Research has established a link between social relationships and health outcomes, indicating that the quality and quantity of these relationships can have both immediate and enduring effects on health. Additionally, studies continue to reveal the impact of music on social development, highlighting its role in enhancing social bonds and overall well-being.

## Music and Community Connection

The study by Hallam et al., including insights from the Music for Life Project, assesses the benefits of participating in music activities among older adults at three centers in the U.K. (Hallam and Creech 2016). Although comparisons with non-music groups were limited due to a lack of focus group interviews, the research indicates that music may have stronger effects on social, cognitive, emotional, health, and well-being outcomes than other activities. Participants in the music groups reported high levels of enjoyment and cognitive engagement, attributing these to music's unique ability to evoke well-being and manage emotions through its temporal and physical demands. The study also highlights the participants' enhanced sense of community contribution through public performances, which provided additional motivation. Facilitators emphasized the social benefits, supporting participants' experiences of extensive benefits from active music involvement. These findings suggest that integrating music activities into individuals' lives can promote healthy aging.

Peter Manuel's article explores the significant role of music in activism, detailing its effect on social change from the mid-20th century to the 1980s across various global and American contexts (Manuel 2017). He points to significant examples like Latin America's Nueva Canción, Jamaica's roots reggae, India's progressive cinema songs, Spain's Nueva Canción, and the protest songs of the U.S. civil rights movement and Vietnam War protests. These examples show how music has not only reflected but also fueled social movements. Manuel argues that music serves as a powerful medium for expressing social discontent and rallying people together, thereby enhancing social health by fostering a sense of community and shared purpose. Through its emotionally resonant and accessible form, music mobilizes individuals, enhances awareness of social issues, and strengthens the resilience of communities facing socio-political challenges. These musical movements often advocate for societal improvements and the upliftment of marginalized groups. In this way, music can not only enrich cultural life but also play a crucial role in the ongoing struggle for a more equitable world.

### Music and Academic Performance

Anvari et al. explored the relationship between music perception skills, awareness of sounds in words (phonological awareness), and early reading development in 100 children aged 4 and 5 years (Anvari et al. 2002). Their research shows that music skills contribute uniquely to predicting reading abilities, beyond what is explained by phonological awareness and other cognitive abilities like math and vocabulary. This indicates that music perception taps into auditory mechanisms related to reading that only partially overlap with those for phonological awareness, suggesting the involvement of both linguistic and nonlinguistic auditory processes in

reading development. This research highlights the potential role of music perception in enhancing early literacy.

Janurik et al.'s seven-year longitudinal study investigated the long-term impacts of early musical abilities on academic achievement among 76 Hungarian students (Janurik, Surján, and Józsa 2022). The research found that early musical abilities, particularly rhythm perception and reproduction, played a significant predictive role in later school success, explaining 11% of the variance in Grade 7 GPA. These findings highlight the potential of early musical training, especially in rhythm, to support academic achievement by enhancing various cognitive skills that are also crucial for reading and other academic areas. The study also revealed that early musical abilities are linked to higher academic performance, affirming the overlapping cognitive processes involved in music and academic skills. It suggests that engaging children in music education can be an effective strategy for enhancing cognitive development and academic outcomes.

Johnson and Memmott explored the effect of participation in school music programs of varying quality on standardized test scores among elementary and middle school students across the United States (Johnson and Memmott 2006). The analysis included 4,739 students, with 1,119 from elementary schools and 3,620 from middle schools. Findings indicated that elementary students in exemplary music education programs scored slightly higher on English and mathematics standardized tests compared to peers without such high-quality music instruction. Similarly, middle school students participating in high-quality music or instrumental programs outperformed those in no music or lower-quality choral programs in both subjects, though the improvements were small. The results suggest that quality music education may positively, albeit slightly, influence academic performance in core subjects.

## Educational Access to Music in Seattle Public Schools

An examination of music education within Seattle Public Schools, guided by insights from two Seattle Public School music program officials, reveal a complex interplay of funding, resource allocation, and educational quality that reflects broader trends in urban music education. A full interview transcript can be found in Appendix A. It was noted in a special board meeting music program report that one trend that persists in secondary music programs is the disproportionality of Black students under-represented (see Appendix B).

### Funding and Allocation of Resources

Seattle Public Schools uses a weighted staffing model significantly influenced by site-based management. This model grants schools the autonomy to decide how additional FTE is allocated based on their specific needs and priorities. The flexibility in FTE allocation allows schools to adapt to fluctuating student enrollments and other academic or extracurricular demands, often choosing how to distribute resources among music, physical education, visual arts, or other programs. As a result, the presence and quality of music education can vary significantly across the district, with some schools potentially placing less emphasis on music (see Appendix B).

### Legislative Impact and Policy Adaptation

Legislation such as Senate Bill 5878 (“2022 Senate Bill 5878: Clarifying visual and performing arts instruction”, n.d.), now codified as RCW 28A.230.020, mandates that each student in K-5 or K-8 receive at least one term of instruction in music, visual, or performing arts annually. Although this law aims to standardize arts education, the lack of specified funding and

detailed implementation guidance allows significant latitude in how districts fulfill these requirements. This legislative environment challenges districts to balance mandated educational goals with the realities of variable funding and resource availability.

### The Creative Advantage Initiative

The Creative Advantage Initiative is an arts equity and expansion program aimed at increasing access to arts education in Seattle Public Schools (“The Creative Advantage”, n.d.). Seattle Public School music officials noted a substantial increase in the number of schools offering both music and visual arts programs, highlighting a more than doubling of schools with such programs compared to before the initiative began. They noted a reliance on donors and arts organizations stepping forward to provide essential resources like instruments and materials (see Appendix B).

### Challenges and Inequities

The variability in music education quality across Seattle Public Schools is exacerbated by economic constraints and uneven distribution of resources, influenced by the district's unique staffing model and broader economic conditions. This results in disparities in program quality and availability, with some schools able to offer richer, more diverse music education experiences than others. These disparities are often compounded by budget cuts and shifting priorities, which can suddenly alter the scope of music education from one academic year to the next.

According to the March 2024 update from Seattle Public Schools, principals are actively involved in developing budgets for the upcoming school year. Despite the primary goal of

ensuring excellent education, the district faces significant financial challenges, including a \$104 million budget shortfall. This deficit is attributed to a broader educational funding gap in Washington state, coupled with the expiration of previously available funds at SPS and reduced student enrollment in public schools (“Seattle Public Schools Budget: Supporting Students Together” 2024).

As per the U.S. Census and reported by the Seattle Times, Seattle exhibits a notably high rate of private school enrollment, with approximately 22% of K-12 students attending private institutions, a rate that is more than double the national average of about 10% (Balk 2020). This high percentage ranks Seattle third among major U.S. cities for private school attendance, surpassed only by San Francisco and Milwaukee, the latter of which supports a substantial voucher program.

Balk further states that this disparity in private school enrollment is particularly pronounced in racially diverse areas like South Seattle, which have experienced gentrification and demographic shifts not fully reflected in public school demographics. For example, Rainier Beach High School's enrollment is only 3% white, despite the area's increasing white population, indicating a preference among white residents for private or selective public schools. This trend raises questions about the socioeconomic and racial segregation facilitated by private schooling, suggesting that wealthy parents opting for private education might be inadvertently perpetuating a system of inequality that disadvantages public schools by diverting critical resources and support. Moreover, Seattle's high private school enrollment is not driven by lower tuition costs; in fact, the city's private school tuition rates are significantly above the national average, further indicating that these schools are predominantly accessible to families with higher incomes. This economic barrier contributes to lower enrollment rates for lower and middle-class children in

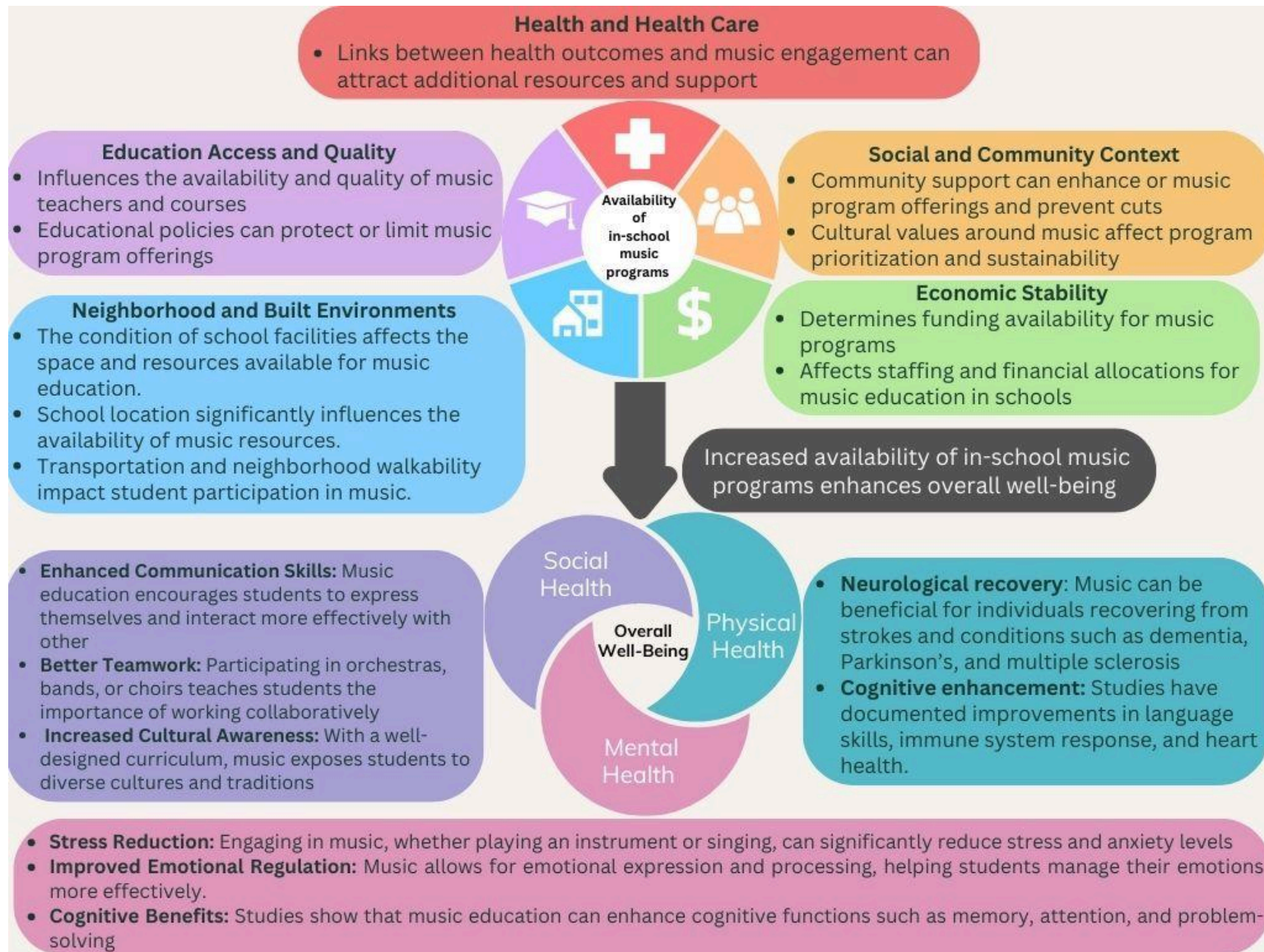
private schools, thus compounding the challenges faced by public education systems in achieving diversity and equity. The high median household income in Seattle, particularly among married couples with children, helps explain the substantial private school enrollment rates, reflecting broader patterns of socioeconomic stratification within urban educational environments.

The insights provided by Seattle Public Schools employees and community members, coupled with budgetary information and pertinent data, illustrate the complexities inherent in managing music education within an urban setting like Seattle. The district's approach to music education, characterized by both flexibility and inconsistency in resource allocation, reflects broader challenges that urban school districts face across the nation. These experiences make Seattle Public Schools a valuable case study for understanding the effects of policy, funding, and administrative strategies on both the equity and quality of music education.

## Conceptual Model

I have created a conceptual model in Figure 1 illustrating how various social determinants of health (SDOH) such as Economic Stability, Education Quality, and Neighborhood and Built Environments impact the availability of music education and, subsequently, affect students' social, mental, and physical health. The model can help educators and policymakers understand potential areas for intervention to enhance the reach and effectiveness of music programs in school.

Figure 1. Model of the Social Determinants of Health Influencing Music Education and Student Well-Being



## Hypotheses

### Hypothesis 1: Relationship Between School Finances/Staffing and Music Program Availability

Schools with higher Full-Time Equivalency (FTE) allocations, teaching staff, total budget, and budget per student are more likely to offer music classes. This hypothesis stems from the understanding that increased staffing resources and financial capacity may facilitate the expansion of extracurricular programs, such as music classes. However, the extent to which these factors influence program availability warrants further investigation.

### Hypothesis 2: Relationship Between Socioeconomic Status of Students and Music Program Availability

Schools with a higher percentage of homeless students, low-income students, and students on free and reduced lunch will have fewer music classes. This hypothesis is based on the assumption that economic constraints limit the school's ability to fund and support extensive music education classes.

### Hypothesis 3: Relationship Between Racial Composition of Schools and Music Program Availability

Schools with a higher percentage of white students will have a higher presence of music classes. This hypothesis is based on the premise that white students generally have higher

participation rates in music education, and higher participation likely influences schools to maintain and prioritize their music classes.

#### Hypothesis 4: Relationship Between Financial Resources, Racial/Ethnic Composition of Schools, and Socioeconomic Status of Students

Schools with a higher percentage of non-white and economically disadvantaged students will have fewer financial resources and staffing compared to schools with a larger non-white and wealthier student body. This hypothesis is based on the understanding that economic disparities linked to racial demographics influence local funding mechanisms such as property taxes, leading to unequal distribution of resources that favors public schools in wealthier, predominantly white neighborhoods.

## Methods

### Study Setting

This study examined the relationship between financial and staffing resources and socio-demographic and economic characteristics of students and the availability of in-school music classes among general education Seattle Public elementary, middle, and high schools during the 2019-2020 academic year.

## Data Collection and Selection of Study Subjects

### Source

Data on music class offerings were obtained from a report presented at the Seattle Public Schools Curriculum & Instruction Policy Committee meeting on August 18, 2020 (see Appendix B). Financial and staffing details came from public data released by Seattle Public Schools (see Appendix C). Student enrollment numbers were sourced from public records maintained by Seattle Public Schools (see Appendix D) and the Washington Office of Superintendent of Public Instruction (see Appendix E).

### Sampling Method/Recruitment

All 114 general education schools within the Seattle Public Schools system (74 elementary, 23 middle, and 17 high schools) were included in this study. The schools were systematically grouped based on the availability of specific types of music classes.

- Elementary Instrumental Music (EIM)
  - Each elementary or K-8 school offers a half-day per week of music instruction, serving up to 40 students in four sections.
  - Additional teaching time can be funded by schools for more instruction.
  - Fifth grade is prioritized for readiness into middle school music programs, with fourth-grade participation possible through extra funding.
  - The program operates on an opt-in basis, with teachers traveling to various schools.
- General Music

- Covers pre-kindergarten through fifth grade, teaching foundational music concepts like rhythm and dynamics through vocal music, percussion, and other instruments.
- The goal is for each school to offer robust music and visual arts programs.
- Middle School
  - Offers a range of music classes including band, choir, and various specialized music groups.
  - Schools make decisions on courses based on resources, student interest, and enrollment.
  - SPS supports beginners and promotes academic mindsets in music, ensuring progression in musicianship from middle school onward.
  - Instruments are provided to all students who need them.
- High School
  - Continues with similar music offerings as in middle school, including band and choir, with the addition of marching band.
  - The approach and resources are largely similar to the middle school level.

For elementary schools, the study primarily assessed the presence of general music classes, since all elementary schools in the district provide instrumental music. For middle and high schools, the research specifically examined the availability of both vocal and instrumental music programs. This classification enabled detailed analysis of how music education varies across different school levels.

## Data Quality Assurance

Data were cross-referenced with Seattle Public Schools' music program officials, to validate accuracy and completeness (see Appendix A). Standardized criteria were implemented for data analysis to ensure consistency across all classes and schools evaluated. All analyses were conducted using the statistical software R (see Appendix G).

## Analysis Plan

### Descriptive Statistics

Descriptive statistics were compiled for the 74 elementary, 23 middle, and 17 high schools in the Seattle Public School District to analyze demographic and staffing characteristics. Mean values were calculated for the number of students per school, white and non-white students, homeless students, low-income students, students receiving free and reduced lunch, and the full-time equivalent (FTE) of teaching staff. Proportions of elementary schools offering general and instrumental music programs, middle schools offering instrumental and vocal music programs, and high schools offering instrumental and vocal music programs were also assessed. These statistics focus on central tendency, variability, and distribution patterns to highlight key aspects of the population before using inferential statistics to test hypotheses and make predictions.

### Hypothesis Testing

To evaluate Hypotheses 1-3, differences were investigated in the number of non-white students, number of white students, number of Black or African American students, number of

homeless students, number of low-income students, number of students on free and reduced lunch, teaching FTE, FTE allocation, total budget, and budget per student between schools that did and did not offer music programs. Homeless students are defined as those who lack a fixed, regular, and adequate nighttime residence, while low-income students are defined as those whose parent(s) or guardian(s) have an annual income equal to or less than one hundred eighty-five percent of the Income Poverty Guidelines published by the U.S. Department of Health and Human Services. Schools were categorized based on the presence or absence of instrumental and general music programs in elementary schools, and vocal and instrumental music programs in middle and high schools. Black or African American students often face disproportionate educational inequities in the United States, which is why they are included both in the broader non-white category and separately analyzed.

The Shapiro-Wilk test was used to assess the normality of the data across these groups, ensuring that the chosen statistical methods would yield reliable and valid results. For datasets with a Shapiro-Wilk p-value greater than 0.05, indicating normal distribution, Welch's T-test was employed, which accommodates unequal variances and different sample sizes. A positive T-value in this test suggests that the mean of the first group is higher than the second, while a negative T-value indicates the opposite. For non-normally distributed data with a Shapiro-Wilk p-value less than 0.05, the Mann-Whitney U test was utilized. The U-value in the Mann-Whitney U test reflects the extent to which the ranks of one group consistently exceed those of another; ranks are assigned based on the order of the data values from lowest to highest across both groups. A low U-value, indicating a significant difference in distributions between the groups, is considered low when it is much closer to zero than to its maximum possible value, which is determined by the product of the sample sizes of the two groups. For both the U-value and the

T-value, the significance level (p-value) was set at 0.05, determining whether the observed differences were statistically significant.

For Hypothesis 4, the strength and direction of correlations between FTE allocation, teaching FTE, student race and ethnicity, total and per-student budgets, and numbers of low-income, free and reduced lunch, and homeless students were tested through Pearson correlation analysis. The analysis focused on identifying strong positive linear correlations ( $r = +0.7$  to  $+1$ ) and strong negative linear correlations ( $r = -0.7$  to  $-1$ ) that were highly significant ( $p < .001$ ). Here, "r" represents the Pearson correlation coefficient, which measures the degree of linear relationship between variables. Race and ethnicity variables analyzed include White, American Indian or Alaska Native, Black or African American, Hispanic or Latino, Native Hawaiian or Other Pacific Islander, students of two or more races, and Asian. The category "Asian" includes individuals with origins in East Asia, Southeast Asia, or the Indian subcontinent, while "White" encompasses individuals with origins in Europe, the Middle East, or North Africa.

The statistical analyses were conducted using R, a programming language widely used for statistical computing and graphics. The codebook and scripts utilized in the analysis are available in Appendix C.

## Results

### Descriptive Statistics

The results of the descriptive statistics summarize the characteristics of schools at different educational levels, covering 74 elementary schools, 23 middle schools, and 17 high

schools. Likely due to an increase in school population, all mean study variables show significant growth with each advancing school level (Table 1 and Figure 2).

The descriptive statistics also reveal notable trends in the music education offerings across different school levels (Figures 3-8). Among the 74 elementary schools, all provide instrumental music programs where 4th and 5th graders are selected through a lottery system to learn seven primary instruments. However, only 55 out of these schools (74.3%) offer general music programs for grades K-5. Due to this variation, general music programs will be the primary focus of subsequent statistical tests to identify patterns in program availability at the elementary level. In middle schools, the landscape of music education shows a contrast in program types: out of 23 middle schools, 11 (47.8%) offer vocal music programs, while a much higher proportion, 21 out of 23 (91.3%), provide instrumental music programs. This indicates a stronger emphasis on instrumental training at the middle school level.

High schools display a more balanced distribution between vocal and instrumental music programs. Of the 17 high schools analyzed, 10 (58.8%) offer vocal music programs, and 11 (64.7%) provide instrumental music programs. This suggests a relatively even focus on both types of music education at the high school level, though instrumental programs slightly outnumber vocal ones.

Table 1. Mean and Median Study Variables for SPS Schools (2019-2020)

	Elementary Schools	Middle Schools	High Schools
Number of Students (Mean)	360.4 (SD=113.8)	501 (SD=359.9)	768.9 (SD=518.4)
Number of Students (Median)	354.5	481.0	801
White Students (Mean)	171.9 (SD=118.5)	239.4 (SD=215.2)	347.9 (SD=382.7)
White Students (Median)	155.0	179.0	166
Non-White Students (Mean)	188.5 (SD=84.8)	261.5 (SD=233.9)	421.2 (SD=290.6)
Non-White Students (Median)	171.5	186.0	412
Homeless Students (Mean)	12.1 (SD=12.4)	18.3 (SD=19.8)	30 (SD=24)
Homeless Students (Median)	8.0	11.0	23.97
Low-Income Students (Mean)	110.6 (SD=85.7)	165.2 (SD=181.4)	268.9 (SD=216.5)
Low-Income Students (Median)	81.0	91.0	221
Students Receiving Free and Reduced Lunch (Mean)	108.9 (SD=89.2)	158.5 (SD=184.6)	279.9 (SD=223.2)

Students Receiving Free and Reduced Lunch (Median)	69.00	81.00	267.00
Teaching FTE (Mean)	19.4 (SD=5.9)	20.5 (SD=13.3)	30.8 (SD=19.9)
Teaching FTE (Median)	19.5	18.7	31.8

Figure 2. Mean Study Variables for SPS Schools (2019-2020)

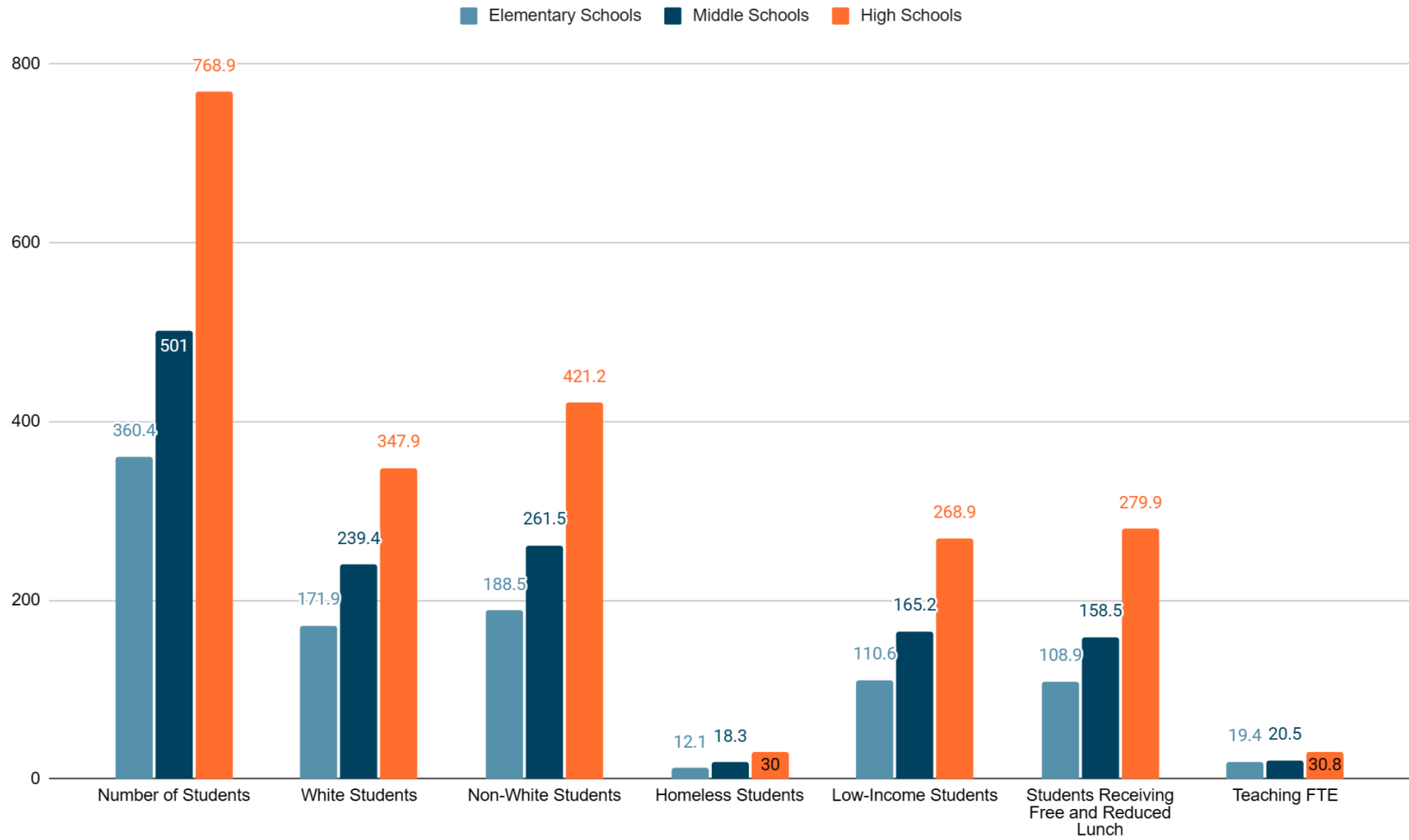


Figure 3. Proportion of Elementary Schools With and Without Instrumental Music (2019-2020)

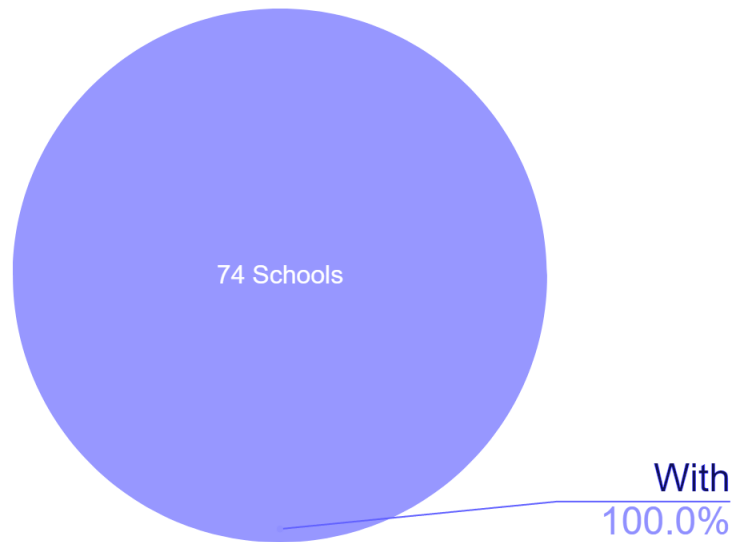


Figure 4. Proportion of Elementary Schools With and Without General Music (2019-2020)

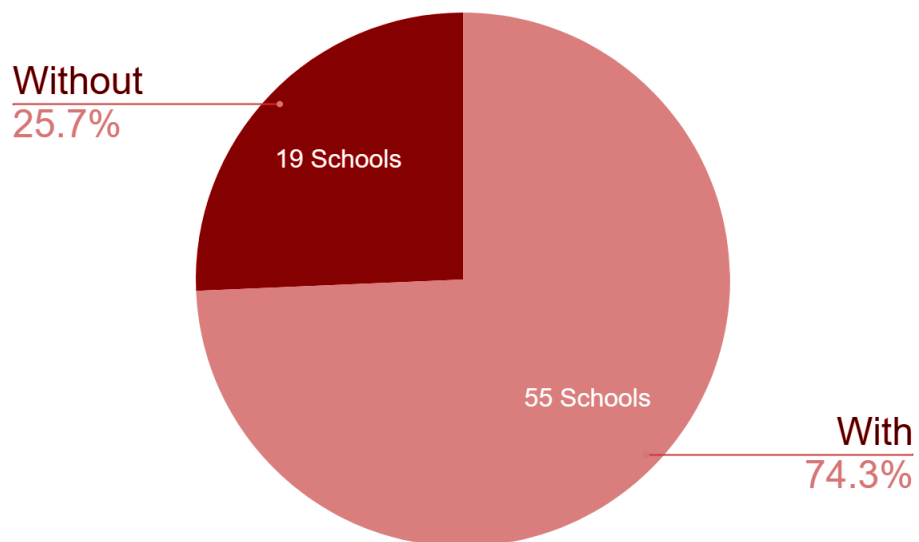


Figure 5. Proportion of Middle Schools With and Without Vocal Music (2019-2020)

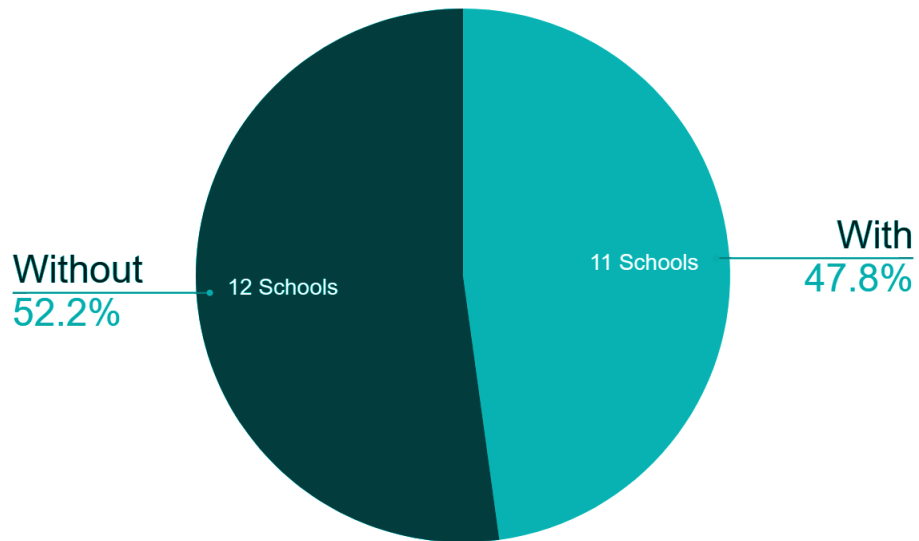


Figure 6. Proportion of Middle Schools With and Without Instrumental Music (2019-2020)

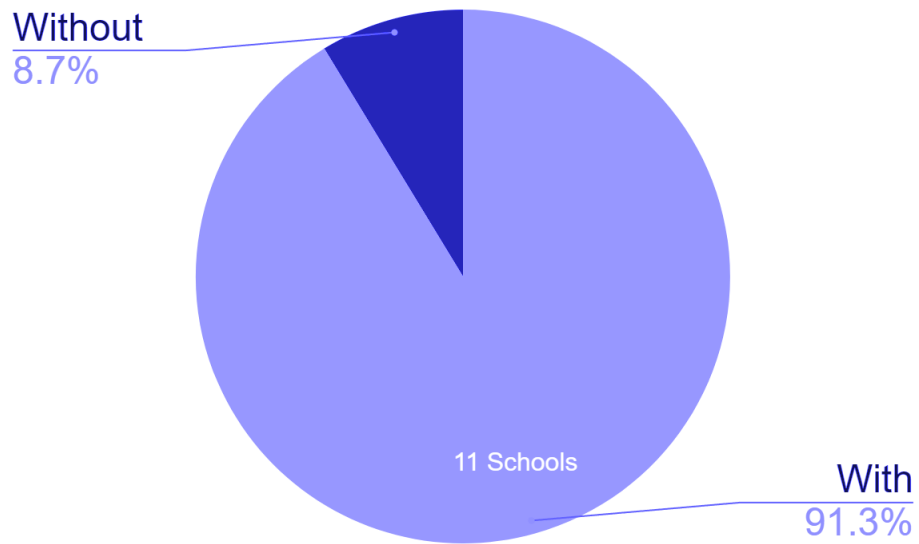


Figure 7. Proportion of High Schools With and Without Vocal Music (2019-2020)

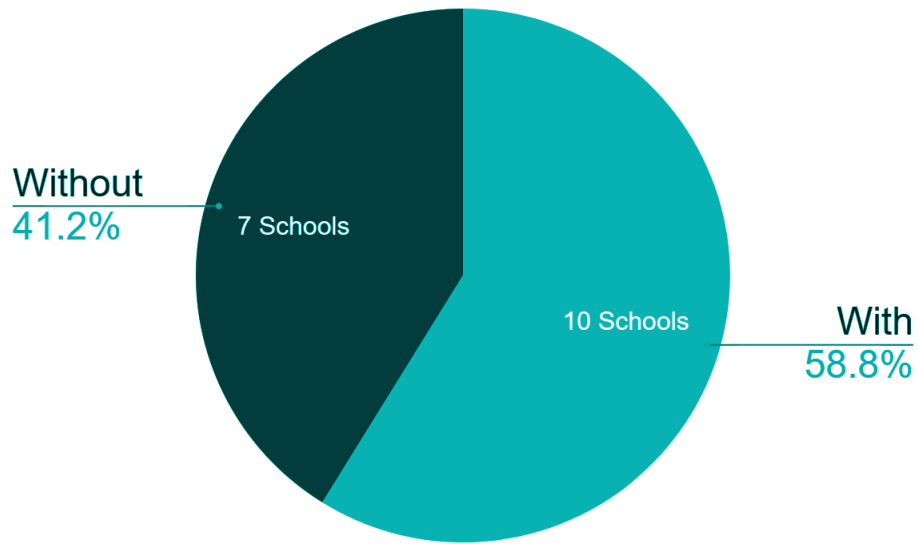
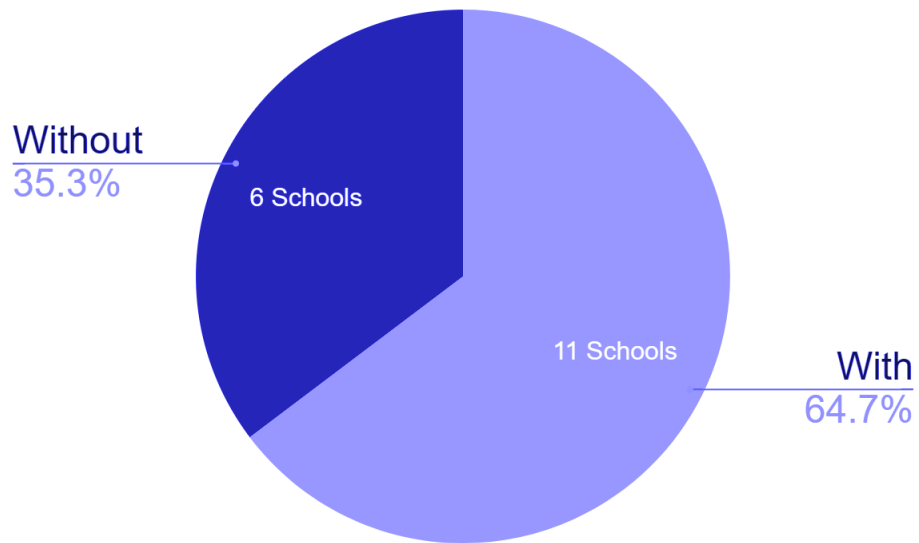


Figure 8. Proportion of High Schools With and Without Instrumental Music (2019-2020)



## Statistical Tests

### Elementary Schools and General Music Inferential Statistical Tests

#### Shapiro-Wilk Test

The test results indicated that the data for non-white students, teaching FTE, FTE allocation, and total budget are normally distributed between the two groups ( $p > .05$ ), allowing for analysis using Welch's T-test. Conversely, the numbers of white students, Black or African American students, homeless students, low-income students, students on free and reduced lunch, and budget per student are not normally distributed between the two groups ( $p < .05$ ) and will be analyzed using the Mann-Whitney U test (Table 2).

Table 2. Shapiro-Wilk Test Results for Study Variables in Elementary Schools With and Without General Music Classes (2019-2020)

Variable	Without		With	
	<i>W</i>	<i>p</i>	<i>W</i>	<i>p</i>
number of non-white students	.92	.10	.96	.06
number of white students	.97	.73	.94	.01
number of Black or African American students	.81	.00	.82	.00
number of homeless students	.89	.04	.85	.00
number of low-income students	.86	.01	.91	.00
number of students on free and reduced lunch	.85	.01	.90	.00
teaching FTE	.95	.43	.99	.94
FTE allocation (\$)	.95	.42	.99	.94
total budget (\$)	.98	.94	.98	.61
budget per student (\$)	.88	.02	.90	.00

Note. *N* = 74; (*n* = 19 for “without” and *n* = 55 for “with”).

## Welch's T-test

Welch's T-test indicated a significant difference in the number of non-white students ( $t = 2.7$ ;  $p = .01$ ) and the total budget ( $t = 3.2$ ;  $p = .00$ ) between elementary schools that did and did not offer general music. The mean number of non-white students was lower in elementary schools without general music ( $M = 150.8$ ;  $SD = 65.2$ ) than in those with general music ( $M = 201.5$ ;  $SD = 87.4$ ). Similarly, the mean total budget was lower in schools without general music ( $M = \$3,594,119.0$ ;  $SD = 1,048,231.0$ ) compared to those with general music ( $M = \$4,521,990.0$ ;  $SD = 1,199,412.0$ ). The results were non-significant for teaching FTE and FTE allocation (Table 3).

Table 3. Welch's T-Test Results for Study Variables in SPS Elementary Schools With and Without General Music Classes (2019-2020)

Variable	Without		With		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
number of non-white students	150.8	65.2	201.5	87.4	2.7	.01
teaching FTE	17.0	6.2	20.2	5.6	2.0	.05
FTE allocation	\$2,038,814.4	745,516.3	\$2,432,270.5	672,418.6	2.0	.05
total budget	\$3,594,118.7	1,048,230.6	\$4,521,989.6	1,199,412.0	3.2	.00

Note. *N* = 74; (*n* = 19 for “without” and *n* = 55 for “with”).

## Mann-Whitney U Test

The Mann-Whitney U test revealed significant differences in the number of low-income students ( $U = 358.0$ ;  $p = .04$ ) and the number of students receiving free and reduced lunch ( $U = 356.0$ ;  $p = .04$ ) between elementary schools that did and did not offer general music. The median number of low-income students in schools without general music classes ( $Mdn = 41.0$ ) was lower than in those with general music classes ( $Mdn = 83.0$ ). The median number of students on free and reduced lunch was lower in elementary schools that do not have general music classes ( $Mdn = 47.0$ ) compared to those that do have general music classes ( $Mdn = 81.0$ ). The results were non-significant for the numbers of white students, Black or African American students, homeless students, and budget per student (Table 4).

Table 4. Mann-Whitney U Test Results for Study Variables in Elementary Schools With and Without General Music Classes (2019-2020)

Variable	Without	With	<i>U</i>	<i>p</i>
	<i>Mdn</i>	<i>Mdn</i>		
number of white students	159.0	150.0	538.5	.85
number of Black or African American students	18.0	29.0	387.0	.10
number of homeless students	6.0	9.0	385.5	.09
number of low-income students	41.0	83.0	358.0	.04
number of students on free and reduced lunch	47.0	81.0	356.0	.04
budget per student	\$10594.2	\$11729.0	423.0	0.22

Note. *N* = 74; (*n* = 19 for “without” and *n* = 55 for “with”).

## Pearson Correlation Analysis of Elementary School Demographics and Resource Allocation

- Strong positive linear correlation ( $r = +0.7$  to  $+1$ ) of high significance ( $p = <.001$ ) were found between the following (Table 5):
  - the number of students of two or more races **with** FTE allocation and the number of white students
  - teaching FTE **with** FTE allocation
  - low-income students **with** the number of Black or African American students and non-white students

Table 5. Pearson Correlation Matrix for SPS Elementary Schools' Financial Resources, Racial/Ethnic Composition, and Socioeconomic Status of Students (2019-2020)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. FTE allocation (\$)	1.00														
2. Number of white students	.64***	1.00													
3. Number of American Indian or Alaska Native students	-.00	-.13	1.00												
4. Number of Asian students	.31**	-.25**	.07	1.00											
5. Number of Black or African American students	-.01	-.60***	.01	.16	1.00										
6. Number of Hispanic or Latino students	.30**	-.20	.24**	.30**	.08	1.00									
7. Number of Native Hawaiian or other Pacific Islander students	-.14	-.43***	.04	.04	.41***	.23	1.00								

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
8. Number of students of two or more races	.76***	.70***	-.02	.13	-.37**	.17	-.35**	1.00							
9. Number of non-white students	.43***	-.41***	.13	.69***	.68***	.58***	.30*	.12	1.00						
10. Total budget (\$)	.66***	.26**	.12	.27**	.26**	.25**	-.02	.34**	.47***	1.00					
11. Budget per student (\$)	-.44***	-.53***	.35**	-.06	.35**	-.01	.21*	-.54***	.07	.31**	1.00				
12. Teaching FTE	1.00***	.64***	-.00	.31**	-.01	.30**	-.14	.76***	.43***	.66***	-.44***	1.00			
13. Low income students	.09	-.66***	.22	.47***	.83***	.49***	.45***	-.32**	.87***	.36**	.36**	.09	1.00		
14. Students on free and reduced lunch	.08	-.66***	.21	.45***	.83***	.48***	.44***	-.33**	.85***	.33**	.34**	.08	.08	1.00	
15. Homeless students	-.07	-.54***	.28**	.08	.61***	.31**	.32**	-.28**	.49***	.14	.35**	-.07	.75***	.68***	1.00

Note.  $N = 74$ . \*\*\*  $p < .001$ , \*\*  $p < .05$ , \*  $p < .10$

## Middle Schools and Vocal Music Inferential Statistical Tests

### Shapiro-Wilk Test

The Shapiro-Wilk test indicated that, except for total budget—which will be analyzed with a Welch's T-test—all other variables will be analyzed using the Mann-Whitney U test due to non-normal distributions (Table 6).

Table 6. Shapiro-Wilk Test Results for Study Variables in Middle Schools With and Without Vocal Music Classes (2019-2020)

Variable	Without		With	
	<i>W</i>	<i>p</i>	<i>W</i>	<i>p</i>
number of non-white students	.74	.00	.91	.28
number of white students	.83	.02	.84	.04
number of Black or African American students	.77	.00	.86	.07
number of homeless students	.81	.01	.82	.02
number of low-income students	.71	.00	.84	.03
number of students on free and reduced lunch	.68	.00	.79	.01
teaching FTE	.86	.05	.88	.12
FTE allocation (\$)	.86	.05	.88	.12
total budget (\$)	.99	1.00	.92	.35
budget per student (\$)	.84	.03	.79	.01

Note. *N* = 23; (*n* = 12 for “without” and *n* = 11 for “with”).

## Welch's T-test

Welch's T-test indicated that there was no statistically significant difference in the total budgets between schools with and without vocal music at conventional significance levels ( $p < 0.05$ ) (Table 7).

Table 7. Welch's T-Test Results for Study Variables in SPS Middle Schools With and Without Vocal Music Classes (2019-2020)

Variable	Without		With		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
total budget	\$5850127.0	2268724.4	\$6969990.0	1573979.2	1.4	.18

Note. *N* = 23; (*n* = 12 for “without” and *n* = 11 for “with”).

## Mann-Whitney U Test

The Mann-Whitney U test revealed that the results were non-significant for all variables examined (Table 8).

Table 8. Mann-Whitney U Test Results for Study Variables in Middle Schools With and Without Vocal Music Classes (2019-2020)

Variable	Without	With	<i>U</i>	<i>p</i>
	<i>Mdn</i>	<i>Mdn</i>		
number of non-white students	126.5	342.0	42.5	.16
number of white students	118.0	187.0	43.0	.17
number of Black or African American students	23.0	44.0	56.0	.56
number of homeless students	9.0	11.0	60.0	.74
number of low-income students	80.5	91.0	55.5	.54
number of students on free and reduced lunch	72.0	86.0	54.0	.49
teaching FTE	11.8	23.1	40.0	.12
FTE allocation (\$)	1443211.5	2831975.0	40.0	.12
budget per student (\$)	23781.5	10678.6	86.0	.23

Note. *N* = 23; (*n* = 12 for “without” and *n* = 11 for “with”).

## Middle Schools and Instrumental Music Inferential Statistical Tests

Due to having only two data points for middle schools without instrumental music classes, conducting the Shapiro-Wilk test to assess data normality was not possible. Consequently, neither the Mann-Whitney U test nor the Welch's T-test could be meaningfully conducted.

## Pearson Correlation Analysis of Middle School Demographics and Resource Allocation

- Strong positive linear correlation ( $r = +0.7$  to  $+1$ ) of high significance ( $p = <.001$ ) were found between the following (Table 9):
  - FTE allocation **with** white students, Hispanic or Latino students, students of two or more races, non-white students, total budget, and teaching FTE
  - white students **with** students of two or more races and teaching FTE
  - American Indian or Alaska Native students with Hispanic or Latino students
  - Asian students **with** Black or African American students, non-white students, low-income students, and students on free and reduced lunch
  - Black or African American students **with** Hispanic or Latino students, non-white students, low-income students, and students on free and reduced lunch
  - Hispanic or Latino students **with** Native Hawaiian or other Pacific Islander students, non-white students, total budget, teaching FTE, low income students, students on free and reduced lunch, and homeless students
  - Native Hawaiian or other Pacific Islander students **with** homeless students
  - Number of students of two or more races **with** teaching FTE
  - Non-white students **with** total budget, teaching FTE, low income students, students on free and reduced lunch, and homeless students
  - Total budget **with** teaching FTE
  - Budget per student **with** students on free and reduced lunch
  - Low-income students **with** students on free and reduced lunch

- Strong negative linear correlation ( $r = -0.7$  to  $-1$ ) of high significance ( $p = <.001$ ) were found between:
  - Budget per student **with** FTE allocation, teaching FTE, and number of students of two or more races

Table 9. Pearson Correlation Matrix for SPS Middle Schools' Financial Resources, Racial/Ethnic Composition, and Socioeconomic Status of Students

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. FTE allocation	1														
2. Number of white students	.82***	1													
3. Number of American Indian or Alaska Native students	.61***	.45**	1												
4. Number of Asian students	.59***	.07	.26	1											
5. Number of Black or African American students	.48**	-.06	.38*	.81***	1										
6. Number of Hispanic or Latino students	.75***	.37*	.77***	.66***	.70***	1									
7. Number of Native Hawaiian or other Pacific Islander students	.34	-.01	.57***	.40*	.66***	.70***	1								
8. Number of students of two or more races	.96***	.89***	.54**	.41**	.35*	.63***	.28***	1							

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
9. Number of non-white students	.78***	.28	.55**	.91***	.89***	.88***	.62***	.64***	1						
10. Total budget (\$)	.79***	.52**	.48**	.61**	.51**	.70***	.38	.67***	.72***	1					
11. Budget per student (\$)	-.70***	-.62***	-.41*	-.42	-.44**	-.56**	-.36*	-.75***	-.56**	-.42**	1				
12. Teaching FTE	1.0***	.82***	.61***	.59***	.48**	.75***	.34	.96***	.78***	.79***	-.70***	1			
13. Low income students	.59**	.05	.53**	.87***	.94***	.87***	.40*	.43*	.96***	.62**	-.47	.59**	1		
14. Students on free and reduced lunch	.56**	.00	.51**	.88***	.93***	.85***	.38*	.39*	.95***	.61**	1.0***	.56**	1.0***	1	
15. Homeless students	.54**	.11	.50**	.62**	.88***	.79***	.71***	.48**	.82***	.45**	-.37	.57**	.31	.33	1

Note.  $N = 23$ . \*\*\*  $p < .001$ , \*\*  $p < .05$ , \*  $p < .10$

## High Schools and Vocal Music Inferential Statistical Tests

### Shapiro-Wilk Test

The test results indicated that the data for white students, low-income students, students on free and reduced lunch, FTE allocation, total budget, and budget per student are normally distributed between the two groups ( $p > .05$ ), allowing for analysis using Welch's T-test.

Conversely, the numbers of non-white students, Black or African American students, homeless students, and teaching FTE are not normally distributed between the two groups ( $p < .05$ ) and will be analyzed using the Mann-Whitney U test (Table 10).

Table 10. Shapiro-Wilk Test Results for Study Variables in SPS High Schools With and Without Vocal Music Classes (2019-2020)

Variable	Without		With	
	<i>W</i>	<i>p</i>	<i>W</i>	<i>p</i>
number of non-white students	.79	.04	.99	1.0
number of white students	.84	.11	.94	.53
number of Black or African American students	.72	.01	.90	.24
number of homeless students	.72	.01	.97	.97
number of low-income students	.84	.11	.96	.88
number of students on free and reduced lunch	.84	.12	.96	.81
teaching FTE	.78	.04	.94	.60
FTE allocation (\$)	.81	.07	.94	.60
total budget (\$)	.80	.05	.95	.69
budget per student (\$)	.82	.07	.90	.20

Note.  $N = 17$ ; ( $n = 7$  for “without” and  $n = 10$  for “with”).

#### Welch's T-test

Welch's T-test indicated a significant difference in the number of white students ( $t = 3.7$ ;  $p = .01$ ), FTE allocation ( $t = 4.7$ ;  $p = .00$ ), and the total budget ( $t = 5.1$ ;  $p = .00$ ) between high schools that did and did not offer vocal music. The mean number white students was lower in elementary schools without vocal music ( $M = 71.9$ ;  $SD = 68.5$ ) than in those with vocal music ( $M = 541.1$ ;  $SD = 395.7$ ). The mean FTE allocation was lower in schools without vocal music ( $M = 1,683,614.3$ ;  $SD = 1,389,104.4$ ) compared to those with vocal music ( $M = 5,392,844.0$ ;  $SD = 1,895,020.1$ ). The mean total budget was lower in schools without vocal music ( $M = 4,060,243.9$ ;  $SD = 2,768,444.4$ ) compared to those with vocal music ( $M = 10,800,860.5$ ;  $SD = 2,498,339.0$ ). The results were non-significant for low-income students, students on free and reduced lunch, and budget per person (Table 11).

Table 11. Welch's T-Test Results for Study Variables in SPS High Schools With and Without Vocal Music Classes (2019-2020)

Variable	Without		With		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
number of white students	71.9	68.5	541.1	395.7	3.7	.01
number of low-income students	156.7	166.2	347.5	219.7	2.0	.06
number of students on free and reduced lunch	165.0	172.1	360.4	226.5	2.0	.06
FTE allocation (\$)	1683614.3	1389104.4	5392844.0	1895020.1	4.7	.00
total budget (\$)	4060243.9	2768444.4	10800860.5	2498339.0	5.1	.00
budget per person (\$)	19654.8	11570.4	10126.8	1507.1	2.2	.07

Note. *N* = 17; (*n* = 7 for “without” and *n* = 10 for “with”).

## Mann-Whitney U Test

Results were significant for number of non-white students ( $U = 9.0$ ,  $p = .01$ ) and teaching FTE ( $U = 4.0$ ,  $p = .00$ ). The median number of non-white students in schools without vocal music ( $Mdn = 77.0$ ) was lower than in those with vocal music ( $Mdn = 546.5$ ). The median teaching FTE was lower in high schools that do not have vocal music classes ( $Mdn = 9.2$ ) compared to those that do have vocal music ( $Mdn = 39.0$ ). The results were non-significant for the numbers of Black or African American students and homeless students (Table 12).

Table 12. Mann-Whitney U Test Results for Study Variables in High Schools With and Without Vocal Music Classes (2019-2020)

Variable	Without	With	<i>U</i>	<i>p</i>
	<i>Mdn</i>	<i>Mdn</i>		
non-white students	77.0	546.5	9.0	.01
number of Black or African American students	21.0	132.5	16.0	.07
homeless students	21.0	36.0	22.0	.22
teaching FTE	9.2	39.0	4.0	.00

Note. *N* = 17; (*n* = 7 for “without” and *n* = 10 for “with”).

## High Schools and Instrumental Music Inferential Statistical Tests

### Shapiro-Wilk Test

The test results indicated that the data for non-white students, white students, low-income students, students on free and reduced lunch, FTE allocation, total budget, and budget per student are normally distributed between the two groups ( $p > .05$ ), allowing for analysis using Welch's T-test. Conversely, the numbers of Black or African American students, homeless students, and teaching FTE are not normally distributed between the two groups ( $p < .05$ ) and will be analyzed using the Mann-Whitney U test (Table 13).

Table 13. Shapiro-Wilk Test Results for Study Variables in SPS High Schools With and Without Instrumental Music Classes (2019-2020)

Variable	Without		With	
	<i>W</i>	<i>p</i>	<i>W</i>	<i>p</i>
number of non-white students	.81	.09	.99	1.00
number of white students	.81	.09	.92	.29
number of Black or African American students	.63	.00	.92	.37
number of homeless students	.75	.03	.98	.98
number of low-income students	.80	.07	.97	.92
number of students on free and reduced lunch	.78	.05	.97	.93
teaching FTE	.74	.03	.94	.51
FTE allocation (\$)	.78	.05	.94	.51
total budget (\$)	.78	.05	.96	.85
budget per student (\$)	.84	.16	.89	.16

Note.  $N = 17$ ; ( $n = 6$  for “without” and  $n = 11$  for “with”).

## Welch's T-test

Welch's T-test indicated a significant difference in the number of non-white students ( $t = 5.2$ ;  $p = .00$ ), white students ( $t = 3.4$ ;  $p = .01$ ), low-income students ( $t = 3.3$ ;  $p = .01$ ), students on free and reduced lunch ( $t = 2.9$ ;  $p = .01$ ), FTE allocation ( $t = 5.7$ ;  $p = .00$ ), and the total budget ( $t = 6.0$ ;  $p = .00$ ) between high schools that did and did not offer instrumental music. The mean number non-white students was lower in high schools without instrumental music ( $M = 133.5$ ;  $SD = 130.3$ ) than in those with instrumental music ( $M = 578.1$ ;  $SD = 223.3$ ). The mean number of white students was lower in schools without instrumental music ( $M = 72.5$ ;  $SD = 75.0$ ) compared to those with instrumental music ( $M = 498.1$ ;  $SD = 401.6$ ). The mean number of low-income students was lower in schools without instrumental music ( $M = 105.3$ ;  $SD = 104.7$ ) compared to those with instrumental music ( $M = 358.2$ ;  $SD = 211.4$ ). The mean number of students on free and reduced lunch was lower in schools without instrumental music ( $M = 119.0$ ;  $SD = 133.4$ ) compared to those with instrumental music ( $M = 367.7$ ;  $SD = 216.3$ ). The mean FTE allocation was lower in schools without instrumental music ( $M = \$1,295,752.0$ ;  $SD = 1025602.8$ ) compared to those with instrumental music ( $M = \$5,267,202.6$ ;  $SD = 1,845,436.1$ ). The mean total budget was lower in schools without instrumental music ( $M = \$3,375,637.2$ ;  $SD = 2,293,507.3$ ) compared to those with instrumental music ( $M = \$10,561,499.0$ ;  $SD = 2,499,552.2$ ). The results were non-significant for budget per person (Table 14).

Table 14. Welch's T-Test Results for Study Variables in SPS High Schools With and Without Instrumental Music Classes (2019-2020)

Variable	Without		With		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
number of non-white students	133.5	130.3	578.1	223.3	5.2	.00
number of white students	72.5	75.0	498.1	401.6	3.4	.01
number of low-income students	105.3	104.7	358.2	211.4	3.3	.01
students on free and reduced lunch	119.0	133.4	367.7	216.3	2.9	.01
FTE allocation	\$1295752.0	1025602.8	\$5267202.6	1845436.1	5.7	.00
total budget	\$3375637.2	2293507.3	\$10561499.0	2499552.2	6.0	.00
budget per student	\$21231.1	11822.7	\$10133.2	1430.0	2.3	.07

Note. *N* = 17; (*n* = 6 for “without” and *n* = 11 for “with”).

## Mann-Whitney U test

The Mann-Whitney U test revealed significant differences in the number of Black or African American students ( $U = 11.0$ ;  $p = .03$ ) and teaching FTE ( $U = 2.0$ ;  $p = .00$ ) between high schools that did and did not offer instrumental music. The median number of Black or African American students in schools without instrumental music ( $Mdn = 20.5$ ) was lower than in those with instrumental music ( $Mdn = 137.0$ ). The median teaching FTE was lower in high schools that do not have instrumental music ( $Mdn = 8.7$ ) compared to those that do have instrumental music ( $Mdn = 38.4$ ). The results were non-significant for the number of homeless students (Table 15).

Table 15. Mann-Whitney U Test Results for Study Variables in High Schools With and Without Instrumental Music Classes (2019-2020)

Variable	Without	With	<i>W</i>	<i>p</i>
	<i>Mdn</i>	<i>Mdn</i>		
number of Black or African American students	20.5	137.0	11.0	.03
number of homeless students	19.0	32.0	21.0	.25
teaching FTE	8.7	38.4	2.0	.00

Note. *N* = 17; (*n* = 6 for “without” and *n* = 11 for “with”).

## Pearson Correlation Analysis of High School Demographics and Resource Allocation

- Strong positive linear correlation ( $r = +0.7$  to  $+1$ ) of high significance ( $p = <.001$ ) were found between the following (Table 16):
  - FTE allocation **with** white students, students of two or more races, total budget, and teaching FTE
  - white students **with** students of two or more races
  - American Indian or Alaska Native students **with** Hispanic or Latino students
  - Asian students **with** non-white students, low-income students, and students on free and reduced lunch
  - Black or African American students **with** non-white students, low-income students, and students on free and reduced lunch
  - Hispanic or Latino students **with** non-white students, low-income students, and students on free and reduced lunch
  - Students of two or more races **with** total budget and teaching FTE
  - Number of non-white students **with** total budget, low-income students, and students on free and reduced lunch
  - Total budget **with** teaching FTE
  - Teaching FTE **with** students on free and reduced lunch
  - Students on free and reduced lunch **with** low-income students

Table 16. Pearson Correlation Matrix for SPS High Schools' Financial Resources, Racial/Ethnic Composition, and Socioeconomic Status of Students (2019-2020)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.FTE allocation	1														
2.Number of white students	.85***	1													
3.Number of American Indian or Alaska Native students	.54**	.34	1												
4.Number of Asian students	.46*	.04	.35	1											
5.Number of Black or African American students	.37	-.13	.42*	.69***	1										
6.Number of Hispanic or Latino students	.52**	.24	.80***	.47*	.47*	1									
7.Number of Native Hawaiian or other Pacific Islander students	.08	-.17	.27	-.03	.50**	.42*	1								
8.Number of students of two or more races	.97***	.87***	.64**	.38	.32	.50**	.04	1							

9. Number of non-white students	.64**	.17	.63**	.88***	.87***	.73***	.31	.59**	1						
10. Total Budget	.96***	.72**	.67**	.55**	.53**	.69**	.27	.92***	.78***	1					
11. Budget per student (\$)	-.61	-.49	-.39	-.43	-.30	-.51**	-.02**	-.61**	-.53**	-.63**	1				
12. Teaching FTE	1.00***	.85	.53**	.45	.38	.52**	.11***	.96***	.64**	.96***	-.61**	1			
13. Low income students	.36	-.13***	.61**	.82***	.86***	.75***	.40	.31***	.94***	.57**	-.40	.36	1		
14. Students on free and reduced lunch	.37	-.12	.58**	.79***	.89***	.75***	.47	.31***	.93***	.58**	-.34	.38	.99***	1	
15. Homeless students	.06	-.12	.34	.23	.38	.60*	.16	.07	.41	.19	-.26	.06	.51**	.52**	1

Note.  $N = 17$ . \*\*\*  $p < .001$ , \*\*  $p < .05$ , \*  $p < .10$

# Discussion

## Findings and Implications

### Elementary Schools

The descriptive statistics reveal that the average number of students in each of the 74 elementary schools in Seattle Public Schools is 360.4, with a nearly even split between white and non-white students, suggesting a diverse student body across the district. Notably, each school has, on average, 12.1 homeless students and 110.6 low-income students, pointing to substantial socio-economic challenges that could affect students' educational experiences and outcomes. The average number of students receiving free or reduced lunch is similar to the number of low-income students.

Despite all schools offering instrumental music programs for 4th and 5th graders, selected through a lottery system, 19 out of 74 schools (25.7%) did not provide general music classes for grades K-5. General music programs are incorporated into the curriculum of all elementary students and cover a broader curriculum that includes singing, rhythm, and exposure to various musical genres, which are crucial for a well-rounded foundational music education. The relatively lower availability of these general programs could indicate budget constraints or strategic decisions to prioritize instrumental training over a more inclusive, varied musical education. This approach highlights a greater focus on specialized skill development in instrumental music for a select few, rather than comprehensive musical education for all students. The emphasis on instrumental training may be driven by goals such as preparing

students for more advanced musical education in subsequent grades. However, the limited availability of general music education raises questions about equitable access to a diverse and holistic music education that nurtures all aspects of musical appreciation and skills from an early age.

The Pearson correlation analysis provides key insights into the relationships among various student demographics and between student demographics and staffing and financial allocations. This analysis reveals a very strong positive correlation between the number of low-income students and the populations of Black or African American and non-white students, highlighting the socio-economic challenges these demographics face. This indicates a pressing need for targeted strategies to effectively support these groups. By identifying and understanding these correlations, educational policymakers and administrators can more accurately tailor their resource distribution and program development to enhance equity and diversity within the school system. The analysis also demonstrates a very strong positive correlation between teaching FTE and overall FTE allocation, indicating that schools with higher total resource allocations tend to have more teaching staff, which is a critical component of educational delivery. Lastly, the strong positive correlations between FTE allocation and the number of white students, as well as between FTE allocation and the number of students of two or more races, indicate that schools with higher populations of these groups tend to receive more staffing resources. This observation could prompt discussions on equity in resource distribution, as it highlights that other demographic groups, which are historically more marginalized, likely require more substantial financial and educational support.

## Elementary Schools and General Music Programs

The results from Welch's T-test indicate that elementary schools offering general music programs not only serve a more diverse student body, characterized by higher numbers of non-white students, but also operate with significantly larger budgets. This suggests that schools with more financial resources and greater student diversity are more likely to have robust music programs. Additionally, the Mann-Whitney U test has shown that schools with general music programs have higher numbers of low-income students and students receiving free and reduced lunch. These findings reflect a trend where schools with more economically and racially diverse populations are more likely to have music programs, likely due to enhanced resource allocations that include support for music education as part of a broader educational strategy. The presence of general music programs in these schools might also reflect a strategic choice to invest in music education as a way to engage and support a diverse student body, indicating that schools with greater diversity prioritize these programs to enhance their educational environment.

## Middle Schools

The analysis of 23 middle schools in Seattle Public Schools during the 2019-2020 school year reveals a student population with a nearly balanced racial composition, averaging 501 students per school, split almost equally between white and non-white students. Additionally, socio-economic challenges are evident, with an average of 18.4 homeless students, 165.2 low-income students, and 158.5 students receiving free or reduced lunch per school. These figures highlight significant economic disparities that necessitate focused educational support to ensure equitable access to learning opportunities.

In terms of music program availability, there is room for improvement, as 12 out of 23 schools (52.2%) do not offer vocal music programs and 2 out of 23 schools (8.7%) do not provide instrumental music programs. Vocal programs being notably less prevalent might be significantly influenced by the challenges associated with finding qualified vocal instructors. Unlike instruments, which can be obtained through donations, the quality and effectiveness of vocal programs depend heavily on the availability and expertise of vocal music teachers. The relatively lower emphasis on vocal music could also suggest a less integrated approach to music education at this stage, where the focus may shift more towards skill refinement in instruments rather than a balanced musical curriculum that includes vocal arts.

The Pearson correlation analysis among demographic variables and resource allocations within middle schools has revealed several key insights into the distribution of educational resources. Strong positive correlations were observed between Full-Time Equivalent (FTE) allocation and various demographic groups such as white students, Hispanic or Latino students, students of two or more races, non-white students, as well as total budget and teaching FTE. This pattern suggests that schools with higher numbers of these demographic groups tend to receive more staffing resources. Additionally, the correlations between various racial and ethnic groups highlight intricate demographic interactions within schools. For instance, Asian students showed strong positive correlations with Black or African American students, low-income students, and those receiving free or reduced lunch, indicating that these groups often overlap within school populations and share socio-economic characteristics. Similarly, Hispanic or Latino students were strongly correlated with Native Hawaiian or other Pacific Islander students, as well as with key indicators of economic disadvantage such as low-income status, free lunch eligibility, and

homelessness. These findings suggest that schools with higher proportions of these groups may face unique challenges and require specific resources to support their educational attainment.

The strong negative correlations between budget per student and both FTE allocation and teaching FTE raise possible concerns about the distribution of educational resources. These findings suggest that in schools where more money is spent per student, there tends to be a lower allocation of FTE and teaching staff. This pattern might reflect a situation where higher spending per student does not translate into more direct teaching resources. This could occur in schools where funds are disproportionately directed towards non-teaching expenditures, such as administrative costs, facility upgrades, or technology, rather than directly supporting teacher-student engagement through increased staffing. In this case, even if the total budget might seem adequate, the distribution does not favor increasing the number of teaching staff proportionally. This could affect the quality of education by limiting student access to individualized attention and support from teachers. This discrepancy could indicate a need for a more strategic approach to budget allocation that prioritizes direct educational support, particularly in terms of teaching personnel, to ensure that increased financial investment per student is effectively enhancing educational delivery and student learning outcomes.

The observed discrepancies in the correlation patterns for budget and teaching FTE allocations among Black, Asian, and Hispanic and Latino students—despite all three groups exhibiting high correlations with low income and eligibility for free and reduced lunch—indicate equity concerns within the school funding framework. All these groups are historically marginalized and confront similar socio-economic challenges, yet the distribution of resources appears to vary. For Hispanic and Latino students, the strong positive correlations with increased budget and teaching FTE suggest that schools with higher concentrations of these students are

receiving more educational resources. This may reflect targeted initiatives or programs specifically designed to support Hispanic and Latino communities, which could ideally be extended to include other marginalized groups as well. Conversely, the absence of similar correlations for Black students is concerning. Despite facing comparable socio-economic challenges, as evidenced by their high correlation with low-income status and eligibility for free or reduced lunch, schools with higher populations of Black students do not seem to receive proportional increases in budget or teaching resources. This indicates a disparity in how resources are allocated, potentially placing Black students at a disadvantage relative to their Hispanic and Latino peers. Such inequities highlight the need for a reassessment of resource distribution strategies to ensure that all marginalized groups receive equitable support.

Overall, these correlations point to a complex web of demographic and financial factors that influence how resources are allocated within schools. Recognizing these patterns is crucial for policymakers and educational leaders aiming to design more equitable and effective strategies for resource distribution, ensuring that all students, regardless of their background, have access to the necessary support to succeed academically.

## Middle Schools and Vocal Music

The Welch's T-test and Mann-Whitney U test conducted on 23 middle schools showed no statistically significant differences in variables between schools with and without vocal music programs. The lack of significant findings may be attributed to the small sample size, which can reduce the statistical power necessary to detect true differences. This highlights the importance of using a larger sample size in educational research to achieve more definitive and reliable conclusions.

## Middle Schools and Instrumental Music

With only two data points for middle schools without instrumental music classes, conducting statistical tests such as the Shapiro-Wilk test for assessing data normality and subsequent analyses like the Mann-Whitney U test and Welch's T-test was not feasible. This limitation underscores the necessity for a greater number of middle schools to enable meaningful statistical evaluations and to better understand if demographic correlations can indicate the existence of music programs.

## High Schools

The analysis of 17 high schools in Seattle Public Schools during the 2019-2020 school year reveals a diverse student population, with an average of 518.4 students per school, comprising 347.9 white students and 421.2 non-white students. These schools also face significant socio-economic challenges, as evidenced by an average of 30.0 homeless students, 268.9 low-income students, and 279.9 students receiving free or reduced lunch per school. The data also indicates notable variations in financial resources among schools, with the total budget averaging \$7,645,098 and budget per student at \$15,366.

Despite these challenges, high schools exhibit better availability of music programs compared to middle schools. However, there are disparities, as 9 out of 17 schools (52.9%) do not offer vocal music programs, and 4 out of 17 (23.5%) schools do not offer instrumental music programs. This lack of availability of vocal programs might reflect challenges in hiring and retaining qualified vocal instructors, who are crucial for the effective delivery of these programs.

Unlike instruments, which can be obtained through donations, vocal programs require trained instructors to guide students in developing their singing skills.

The Pearson correlation analysis for high schools reveals that the only strong positive correlations are between the total student population and the number of teaching staff (0.95), and between total FTE and teaching FTE (0.98). This indicates that larger schools tend to have more teaching staff, which is a crucial factor in maintaining manageable class sizes and providing individualized attention to students. These strong correlations highlight the relationship between school size and staffing levels, emphasizing the need for adequate resources to support student learning.

Interestingly, despite the varied demographics and socio-economic challenges, no significant correlations were found between the total budget, budget per student, and other variables such as race, homelessness, low income, or free and reduced lunch status. This suggests that financial resources are allocated in a manner that does not directly correlate with these specific demographic and socio-economic factors, potentially pointing to a need for more nuanced and equitable resource distribution strategies that consider the unique needs of different student populations.

## High Schools and Vocal Music

Welch's T-test and Mann-Whitney U test findings highlight disparities in resources and demographics between high schools that offer vocal music programs and those that do not. Schools that provide vocal music programs generally have more non-white and white students, greater FTE allocation, and larger total budgets. This suggests that vocal music programs are more likely to be found in schools that have more students and are better resourced, both in terms

of staffing and overall financial capacity. Consequently, the availability of vocal music programs could serve as a useful indicator of a school's resource level and demographic diversity, and vice versa.

Interestingly, the results showed no significant differences concerning the number of low-income students, students on free and reduced lunch, and budget per student, suggesting that the availability of vocal music programs does not necessarily correlate with the economic status of the student body. Additionally, the number of Black or African American students and homeless students did not show significant differences based on the presence of vocal music programs, indicating that these demographic factors alone do not predict the availability of these programs.

## High Schools and Instrumental Music

Welch's T-test and the Mann-Whitney U test provide compelling evidence that the availability of instrumental music programs in high schools is significantly associated with various demographic and resource indicators. Schools offering instrumental music programs consistently show higher populations of non-white and white students, more low-income students, and more students receiving free or reduced lunch, compared to schools without these programs. This suggests that instrumental music programs may be a feature of schools that are larger or have greater resources, which enable them to support more diverse and economically disadvantaged populations.

Furthermore, the tests reveal that schools with instrumental music programs have higher FTE allocations and larger total budgets, indicating that such schools are better resourced not only financially but also in terms of staffing. This could imply that schools committed to

maintaining music programs are also those that receive more comprehensive funding and staffing support, which might be due to larger student bodies or higher overall school funding.

The Mann-Whitney U test results specifically highlight that the presence of instrumental music programs correlates with a higher number of Black or African American students and significantly more teaching staff, as measured by FTE. This emphasizes the notion that schools with richer educational programs, like music, might also be those that are more robustly supported in terms of resources and are able to educate a more diverse student population.

## Study Limitations

A significant limitation of this study is the lack of specific demographic data on the students who actually participate in the music programs. While the analysis indicates that schools with greater diversity and more substantial socio-economic challenges are more likely to offer music programs, it does not confirm that the more marginalized student groups within those schools are the ones benefiting from or participating in them, especially at the middle and high school levels where music is an elective. This gap in data prevents a detailed understanding of who is accessing these educational opportunities, which is crucial for assessing the true inclusivity of music education in diverse settings.

Furthermore, the classification of "white" students in the data included individuals from Middle Eastern and North African backgrounds, while "Asian" encompassed diverse regions of origin. This aggregation could obscure significant differences in educational experiences and outcomes among these culturally and ethnically distinct groups. The analysis might have been strengthened by more finely distinguishing race and ethnicity to better understand nuanced disparities and reveal specific challenges.

Additionally, the study does not include measures of the quality of the music programs or specific data on how many teachers are allocated to teach music at each school. This absence of detailed information on program quality and staffing levels limits the ability to assess the effectiveness and comprehensiveness of the music education provided, which is essential for understanding the true educational value these programs offer to students.

This study also does not account for students in Seattle who attend private schools. Gathering accurate data from every private school regarding their music programs proved challenging, which may affect the comprehensiveness of the findings related to the overall music education landscape in Seattle.

Finally, the data used in this study is from the 2019-2020 academic year, which was notably disrupted by the onset of the COVID-19 pandemic. The pandemic likely altered the educational landscape significantly for many schools, affecting both the delivery and the availability of music education. Schools may have shifted their resource allocation priorities, potentially leading to changes in program availability and participation that are not reflected in this study. This suggests the need for updated research to assess ongoing changes and challenges in this field.

Overall, while the study offers important insights into the correlations between school demographics and music program availability, the limitations regarding participant-specific data, program quality, and staffing specifics highlight areas where further research is needed. Such research would more comprehensively reveal how many students in Seattle have access to music education programs and explore the benefits of music engagement on their physical, mental, and social health.

# Conclusion

This study uncovers significant correlations between school demographics, financial resources, and the availability of music programs, confirming some initial hypotheses while challenging others. Despite facing substantial socio-economic challenges, elementary schools maintain instrumental music programs for a select group of 4th and 5th graders through a lottery system. However, the lack of general music classes accessible to all students underscores significant gaps in music education equity and accessibility.

Hypothesis 1 is supported in that schools with music programs do indeed have more overall teaching staff and higher financial resources. This finding indicates that increased staffing and financial capacity facilitate the provision of music education. The analysis also reveals strong positive correlations at the high school level between higher financial allocations and the presence of white students, indicating that schools with a predominantly white student body tend to receive more funding. This observation supports Hypothesis 4, suggesting inequities in funding distribution based on racial demographics. However, this hypothesis is refuted at the middle school level, where low-income students and students from certain racial and ethnic minority groups receive more funding, which aligns with communicated goals of equity.

Contrary to Hypotheses 2 and 3, the data show that schools with higher numbers of economically and racially diverse students are more likely to allocate specialist FTE to music programs. This discrepancy suggests that, for reasons not yet known, music education is prioritized in these schools, even though they may not receive proportionally greater overall funding compared to schools with predominantly white student bodies. Therefore, despite the presence of music programs in schools serving low-income and minority students, these

programs do not necessarily translate into proportionally greater educational resources for these students. This emphasizes the need for further research to understand the underlying factors and reasons for this and indicates the necessity to investigate what specific policies and approaches are required to achieve true equity in educational resources.

Overall, this study not only highlights disparities in providing equitable music education but also showcases efforts by many schools to integrate music programs, particularly in economically and racially diverse environments. Noted limitations, such as the absence of detailed data on student participation and the need for more granular racial and ethnic categorization, underscore the necessity for more comprehensive research. Future investigations should delve deeper into the allocation of educational resources and their impact on the inclusivity and effectiveness of music education. Understanding the relationship between the quality of music programs and educational outcomes could further elucidate the role of music education within the broader educational landscape, especially for students most in need of support. Further research is also recommended to explore the links between physical, mental, and social health and the presence of music programs in schools, as well as the decision-making processes behind the allocation of funding to music education.

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# Appendixes

## Appendix A: Interview transcript with Seattle Public Schools music official A and B

Nicole: Before we dive in, I'd like to confirm if it's okay with you to record this interview for use in my thesis and any subsequent publications?

Official A: Yes, that should be fine.

Nicole: Thank you!

Nicole: I believe you all gave a music program report, which was super helpful. That way I didn't have to call every school and see if they had a music program.

Nicole: But I just wanted to ask you just some questions about your experiences and your knowledge of the K-12 Seattle Public Schools. So my first question is, is music education a requirement at all elementary schools in Seattle right now?

Official A: That's a really excellent question, and I know that when Official B gets here, we put the report together for the board, but she would have been the one who presented and she'll be able to address that.

Official A: And I know that one of your wonders is which schools currently do or do not have music, whether it be elementary, K8, and then again, of course, at the secondary level, where we do have music.

Official A: Unfortunately, music is not a part of every one of our K5 or K8 schools at the elementary level. We have 73 schools and we have 62 music programs, but unfortunately, we do... We do not have that in every school because we have something called site-based management and our staffing formula, it differs.

Official A: So if a school has, let's say FTE to support specialists at a 1.5 FTE, so you'd have a full-time PE teacher to meet those state requirements of 100 minutes of physical education, health and physical education instruction. And you'd also then have a 0.5 visual arts teacher or a 0.5 music teacher.

Official A: And so if something happens within the enrollment of the school and you have more classrooms coming on board, because you have more students enrolling, then you could be given another 0.5 for specialist time. And I think you understand what I mean by specialist time, is that specialists provide that conference time and that planning time for the classroom teacher.

Official A: So you would be required them to either fill that with a visual arts person or with a music person, depending upon what other art form you already had in existence. Or if you didn't have an art form, you'd have to add an art form, and right now we have art in all of our schools, so that's art or music in all of our schools. And about I would say a good, almost 60% of our schools have both.

Official A: So we're getting there and that has been a goal of ours for a good 10 years. We would like to see art and music in all of our elementary schools, but again, under the weighted staffing model that we have, it's just not possible yet at this time.

Nicole: Got it. Okay, perfect. You were talking about, physical education requirements from the government. Is there something similar for music and arts?

Official A: That's a good question that you're asking. So as you know, there is a requirement for students in grades 1-8 that they have 100 minutes of physical education each week. We know that if you were to discuss this with other districts you would find that most of us are not meeting that 100-minute requirement, it's just very difficult to schedule.

Official A: Seattle has made a very concerted effort to try and do that to the best of their ability, which is why in all of our elementary and K-8s there is a PE teacher.

Official A: Going back to your question. So that has existed for quite some time now on the books. Recently in 2022 with Senate Bill 5878, it now requires that every student in K-5 or K-8 receive at least one term of music, visual or performing arts instruction every year that they're in school.

Official A: So it was known as Senate Bill 5878, it is now known as... Give me just one second. I wanna make sure I give you the right RCW. It's now known as RCW 288 because it is a law. It's not... There's no additional funding set to it, there is no specifics as to how you must implement this within your district. There's a little bit of flexibility.

Official A: So within Seattle Public Schools, we have determined that at the elementary level, that means that every student will need to have at least one year, every year they will have to have experience in music or visual arts at the elementary level.

Official A: And at the secondary level, meaning middle school in this particular case, they will need to have one semester of a visual or performing arts class in 6th grade, 7th grade and 8th grade, moving forward. High school, we already addressed that because of the graduation requirements.

Nicole: Perfect. Thank you so much. So I'm gonna start with elementary schools first.

Official A: Yeah, sure.

Nicole: But in the elementary schools that do have music education, would you say that the quality of it is consistent?

Official A: So I would say the quality is very high, we have great teachers, they work very collaboratively. We have something called job-like groups, and what that basically translates to is that the first Wednesday of every month for the school year, teachers have the opportunity to meet in their content and [0:06:10.7] \_\_\_\_ specific groups.

Official A: So we have a K5 music job-like group, and we have a secondary music job-like group, and we have one of course for K5 visual arts, middle school arts and high school theater and high school visual arts and media arts.

Official A: And this particular job-like group at the elementary level is facilitated by two of our strong and long-time teaching music educators at the K5 level, and it's a space where teachers can delve into their problem of practice.

Official A: They can discuss activities and lessons that they have been doing with their students such as around Black Lives Matter or Black History Month, or Filipino Heritage Month, or within the context of preparing for concerts, whether it be in the mid-year or the end of the year, so there's many topics that they cover.

Official A: They also cover social-emotional learning and tools in which they're bringing into the classroom to support our students, especially after the pandemic, as you can imagine.

Nicole: Yes.

Official A: So it is a highly collaborative group, they're very interconnected and they support each other greatly. The unfortunate thing here in Seattle Public Schools is that our curriculum that we do have for music is outdated, it was

adopted in 2011-2012, and it is not culturally relevant or responsive in many cases, so we recommend that our teachers use it as a guide for what's developmentally appropriate, but to really look strongly at the content.

Official A: The other thing I would like to share is that we've been doing for the past four years a lot of work and offering a lot of PD around our roots, culturally responsive and anti-racist arts framework, which was developed and the PDs are facilitated by teachers and teaching artists of colour.

Official A: So this document, this framework has really been critical in our work at looking at the needs of our students, the interests of our students, bringing in student voice and choice, liberalizing the curriculum in the sense that it's not teacher-directed, but it's a student engagement with the teacher.

Official A: To really make sure that the content that we're providing regardless of the grade level or the art form, that students see themselves in it, students can engage with it, and they feel as if they're seen and heard and they're welcomed into the learning space.

Nicole: Wonderful. That's great to hear. To reiterate what you said, it seems like it's kind of dependent on the site and how they would like to use their funds...

Official A: Exactly, exactly.

Nicole: Or whether they want to direct it towards music or not.

Official A: For visual arts, yes.

Nicole: Okay. I just wanna make sure I'm kind of understanding that correctly.

Official A: You are understanding correctly.

Nicole: Okay.

Nicole: I was going to ask this at the end, but I feel like this is a good time to talk about that, so have you observed any disparities and inequalities in music education amongst different schools or districts because of that difference and allocation of funds?

Official A: I think what it comes down to is when you look at some of our neighboring districts, and it's a great time for you to be asking that question of us, because Official B and I did a longitudinal study of what is happening music-wise at the elementary level in particular, with some of our neighboring districts that are similar in size as well, so looking at Spokane, Edmonds, Bellevue, Lake Washington, Vancouver, and just really thinking about what do they offer.

Official A: And what we found interesting is that within the majority of those school districts there is a set time for music class, and it's 45 minutes or 40 minutes, and it could be twice per week. And it's consistent and it's at every one of their elementary schools. So having that consistency.

Official A: And it's something we've been talking about quite a bit here, is that families and students coming in know that they're going to have music one day a week, they're gonna have visual arts one day a week, library one day a week, and science one day a week, and PE. So it's consistency and so you have that.

Official A: Whereas in our particular case, you could have a year like we did last year, where we had full-time music in one of our schools, but because of budget problems, it's reduced from full-time to part-time, so you can't see the students as much, you can't be engaged in your community as much.

Official A: And you might be a teacher who instead of serving as one school, you're now serving two, because you're divided, your FTE is full-time but you're the divided between two schools.

Official A: So I think where the challenge is, is how to build those relationships with students, how do you build a relationship with your community and with your families, and how do you really make sure that you can see your students and provide them with the best education CADs. It's challenging because you're stretched.

Nicole: Yeah, absolutely. It must be difficult for the teachers to have everything up in the air too, year to year.

Official A: It is, it is, and I admire the fact that they can juggle all these balls and they do it really well.

Nicole: Yeah. Wonderful. So I do wanna move on to middle school and high school, but I may jump back to elementary soon.

Official A: Absolutely.

Nicole: Could you talk a little bit about music education requirements for students in middle school and high schools?

Official A: Yeah. So right now there are electives, as you can imagine. We recommend currently that students at the middle school level take two semesters of an arts class, hopefully during their middle school experience.

Official A: Things will be changing with the implementation of Senate Bill 5878, but those are still... They're being announced. So I need to be careful about that. So principals are just, and communities are just learning about that.

Official A: But there are gonna be shifts to align with the law because the law states that every student in 6th, 7th and 8th grade must take a visual performing arts class moving forward one semester every year. So there are gonna be some shifts.

Official A: But right now, students are taking the arts, we have visual arts, we have music. Where we're a little bit less focused is on theater, but we want to build that out, but there are music offerings at all of our middle schools, and at a majority of our K8 schools at the middle school level.

Official A: Not all of them, unfortunately, and that has to do oftentimes with size. We have some K8s that are 45 students.

Nicole: That's right, yeah. I was seeing some where the K-8 schools had music programs in the elementary, but not for six or eight. Or like they only had for specific grades, right?

Official A: Yes, that's correct. Right.

Nicole: Okay. And then do you know off the top of your head how many music teachers we currently have in Seattle Public Schools?

Official A: I can give you an exact number, I'll go back and count for you, but I believe it's 116, but I have to go back and check. [chuckle]

Nicole: No worries at all. No worries.

Official A: No worries.

Nicole: And then, let's see. I guess a similar question of quality of music education and whether it's consistent across secondary schools, would you say?

Official A: That's an excellent question as well. I think where the quality as far as teaching the teachers, again, I really do think the world of my colleagues, they are really strong teachers. Where you get the difference between schools is if you have more than one section.

Official A: So for example, do you only have one band class and one orchestra class for your 6th through 8th graders. Or do you have ability level or tier-level classes.

Official A: So we offer at the, for the band area, for middle school, we offered introductory, premier, intermediate, and then concert band. And you do have schools as well as jazz band, and you do have schools that can provide all five of those within the day. But you also have schools that are lucky if they can provide one or two of those.

Official A: So it's not necessarily is there not instruction in that content area, there is, but there's not always that ability to actually grow as much as you would want students to grow necessarily, because it's one teacher versus two teachers, it's staffing, it's numbers of students, size of school. And you get the idea enlisting. [chuckle]

Nicole: If we had endless funding, right?

Official A: Yeah, if we had endless funding. And I could say the same for orchestra. Orchestra and band are pretty much on a similar type of course.

Official A: And here's my colleague. Hi, Official B.

Nicole: Hi.

Official B: Oh my gosh, hi.

Nicole: Hi Official B.

Official B: It's so nice to meet you. Nicole.

Nicole: It's nice to meet you too.

Official B: I apologize. It's... Oh yeah, I'm never late like this, but it was this other meeting that went over and I'm now gonna eat while we meet, if that's okay?

Nicole: Absolutely. Of course.

Official B: Okay, all right. And I'm, I'll just listen in wherever you all are and add things if it's useful.

Nicole: Okay, great. Perfect.

Official A: And I got started late because my computer decided it didn't want to function with Teams on it, so I was going back and forth with my phone. Sorry, Nicole.

Official A: We were just discussing middle school, and Nicole, if you want to say your question again, Official B might have some ideas. Or I can continue mid-bite. [chuckle]

Nicole: Yeah, sure. The question that I just asked, so we're on middle schools and high schools and their music education, but the question I just asked was, would you say the quality of music education is consistent across all schools and districts?

Official B: No. But Official A, what did you say?

Official A: I said that we have offerings, but the difference really comes down to the number of courses that we have. We have some schools that can provide five different levels of band experience, and we have some schools that have one.

Official A: And we also... The access and the ability for students to grow in that content area are challenged because you're constantly in the same level of course with beginning level students, and it's just that chance to really grow their skills.

Official A: And I would say that the same happens with orchestra and the same happens with choir, even more so with choir, because we do not have a choir at all of our schools, middle schools.

Official A: So Official B, what would you add?

Official B: Oh, so you had said district. Did you say within our district or across districts?

Nicole: Across districts. Or within district too. I'm mostly focused on Seattle Public Schools.

Official B: Okay. I would say across districts, every school district is different. And so, and some districts prioritize some arts disciplines more than others, so there's that to factor in as well.

Official B: So like at the elementary level anyway, for example, Highline focused on general music, but no visual art. They had music consistently, but no visual art for students. And I don't even know if they have general music anymore. And so I think variability, district to district.

Official B: And there's a lot of factors around that, there's like being in a rural area, having enough people that live in the area to teach a particular subject. And we also see in some smaller school districts, it's really common for the middle and high school orchestra teacher to be the same teacher, so working at two schools for example.

Official A: And we have that too within Seattle at our Denny International and Chief Sealth. It's a very symbiotic relationship and so the same teachers teach the middle school as well as the high school courses at that school, and band orchestra and choir.

Nicole: Okay. Perfect. I think... I don't wanna sound like a broken record here, 'cause I feel like I've kind of talked about this already, but just to re-state, do you believe there's enough capacity and resources right now for every interested student to participate in music programs if they would like to?

Official A: No. I mean, no. No.

Nicole: So we were talking just a little bit ago about if there was unlimited funding, how great that would be. It does seem to me that unlike a lot of programs, music programs seem to constantly have to prove their worth and why it's important in a kid's education.

Nicole: And I was just wondering if you had insight on why you might think that is?

Official B: I think I might have a slightly different perspective. I would say that I don't think music has to justify itself more than any other arts discipline. I actually think music... There's a hierarchy to the arts, it's music, visual art, theater, dance.

Official B: And within music, there's a hierarchy. You know, band, orchestra, choir. And you can see it in the FTE that is staffed at schools. I would just start... And the number of courses that are taught.

Official B: So for in our district, not every high school has a theater program. Every high school has a music program.

Official A: And fine arts program.

Official B: Yeah. You mean visual arts, Official A?

Official A: Visual arts, I mean. Sorry.

Official B: Yeah. And every school has a visual arts program. So that would be my take on that.

Nicole: I think that's a lovely answer. So overall with the arts struggling to get enough funding so that all kids can access music programs, what are your strategies to get funding?

Official A: Official B, I'm gonna hand that one to you. Is this where we dive into the creative advantage, arts in the school? What do you think?

Official B: Yeah, probably. Right now in curriculum assessment and instruction, we have leadership that believes in resources for students, and so Seattle Public Schools, any time a new elementary music or visual art program opens up, Curriculum Assessment and Instruction will buy all the instructional materials. So for music, like our percussion instruments, the curriculum that we have that is adopted.

Official B: So all of those are purchased, same for visual art. And for our elementary instrumental music program, we have a commitment from CAI. Official A's managing this, so you should probably be talking about it, Official A. So please add the nuances.

Official B: But we have a commitment for a certain amount of time, and each year Official A is buying instruments for our elementary instrumental music program, so that we can more fully... We can have a larger inventory for students to use district instruments versus renting or buying.

Official B: And then the other strategy we have for instructional materials is any time a new building opens up, that's our opportunity, and Official A spearheaded this years ago with my predecessor, schools are outfitted with like, I'm gonna say a full inventory, but it's a pretty robust inventory for music, for theater, for visual art, whether it's an elementary, middle or high.

Official B: And that's like our opportunity to really buy the instruction materials, which in visual and performing arts are things that you're using and you're wearing down or they're gone, it's paper. You know?

Official A: And then the other piece is, gosh, grants that teachers are writing, and random donors. We just got a donor that purchased \$30,000 worth of drumline materials for three of our high schools.

Official A: And we get donations all the time, of like this coming Thursday, I'm going to go see a concert baby grand that a person is donating and asking to have moved here. It's in excellent condition and we'll put it in one of our schools.

Official A: So I think what it is, getting back to your original question is, do we have to make ourselves known? We're known. I think the arts are known in Seattle.

Official A: I do want to say that this has been ongoing work and a lot of work. I would say when I stepped into my position in 2008, I don't think the arts in Seattle Public Schools had been as visible since maybe the late 1970s after the double levy failure, until 2007-2008 when Official B's predecessor Carri Campbell came on board, then I came on board.

Official A: To really start building out the vision for visual and performing arts within Seattle Public Schools, and really thinking forward about what does arts education mean for all of our students in all of our schools in our variety of communities.

Official A: And so because we've been working so closely, not only with our schools and our school communities, but with our colleagues over at the Office of Arts and Culture, we have this wonderful partnership that actually I

think allows us to be able to share the incredible work that is happening in our schools. And so people see that, and that's the way they're like, "Oh, I wanna get involved. Oh, I wanna give. Oh, I've learned more about this."

Official A: And so I don't think we have to make a case for our existence, I think we have to make a case for what we need to support the continuing of our existence and serving all of our students. Which goes back to making sure that every student who walks through our door that says, "I need a flute," great, I got a flute for you.

Official A: And not only a flute, but a functioning flute that actually you can immediately pick up and use. And that's critical because that wasn't exactly existing when I stepped into this role.

Official A: And so I don't know, what else would you like to add, Official B, to that?

Official B: Really well said, Official A.

Official A: Thanks. And the other thing I'd like to point out is I know your focus is on music, but the other thing I'd like to say is that, boy, Official B and I have worked really hard in hopefully making it so that all of our arts teachers know that regardless of the fact that I am a music educator by training, Official B is an amazing theater artist by training, it doesn't matter, we care about all the art forms because that's what our students need and want. And really at the end of the day, it's our students that are top of mind.

Official A: And so we really try to foster this collaborative cross-cultural, cross-discipline culture here in Seattle Public Schools, because we know that we teach better when we work together.

Nicole: Absolutely, yeah. No, so just as a background, so I'm a Piano Performance Master's student, but I'm also a Public Health Master's student, so I'm just kind of trying to tie both of those in, and I love seeing the work that public schools are doing.

Nicole: That's my whole thing, is to try and make all this public and make sure that every child can access music, just like you were saying.

Official A: Absolutely. Absolutely.

Nicole: I'm a big arts lover in general, so it's really great to see some of the arts that are traditionally, I guess sometimes often ignored, to see people really fight for those.

Nicole: But I guess I wanna move to... I would love to ask my earlier question this time to Official B, but it was about if you've noticed any disparities or inequalities in music education among different schools in Seattle Public School district? And maybe in which schools, and why you might think that is?

Official A: Official B, you're muted. That's okay.

Official B: I'm gonna repeat the question.

Nicole: Yeah.

Official B: So you're asking, do I notice a disparity in music programs at different schools in our district?

Nicole: Yeah.

Official B: And then... Okay. And then my interpretation, where some schools have more and some schools have less?

Nicole: Yes. Mm-hmm.

Official B: Yes, yes. Definitely. One thing I'll share, we... And Official A may have already shared this. Did you talk about the course-taking indexes?

Official A: No, I did not. I waited for you to be here.

Official B: Oh, okay. So we track course-taking patterns by race and ethnicity at the middle and high school level, and one of the things that we notice, in music and in theater too, is that our courses are under-represented by Black students, Latinx students, students of color for this from educational justice, and are more populated by our White and or Asian students.

Official B: And so that is consistent at all of our schools. And this is based on proportionality, so based on the number of students you have, you're looking to see some proportionality based on the percentage of students by race. So we know we, right there, in terms of students that are being served in buildings across the district, that's a growth area for us.

Official B: And then you can also see in terms of schools' FTE. So at Rainier Beach last year, and that these are no fault things, like schools are having to make some really tough decisions. We are in a budget deficit. We have another, I think 130 that has to be cut from the budget for next year.

Official B: So they had a full-time music teacher, one teacher that was teaching, what were the subject areas?

Official A: Band, orchestra. They had two sections of orchestra, then they had a general music class, a music survey class, and then they had a percussion ensemble class. And they had to reduce it down from a 1.0 to a 0.6, so they combined the orchestra class and the band class together and made a percussion ensemble class and a music survey class.

Official A: And then the teacher who was there last year is now at another school, and they brought in a new teacher who's doing a fantastic job. Of course, all the teachers are amazing.

Official A: And they added another 0.2 this person's job, their FTE near the beginning of the school year. So now they're teaching two sections of music survey, one orchestra, and one drumline class.

Official B: And then you'll have another school that will have three teachers, a full-time band, a full-time orchestra, and a part-time choir, serving students. And so it's very inequitable.

Official B: A lot of this is driven by FTE allocations to schools that's based on enrollment. If you have more students, you get more FTE, you have more options. Versus if you have fewer students, fewer options.

Official B: So there's also like, that you have one teacher teaching all of these different genres of music, and so you're not getting necessarily the level of expertise that you are if it is a band teacher teaching band sections, like you might have at another school.

Official B: So there's, so in terms of resources, you're seeing a difference even in the number of courses and the ability for a student to progress, so you're combining a more beginning level and at a more advanced level into one section, so the teacher's having to differentiate, whereas students at another school will be able to progress each year. They can keep moving up and up and up in that vertical alignment.

Official A: Yeah. The other challenge too, is that as you know as a music educator and a musician yourself, there's so many facets of music. You may be somebody who specialized in band, that's your focus area, now you doing choir and strings and everything else.

Official A: And so that's really pulling on a teacher and asking them sometimes to do four or five different preps for one day of class, and so that's very... I would say it's very stressful, it really asks a lot of teachers, and it leads to teachers moving on to other positions once they open up that are not as involved or stressful. Or those who say, figure out how to make it work.

Official A: So I think that's a challenge too, because then when you have a constant revolving door of teachers, we know how that impacts students, those relationships no longer exist, students decide, "Well, I'm not gonna take it."

Official B: And the other thing I'll add is boosters. So boosters are funding things like instruments, coaches, come in during the school day, field trips, plane tickets, fees.

Official B: And so we also see some of our students having these experiences, and then students at our other schools not having any of these. Maybe some of the local ones. But we're dealing with a different... I mean, this is Seattle, it's like the socio-economic divide is huge.

Nicole: Oh, absolutely. And for middle school and high school is there an audition process to get into band and orchestra and choir?

Official A: So at the middle school level, we spent quite a bit of time, right before and during the pandemic, revising our course descriptions so that they would be more student-friendly and remove as many barriers as possible.

Official A: So at the middle school level, if you looked at our course descriptors, you would never see the word "audition".

Nicole: Okay.

Official A: It's something that we tried to move away from to some degree within high school, I don't think we were successful with the upper level courses, but it's something that's on our mind.

Official A: And that's the challenge, as you can imagine, because in our field there's always that audition process and that fight of, "Well, what's the real world and what's not the real world?" It's like, "Well, you know, this is education, we're not supposed to be putting barriers in the way."

Official A: But no, at the middle school level, no. It should be based on, what have you been doing? Have you already done a band class, choir class or orchestra class? Then you should be going to the next level of class. It's the progression of learning, and that's how we would like it to be seen.

Official A: And to have that dialogue with your teacher, because you may be somebody who's coming in to middle school and you've had a year's worth experience playing the flute, and you may not feel ready to go into that next level of band class, so you should have the right to say the teacher, "You know, I'd really like to take the Beginning again, because I'd like to get another chance at it."

Official A: And so that's where we're hoping that these jobs... Sorry. Course descriptions are going to help students and teachers, again, build that relationship and talk to each other to determine what's best for the child.

Nicole: So I guess, would you say it's more of a first come, first serve thing, just in case there are more students who want to be in those classes than there are seats available?

Official A: No, we actually don't have any limits as far as class size at the secondary level. Within our contract, our... Gosh, our CBA. I can't remember what the acronym stands for. I must be tired today. [chuckle]

Official A: But for the electives such as music, at the secondary level, there are no limits. So if your room can hold 100 kids and you have 100 kids in your beginning band, good luck to you.

Nicole: Okay. That's great to know.

Official B: Official A, would you say that our teachers in music want that?

Official A: Yes, they do. Yes. I would say it's kind of a mixed bag. Yes, they do want it, but they want it to be a number of students in a class that they can serve and serve well.

Official A: So for beginning, you wouldn't want a 100 kids in your beginning level class, you would want that to be smaller, more intimate, so that you could meet those introductory needs that students have.

Official A: Now, at your advance level, it's your concert band level at middle school and your wind ensemble level at high school, those are the top level bands, yeah, you probably do want 60, 70 kids in those groups.

Official A: We do have... Some of our middle schools have as many as 75 students in concert band, or 100 kids in concert band, 80 kids in concert band, and some of them are 50. But in the beginning level, what they try to do, and I'm sure you're familiar with this, is keep those higher level courses higher in enrollment numbers, so it can offset and allow you to have those smaller beginning level classes, if that makes sense.

Nicole: Yes, absolutely. Perfect. And then I wanted to ask a few questions about the data that you compiled for that board meeting. So I noticed for elementary schools, some schools had instrumental music, but they did not have general music. Is that correct?

Official B: Yes.

Nicole: Okay. So general music, could you just kinda give me a description on those three categories... Or those two categories, instrumental music versus general music, and what kinds of students are in those? Is it all students, or is it just whoever wants to sign up?

Official B: So general music is for K5, and so how our system works, I'm gonna use a bunch of systems jargon, so feel free to ask questions. Our school in our district uses a, it's called weighted staffing standard, which is basically based on enrollment, like however many students you have, this is just elementary, you get a certain amount of classroom teachers.

Official B: And based on those classroom teachers, you get a certain amount of FTE for your specialists. Your specialists are like physical education, general music and visual art, for example.

Official B: And so schools will decide how they wanna use that WSS. The other acronym I'm gonna add is PCP, planning conference and preparation time.

Official B: So those specialists, students go to music class, and that classroom teacher gets their 30 or 40 minute break for the week to do planning, do emails, prep curriculum. And so that's how it functions in our district.

Official B: And because of that, schools can decide if they want music or visual art. And they have to... Things are changing because of Senate Bill 5878, which is... Did you guys already talk about that? Or shared about that?

Nicole: Yeah.

Official B: Okay. So what it's looking like for us moving forward is it will be a requirement for students to try and meet the 100-minute physical education requirement, and for there to be at least one visual or performing art. So yeah, a school could decide to focus on visual art and not have general music.

Nicole: Okay.

Official B: Whereas with elementary instrumental music, we teach seven primary instruments, it's for 4th and 5th graders, with 5th graders prioritised, so that they can move into middle school.

Official B: It is, every school in our district gets a 0.1 FTE, so that's one half day of instruction, which is about three to four sections that are 30 to 40 minutes long and have about 40 students in it.

Official B: We try and keep the classes at about, maxing out at about 12 students because it's beginning sections. So it means we have to do a lottery model, so you could have 80 kids that submit forms for EIM, and about 40 will get in and the rest have to be told they can't get into EIM.

Official B: So it's an inequitable model. We really do our best with our teachers, some of our teachers are at nine schools.

Nicole: Right. That's a lot.

Official B: Yeah. Does that help?

Nicole: Yes.

Official B: And Official A, you can answer. But does that help answer the question you were...

Nicole: Yes, yes. Thank you.

Official B: Okay.

Official A: I have nothing to add.

Official B: I'll add one other thing. Our visual and performing arts school is for every school to have both music and visual art. And 40% of our schools... Sorry, 55% of our schools do have both. There's 73 elementaries and K8s in our system.

Nicole: Perfect.

Official A: Official B, I'm sorry, could I ask you to clarify, how many of our schools have music right now, general music right now? I'm not good at writing the number off the top of my head.

Official B: Yeah, and I misquoted in our meeting with Mike today, I got nervous and said the wrong numbers.

Nicole: I'm gonna pull up my data sheet too, 'cause I think I did the tally too based on your report, but it might be different now.

Official A: It is gonna be different. That's why I wanted to check with Official B.

Official B: Because of the, our budgeting, we put a budget guideline in the principal budget book in '24, 2016-17, where they had to staff music, visual art or PE. Prior to that, they only had to staff PE. And you could have chess, you could have yoga, you could have...

Official A: Tech.

Official B: Tech is a big one. And so this is why our system went from... I will quote the correct numbers here. And this could be, actually, you probably have the data, 'cause this is last year's data, not this year's data.

Nicole: I think I do have 2019 to 2020.

Official B: Oh, okay.

Nicole: I was going to ask if you all had an updated data sheet that you would be able to share with me, however recent? Preferably this school year. I think I'm looking at some stats from there, but even the year prior is fine too.

Official B: Okay. You would think I would just... I say this all the time. You ever just second guess yourself and because you second guess yourself, then you give the wrong information?

Nicole: Oh, all the time.

Official B: I'm notorious.

Official B: Okay. So as of last year... Yeah, I misquoted today. We have 52 general music programs, and we have 61 visual art programs. And when we started in 2012-13, before we started the Creative Advantage, which is our arts, equity and expansion initiative, we had 24 schools that had music and 24 schools that had visual art.

Nicole: Okay.

Official B: So we more than doubled.

Nicole: Yeah. That's great. That's fantastic.

Official A: How many of our schools have both, Official B? Is it...

Official B: 40.

Official A: 40. Okay, I really jumped too high on that one. Yeah, so 40.

Official B: But it's 55%.

Official A: Okay, so it's close.

Nicole: I think we can probably discuss the data sheet later, but I guess my last big question is, what are your perspectives on the impact of music education on children's physical, mental and emotional well-being? And maybe just any insights or experiences you have related to this?

Official A: Wow, that's a great question. I could go on for about an hour on that one.

Official B: Yeah.

Official A: I honestly believe that the arts, regardless of which art form we're talking about, are many times the reasons why our students get up in the morning and get themselves to school and stay in school and graduate.

Official A: I do believe that the arts are a place where students get to be themselves, to express themselves, to explore areas that they're interested in and get a chance or a break from what's going on in the general classroom or within other content areas. It's an opportunity to create, to explore, and sometimes just be themselves, their true self in that space.

Official A: I think that the arts are an amazing way in which to address social-emotional learning, and I will forward to you a link to OSPI, the social-emotional learning standards that have been aligned with the arts that unfortunately, not a lot of people know exist.

Official A: I also think that by giving students this opportunity to have access to the arts, we can see them shine in ways that maybe we would never see in another circumstance, we get to know them better and in other ways.

Official B: Because we get to know them better, we get to develop a different relationship with them, it gives us just more a chance to support them as they move further in their education.

Nicole: Okay. Great. Thank you.

Official A: Official B?

Official B: Oh Official A, you've said all the things.

[chuckle]

Official B: You know... Sure. I, in what I see, is joy and play. This year in several classrooms and to watch students problem-solve together, to watch students be kind to each other.

Official B: Like if a mistake is made or, "Oh hey, let me fix that for you." These are specifically music observations I've had. I think that just is about agency and community and a sense of identity and place and pride.

Official B: At the elementary level, there's so much physical movement that happens in our music classes, and an opportunity to utilize many different types of instruments, percussion, drum sticks, xylophone, and just watching students take that moment to try and figure out how to do something.

Official B: And it's real world, it's real practice and they're making something. So I... And just like the laughter that you hear in the classroom too. And the interactions that students have with their teacher also.

Official B: And then we also have robust arts partnerships in Seattle Public Schools, so bringing in artists from the field and teaching artists to bring in a new type of music that the teacher doesn't necessarily know but had the vision to bring somebody else in to introduce this type of music to their students. So like really looking at ways to bring the global majority into our classrooms.

Official B: But yeah, no, joy, play, sense of place, ensemble. Those are all things that, Official A, I think you said this, keep kids coming to school. So yeah. That's why I wish it would be more like equitable, right?

Nicole: Yeah, absolutely. Embracing the most human parts of us, yeah.

Official A: And that's the piece I think we have to keep explaining to folks because I don't know if they always understand that important connection for our students.

Nicole: Absolutely, yeah. I think that's the big thing that I wanna tackle is trying to prove that it is beneficial to kids, and then just kind of seeing and exploring the ways that we can make sure that kids have access to it.

Nicole: Great. I think that covers all of my questions, I believe. Was there anything either of you wanted to add before I talk about the data work, I guess, that I'm trying to do?

Official B: I was just wondering if you could send back the data I sent you?

Nicole: Yeah.

Official B: Because I just did a search and I can't find the email.

Nicole: Absolutely.

Official B: Because then I can verify if that is the most recent or if we should get you the '22-'23 data. Just show me what I sent you?

Nicole: Yeah, absolutely. I have 2019 and 2020, and I'll send you the board meeting minutes that I got off the internet. So I'll send you that.

Official B: Okay, good.

Nicole: That is going to be a chunk of my research. I am kind of looking at pre-COVID versus post-COVID, just to make sure I'm not excluding any factors, any variables.

Nicole: And then something more recent would be great, just so that I have something to compare it to and when we can kind of see all the great improvements that have happened since and how we managed out of the pandemic too. But any other just numbers that I would be able to work with would be absolutely wonderful.

Official B: Okay.

Nicole: So I'm gonna be talking to, I think SYSO and Seattle Opera, which I know, I think do a lot of work in public schools. Do you know of any other people that I may wanna talk to that you've all enjoyed working with that might add some great insight?

Official A: What do you think, Official B? Are there some partners?

Official B: There's Seattle JazzEd. There's...

Official A: Kelly Clingan, yeah.

Official B: Kelly Clingan. I was thinking... I don't know, it's an individual, but Eduardo... What is Eduardo's last name? Mendesina?

Official A: I'm looking it up. I think so. I'm looking it up, but I can put it into the chat.

Official B: He's been a teaching artist forever, and even prior to the Creative Advantage was working in a lot of our schools through arts core. It'd be interesting to see, he's an incredible practitioner percussionist, and might be interesting to see what his perspective is, just 'cause he's been in so many classes.

Official B: It's not necessarily a music class. It might be a music class, it might be all 3rd graders are gonna... And he's gonna go into the 3rd grade classrooms and we're gonna do Brazilian drumming.

Official B: So we could think on that a little bit more about what might be some maybe out of the box music entities that are working in our schools.

Nicole: Perfect.

Official A: Yeah, I'd like to think about that a bit as well.

Official B: I'm gonna have to hop off to go pick up daughter.

Nicole: No worries. No worries at all. Perfect. Thank you so much, Official B, for staying on. And then maybe we can stay in contact through email and I could get some data from you?

Official B: Mm-hmm.

Nicole: Okay.

Official B: Yeah, and I think... Yeah, we'll definitely do that. And if you wanted to have another follow-up meeting with Official A and I or both of us, yeah, we'd be happy to.

Nicole: Wonderful.

Official A: Absolutely.

Nicole: Official A, I have one last question for you, if you wouldn't mind?

Official A: Sure. Go ahead.

Nicole: Perfect. Thank you so much, Official B.

Official A: Bye, Official B.

Nicole: Just to narrow down my spreadsheet, I am looking at the... I do have access to some of the budgets, but there's quite a lot. There's the federal, there's state, there's city.

Official A: Right.

Nicole: There's stuff for instructional stuff and for not instructional. Which category do you believe I should be looking at in comparing schools and the money they're allocated?

Official A: I think staffing is a big one.

Nicole: Okay. So would you say probably like total instructional expenditure from local funds?

Official A: That's a great question. I really do think staffing is critical, and looking at how that staffing is divided in the sense of, especially at the elementary level, how much of it's going to the general classroom and then how much it is going to other. And if you can break that down.

Official A: And then looking at supplies. And that a lot of times that falls under discretionary funding, especially at the middle one and elementary level. But staffing is critical because that tells you what the...

Official A: If you see staffing decreases or increases, that tells you that there's enrollment increases or decreases. And that tells you also, there's going to be an impact on arts within the elementary level for sure.

Official A: And also secondary, we've seen reductions in our arts FTE over the last year. So I think staffing budgets.

Nicole: And most students usually stay within the district that they live in, correct?

Official A: Yes. Yes.

Nicole: Okay. Perfect.

Official A: We do have some kids like in West Seattle that go to Vashon, but not as much as it used to be before we went back to a neighborhood model.

Nicole: Okay. Perfect. Well, thank you so much.

Official A: You're welcome. And I'm gonna go through... I will email you the list of exactly how many music teachers we have right now.

Nicole: Yeah, yeah. No problem. Perfect.

Official A: You would think I would know, but I can't remember. And I'm gonna look at... I'm gonna think about some of the partners, because I think SYSO and Seattle Opera... Seattle Opera, because they do so much within a lot of different districts with their traveling offer programs, and they do a great job with that, and SYSO has been in our schools, especially here in Seattle, for so long, and neighboring districts.

Official A: And Seattle JazzED would definitely be a good place to look, 'cause Kelly was one of our music teachers at Washington Middle School, so she has that lens on both sides. And let me think about some other folks and I'll send those recommendations to you.

Nicole: Perfect. Sounds good. I'll follow-up because I am a little anxious about getting some updated numbers just so I can start the next part. [chuckle]

Official A: Absolutely. I totally understand. And reach out if there's some anomalies that come up or areas that there's questions like, "Oh, this isn't making sense." Reach out to us, because hopefully we can figure it out too. It's good for us.

Nicole: Yeah, absolutely. I hope this research will be helpful for you all too.

Official A: I hope so too. I look forward to seeing it. Because all of this is nice to have. And I'll send you the SEL standards. Are you familiar with them?

Nicole: No. I would love to learn more about them.

Official A: I will send them to you.

Nicole: Perfect. Thank you.

Official A: Yeah. Because if you're in public health, I think you might be interesting.

Nicole: Yes.

Official A: Well, let me know if you need anything else, Nicole. Sounds exciting. Thank you for your time.

Nicole: Thank you. Have a great rest of your week.

Official A: You too.

Nicole: Bye.

Official A: Bye.

## Appendix B: August 18, 2020 Board Special Meeting Music Program Report

An overview of and data on music programs at Seattle public elementary, middle, and high schools can be accessed [here](#).

## Appendix C: 2019-20 Seattle Public Schools' Funding Allocations

Financial and FTE data from Seattle Public School records can be accessed [here](#).

## Appendix D: 2019-20 Annual Enrollment Report for Seattle Public Schools

2019-2020 student enrollment data can be accessed [here](#).

## Appendix E: Washington State Report Card - Seattle School District No.

1

2019-2020 student demographic data can be accessed [here](#).

## Appendix F: Dataset

The combined data on demographics from the Washington Office of Superintendent of Public Instruction, music data from the Board Special Meeting Music Program Report, and financial and enrollment data from Seattle Public School records can be accessed [here](#).

## Appendix G: R Code

```
---  
title: "Dataset"  
author: "Nicole Stankovic"  
date: "2024-04-07"  
—  
  
# Create data  
``{r}  
Data <- read_excel("Elementary Schools Only")  
View(Data)  
data1 <- Elementary Schools Only  
``  
  
# Elementary schools and general music  
  
## Shapiro-Wilk test  
``{r}  
shapiro_test_group1 <- shapiro.test(data1$`Non-White` [data1$`General Music Presence` ==  
"0"])  
shapiro_test_group2 <- shapiro.test(data1$`Non-White` [data1$`General Music Presence` ==  
"1"])  
print(shapiro_test_group1)  
print(shapiro_test_group2)  
  
shapiro_test_group3 <- shapiro.test(data1$`Black or African American Students`  
[data1$`General Music Presence` == "0"])  
shapiro_test_group4 <- shapiro.test(data1$`Black or African American Students`  
[data1$`General Music Presence` == "1"])  
print(shapiro_test_group3)  
print(shapiro_test_group4)  
  
shapiro_test_group5 <- shapiro.test(data1$Homeless [data1$`General Music Presence` == "0"])  
shapiro_test_group6 <- shapiro.test(data1$Homeless [data1$`General Music Presence` == "1"])  
print(shapiro_test_group5)  
print(shapiro_test_group6)  
  
shapiro_test_group7 <- shapiro.test(data1$`Low-Income` [data1$`General Music Presence` ==  
"0"])
```

```
shapiro_test_group8 <- shapiro.test(data1$`Low-Income` [data1$`General Music Presence` ==  
"1"])  
print(shapiro_test_group7)  
print(shapiro_test_group8)
```

```
shapiro_test_group9 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch`  
[data1$`General Music Presence` == "0"])  
shapiro_test_group10 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch`  
[data1$`General Music Presence` == "1"])  
print(shapiro_test_group9)  
print(shapiro_test_group10)
```

```
shapiro_test_group11 <- shapiro.test(data1$`Teaching FTE` [data1$`General Music Presence` ==  
"0"])  
shapiro_test_group12 <- shapiro.test(data1$`Teaching FTE` [data1$`General Music Presence` ==  
"1"])  
print(shapiro_test_group11)  
print(shapiro_test_group12)
```

```
shapiro_test_group13 <- shapiro.test(data1$`FTE Allocation` [data1$`General Music Presence`  
== "0"])  
shapiro_test_group14 <- shapiro.test(data1$`FTE Allocation` [data1$`General Music Presence`  
== "1"])  
print(shapiro_test_group13)  
print(shapiro_test_group14)
```

```
shapiro_test_group15 <- shapiro.test(data1$`Total Budget` [data1$`General Music Presence` ==  
"0"])  
shapiro_test_group16 <- shapiro.test(data1$`Total Budget` [data1$`General Music Presence` ==  
"1"])  
print(shapiro_test_group15)  
print(shapiro_test_group16)
```

```
Shapiro_test_group17 <- shapiro.test(data1$`White` [data1$`General Music Presence` == "0"])  
shapiro_test_group18 <- shapiro.test(data1$`White` [data1$`General Music Presence` == "1"])  
print(shapiro_test_group17)  
print(shapiro_test_group18)
```

```
shapiro_test_group19 <- shapiro.test(data1$`Budget per Student` [data1$`General Music  
Presence` == "0"])
```

```

shapiro_test_group20 <- shapiro.test(data1$`Budget per Student` [data1$`General Music
Presence` == "1"])
print(shapiro_test_group19)
print(shapiro_test_group20)
```

## Independent samples t-test results
```{r}
t_test_result1 <- t.test(data1$`Non-White` ~ data1$`General Music Presence`, data = data1)
print(t_test_result1)

t_test_result2 <- t.test(data1$`Teaching FTE` ~ data1$`General Music Presence`, data = data1)
print(t_test_result2)

t_test_result3 <- t.test(data1$`FTE Allocation` ~ data1$`General Music Presence`, data = data1)
print(t_test_result3)

t_test_result4 <- t.test(data1$`Total Budget` ~ data1$`General Music Presence`, data = data1)
print(t_test_result4)
```

## Mann-Whitney U test results
```{r}
mann_whitney_test1 <- wilcox.test(data1$`Black or African American Students` ~
data1$`General Music Presence`, data = data1)
print(mann_whitney_test1)

mann_whitney_test2 <- wilcox.test(data1$`Homeless` ~ data1$`General Music Presence`, data =
data1)
print(mann_whitney_test2)

mann_whitney_test3 <- wilcox.test(data1$`Low-Income` ~ data1$`General Music Presence`,
data = data1)
print(mann_whitney_test3)

mann_whitney_test4 <- wilcox.test(data1$`Students Receiving Free and Reduced Lunch` ~
data1$`General Music Presence`, data = data1)
print(mann_whitney_test4)

mann_whitney_test5 <- wilcox.test(data1$`White` ~ data1$`General Music Presence`, data =

```

```

data1)
print(mann_whitney_test5)

mann_whitney_test6 <- wilcox.test(data1$Budget per Student ~ data1$`Budget per Student`,
data = data1)
print(mann_whitney_test6)
...

## Means, Medians, and standard deviations
```{r}
mean1 <- aggregate(data1$`Non-White` ~ data1$`General Music Presence`, data = data1, FUN =
mean)
print(mean1)
sd1 <- aggregate(data1$`Non-White` ~ data1$`General Music Presence`, data = data1, FUN =
sd)
print(sd1)

mean2 <- aggregate(data1$`Teaching FTE` ~ data1$`General Music Presence`, data = data1,
FUN = mean)
print(mean2)
sd2 <- aggregate(data1$`Teaching FTE` ~ data1$`General Music Presence`, data = data1, FUN =
sd)
print(sd2)

mean3 <- aggregate(data1$`FTE Allocation` ~ data1$`General Music Presence`, data = data1,
FUN = mean)
print(mean3)
sd3 <- aggregate(data1$`FTE Allocation` ~ data1$`General Music Presence`, data = data1, FUN
= sd)
print(sd3)

mean4 <- aggregate(data1$`Total Budget` ~ data1$`General Music Presence`, data = data1, FUN
= mean)
print(mean4)
sd_4 <- aggregate(data1$`Total Budget` ~ data1$`General Music Presence`, data = data1, FUN =
sd)
print(sd_4)

median1 <- aggregate(data1$`Black or African American Students` ~ data1$`General Music
Presence`, data = data1, FUN = median)

```

```

print(median1)

median2 <- aggregate(data1$Homeless ~ data1$`General Music Presence`, data = data1, FUN =
median)
print(median2)

median3 <- aggregate(data1$`Low-Income` ~ data1$`General Music Presence`, data = data1,
FUN = median)
print(median3)

median4 <- aggregate(data1$`Students Receiving Free and Reduced Lunch` ~ data1$`General
Music Presence`, data = data1, FUN = median)
print(median4)

median5 <- aggregate(data1$`White` ~ data1$`General Music Presence`, data = data1, FUN =
median)
print(median5)

median6 <- aggregate(data1$`Budget per Student` ~ data1$`General Music Presence`, data =
data1, FUN = median)
print(median6)
```



```

## Correlation
```{r}
library(corrplot)
library(psych)
corrdata=data.frame(data1$`FTE Allocation`, data1$White, data1$`American Indian or Alaska
Native`, data1$Asian, data1$`Black or African American Students`, data1$`Hispanic or Latino`,
data1$`Native Hawaiian or Other Pacific Islander`, data1$`Two or more races`,
data1$`Non-White`, data1$`Total Budget`, data1$`Budget per Student`, data1$`Teaching FTE`,
data1$Low Income`, data1$`Students Receiving Free and Reduced Lunch`, data1$`Homeless`)
corr.test(corrdata1$)
```

# Middle school and vocal music

# Create data
Data <- read_excel("Middle Schools Only")
View(Data)

```


```

```

data1 <- Data
Vocal <- data1$`Vocal Music Presence`
Instrumental <- data1$`Instrumental Music Presence`
...

## Shapiro-Wilk test
```{r}
shapiro_test_group1 <- shapiro.test(data1$`Non-White` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group2 <- shapiro.test(data1$`Non-White` [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group1)
print(shapiro_test_group2)

shapiro_test_group3 <- shapiro.test(data1$`Black or African American Students` [data1$`Vocal
Music Presence` == "0"])
shapiro_test_group4 <- shapiro.test(data1$`Black or African American Students` [data1$`Vocal
Music Presence` == "1"])
print(shapiro_test_group3)
print(shapiro_test_group4)

shapiro_test_group5 <- shapiro.test(data1$`Homeless` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group6 <- shapiro.test(data1$`Homeless` [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group5)
print(shapiro_test_group6)

shapiro_test_group7 <- shapiro.test(data1$`Low-Income` [data1$`Vocal Music Presence` ==
"0"])
shapiro_test_group8 <- shapiro.test(data1$`Low-Income` [data1$`Vocal Music Presence` ==
"1"])
print(shapiro_test_group7)
print(shapiro_test_group8)

shapiro_test_group9 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch`
[data1$`Vocal Music Presence` == "0"])
shapiro_test_group10 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch`
[data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group9)
print(shapiro_test_group10)

shapiro_test_group11 <- shapiro.test(data1$`Teaching FTE` [data1$`Vocal Music Presence` ==
"0"])
shapiro_test_group12 <- shapiro.test(data1$`Teaching FTE` [data1$`Vocal Music Presence` ==

```

```

"1"])
print(shapiro_test_group11)
print(shapiro_test_group12)

shapiro_test_group13 <- shapiro.test(data1$`FTE Allocation` [data1$`Vocal Music Presence` ==
"0"])
shapiro_test_group14 <- shapiro.test(data1$`FTE Allocation` [data1$`Vocal Music Presence` ==
"1"])
print(shapiro_test_group13)
print(shapiro_test_group14)

shapiro_test_group15 <- shapiro.test(data1$`Total Budget` [data1$`Vocal Music Presence` ==
"0"])
shapiro_test_group16 <- shapiro.test(data1$`Total Budget` [data1$`Vocal Music Presence` ==
"1"])
print(shapiro_test_group15)
print(shapiro_test_group16)

shapiro_test_group17 <- shapiro.test(data1$`White` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group18 <- shapiro.test(data1$`White` [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group17)
print(shapiro_test_group18)

shapiro_test_group19 <- shapiro.test(data1$`Budget per Student` [data1$`Vocal Music Presence`
== "0"])
shapiro_test_group20 <- shapiro.test(data1$`Budget per Student` [data1$`Vocal Music Presence`
== "1"])
print(shapiro_test_group19)
print(shapiro_test_group20)

## Independent samples t-test results
```{r}
t_test_result1 <- t.test(data1$`Total Budget` ~ data1$`Vocal Music Presence`, data = data1)
print(t_test_result1)

## Mann-Whitney U test
```{r}
mann_whitney_test_1 <- wilcox.test(data1$`Non-White` ~ data1$Vocal, data = data1)
print(mann_whitney_test_1)

```

```

mann_whitney_test_2 <- wilcox.test(data1$`Black or African American Students` ~
data1$Vocal, data = data1)
print(mann_whitney_test_2)

mann_whitney_test_3 <- wilcox.test(data1$Homeless ~ data1$Vocal, data = data1)
print(mann_whitney_test_3)

mann_whitney_test_4 <- wilcox.test(data1$`Low-Income` ~ data1$Vocal, data = data1)
print(mann_whitney_test_4)

mann_whitney_test_5 <- wilcox.test(data1$`Students Receiving Free and Reduced Lunch` ~
data1$Vocal, data = data1)
print(mann_whitney_test_5)

mann_whitney_test_6 <- wilcox.test(data1$`Teaching FTE` ~ data1$Vocal, data = data1)
print(mann_whitney_test_6)

mann_whitney_test_7 <- wilcox.test(data1$`FTE Allocation` ~ data1$Vocal, data = data1)
print(mann_whitney_test_7)

mann_whitney_test_8 <- wilcox.test(data1$`White` ~ data1$Vocal, data = data1)
print(mann_whitney_test_)

mann_whitney_test_9 <- wilcox.test(data1$`Budget per Student` ~ data1$Vocal, data = data1)
print(mann_whitney_test_)
...

## Means, Medians, and standard deviations
```{r}
mean1 <- aggregate(data1$`Total Budget` ~ data1$`Vocal`, data = data1, FUN = mean)
print(mean1)
sd1 <- aggregate(data1$`Total Budget` ~ data1$`Vocal`, data = data1, FUN = sd)
print(sd1)

median1 <- aggregate(data1$`Black or African American Students` ~ data1$`Vocal`, data =
data1, FUN = median)
print(median1)

median2 <- aggregate(data1$Homeless ~ data1$`Vocal`, data = data1, FUN = median)
print(median2)

```

```

median3 <- aggregate(data1$`Low-Income` ~ data1$`Vocal`, data = data1, FUN = median)
print(median3)

median4 <- aggregate(data1$`Students Receiving Free and Reduced Lunch` ~ data1$`Vocal`,
data = data1, FUN = median)
print(median4)

median5 <- aggregate(data1$`Non-White` ~ data1$`Vocal`, data = data1, FUN = median)
print(median5)

median6 <- aggregate(data1$`Teaching FTE` ~ data1$`Vocal`, data = data1, FUN = median)
print(median6)

median7 <- aggregate(data1$`FTE Allocation` ~ data1$`Vocal`, data = data1, FUN = median)
print(median7)

median8 <- aggregate(data1$`Budget per Student` ~ data1$`Vocal`, data = data1, FUN = median)
print(median8)

# Middle school and instrumental music

## Shapiro-Wilk test
```{r}
shapiro_test_group1 <- shapiro.test(data1$`Non-White` [data1$`Instrumental Music Presence`
== "0"])
shapiro_test_group2 <- shapiro.test(data1$`Non-White` [data1$`Instrumental Music Presence`
== "1"])
print(shapiro_test_group1)
print(shapiro_test_group2)

shapiro_test_group3 <- shapiro.test(data1$`Black or African American Students`
[data1$`Instrumental Music Presence` == "0"])
shapiro_test_group4 <- shapiro.test(data1$`Black or African American Students`
[data1$`Instrumental Music Presence` == "1"])
print(shapiro_test_group3)
print(shapiro_test_group4)

shapiro_test_group5 <- shapiro.test(data1$`Homeless` [data1$`Instrumental Music Presence` ==
"0"])

```

```

shapiro_test_group6 <- shapiro.test(data1$Homeless [data1$`Instrumental Music Presence` ==
"1"])
print(shapiro_test_group5)
print(shapiro_test_group6)

shapiro_test_group7 <- shapiro.test(data1$`Low-Income` [data1$`Instrumental Music Presence`
== "0"])
shapiro_test_group8 <- shapiro.test(data1$`Low-Income` [data1$`Instrumental Music Presence`
== "1"])
print(shapiro_test_group7)
print(shapiro_test_group8)

shapiro_test_group9 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch`
[data1$`Instrumental Music Presence` == "0"])
shapiro_test_group10 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch`
[data1$`Instrumental Music Presence` == "1"])
print(shapiro_test_group9)
print(shapiro_test_group10)

shapiro_test_group11 <- shapiro.test(data1$`Teaching FTE` [data1$`Instrumental Music
Presence` == "0"])
shapiro_test_group12 <- shapiro.test(data1$`Teaching FTE` [data1$`Instrumental Music
Presence` == "1"])
print(shapiro_test_group11)
print(shapiro_test_group12)

shapiro_test_group13 <- shapiro.test(data1$`FTE Allocation` [data1$`Instrumental Music
Presence` == "0"])
shapiro_test_group14 <- shapiro.test(data1$`FTE Allocation` [data1$`Instrumental Music
Presence` == "1"])
print(shapiro_test_group13)
print(shapiro_test_group14)

shapiro_test_group15 <- shapiro.test(data1$`Total Budget` [data1$`Instrumental Music
Presence` == "0"])
shapiro_test_group16 <- shapiro.test(data1$`Total Budget` [data1$`Instrumental Music
Presence` == "1"])
print(shapiro_test_group15)
print(shapiro_test_group16)

```

```

shapiro_test_group17 <- shapiro.test(data1$`White` [data1$`Instrumental Music Presence` ==
"0"])
shapiro_test_group18 <- shapiro.test(data1$`White` [data1$`Instrumental Music Presence` ==
"1"])
print(shapiro_test_group17)
print(shapiro_test_group18)

shapiro_test_group19 <- shapiro.test(data1$`Budget per Student` [data1$`Instrumental Music
Presence` == "0"])
shapiro_test_group20 <- shapiro.test(data1$`Budget per Student` [data1$`Instrumental Music
Presence` == "1"])
print(shapiro_test_group19)
print(shapiro_test_group20)

## Correlation
```{r}
library(corrplot)
library(psych)
corrdata1=data.frame(data1$`FTE Allocation`, data1$`White`, data1$`American Indian or Alaska
Native`, data1$`Asian`, data1$`Black or African American Students`, data1$`Hispanic or Latino`,
data1$`Native Hawaiian or Other Pacific Islander`, data1$`Two or more races`,
data1$`Non-White`, data1$`Total Budget`, data1$`Budget per Student`, data1$`Teaching FTE`,
data1$`Low Income`, data1$`Students Receiving Free and Reduced Lunch`, data1$`Homeless`)
corr.test(corrdata1)
```

# High school and vocal music

## Data and variables
```{r}
Data <- read_excel("High Schools Only")
View(Data)
data1 <- Data
Vocal <- data1$`Vocal Music Presence`
Instrumental <- data1$`Instrumental Music Presence`

## Shapiro-Wilk test
```{r}
shapiro_test_group1 <- shapiro.test(data1$`Non-White` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group2 <- shapiro.test(data1$`Non-White` [data1$`Vocal Music Presence` == "1"])

```

```
print(shapiro_test_group1)
print(shapiro_test_group2)
```

```
shapiro_test_group3 <- shapiro.test(data1$`Black or African American Students` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group4 <- shapiro.test(data1$`Black or African American Students` [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group3)
print(shapiro_test_group4)
```

```
shapiro_test_group5 <- shapiro.test(data1$Homeless [data1$`Vocal Music Presence` == "0"])
shapiro_test_group6 <- shapiro.test(data1$Homeless [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group5)
print(shapiro_test_group6)
```

```
shapiro_test_group7 <- shapiro.test(data1$`Low-Income` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group8 <- shapiro.test(data1$`Low-Income` [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group7)
print(shapiro_test_group8)
```

```
shapiro_test_group9 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group10 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch` [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group9)
print(shapiro_test_group10)
```

```
shapiro_test_group11 <- shapiro.test(data1$`Teaching FTE` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group12 <- shapiro.test(data1$`Teaching FTE` [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group11)
print(shapiro_test_group12)
```

```
shapiro_test_group13 <- shapiro.test(data1$`FTE Allocation` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group14 <- shapiro.test(data1$`FTE Allocation` [data1$`Vocal Music Presence` == "1"])
```

```

print(shapiro_test_group13)
print(shapiro_test_group14)

shapiro_test_group15 <- shapiro.test(data1$`Total Budget` [data1$`Vocal Music Presence` ==
"0"])
shapiro_test_group16 <- shapiro.test(data1$`Total Budget` [data1$`Vocal Music Presence` ==
"1"])
print(shapiro_test_group15)
print(shapiro_test_group16)

shapiro_test_group17 <- shapiro.test(data1$`White` [data1$`Vocal Music Presence` == "0"])
shapiro_test_group18 <- shapiro.test(data1$`White` [data1$`Vocal Music Presence` == "1"])
print(shapiro_test_group17)
print(shapiro_test_group18)

shapiro_test_group19 <- shapiro.test(data1$`Budget per Student` [data1$`Vocal Music Presence`
== "0"])
shapiro_test_group20 <- shapiro.test(data1$`Budget per Student` [data1$`Vocal Music Presence`
== "1"])
print(shapiro_test_group19)
print(shapiro_test_group20)

## Independent samples t-test results
```{r}
t_test_result1 <- t.test(data1$`White` ~ data1$`Vocal Music Presence`, data = data1)
print(t_test_result1)

t_test_result2 <- t.test(data1$`FTE Allocation` ~ data1$`Vocal Music Presence`, data = data1)
print(t_test_result2)

t_test_result3 <- t.test(data1$`Budget per Person` ~ data1$`Vocal Music Presence`, data = data1)
print(t_test_result3)

t_test_result4 <- t.test(data1$`Total Budget` ~ data1$`Vocal Music Presence`, data = data1)
print(t_test_result4)

t_test_result5 <- t.test(data1$`Low-Income` ~ data1$`Vocal Music Presence`, data = data1)
print(t_test_result5)

t_test_result6 <- t.test(data1$`Students Receiving Free and Reduced Lunch` ~ data1$`Vocal

```

```

Music Presence`, data = data1)
print(t_test_result6)
```

## Mann-Whitney U test results
```{r}
mann_whitney_test_1 <- wilcox.test(data1$`White` ~ Vocal, data = data1)
print(mann_whitney_test_1)

mann_whitney_test_2 <- wilcox.test(data1$`Low-Income` ~ Vocal, data = data1)
print(mann_whitney_test_2)

mann_whitney_test_3 <- wilcox.test(data1$`Homeless ~ Vocal, data = data1)
print(mann_whitney_test_3)

mann_whitney_test_4 <- wilcox.test(data1$`Teaching FTE` ~ Vocal, data = data1)
print(mann_whitney_test_4)
```

## Means and standard deviations
```{r}
mean1 <- aggregate(data1$`White` ~ Vocal, data = data1, FUN = mean)
print(mean1)
sd1 <- aggregate(data1$`White` ~ Vocal, data = data1, FUN = sd)
print(sd1)

mean2 <- aggregate(data1$`Students Receiving Free and Reduced Lunch` ~ Vocal, data = data1,
FUN = mean)
print(mean2)
sd2 <- aggregate(data1$`Students Receiving Free and Reduced Lunch` ~ Vocal, data = data1,
FUN = sd)
print(sd2)

mean3 <- aggregate(data1$`Low-Income` ~ Vocal, data = data1, FUN = mean)
print(mean3)
sd3 <- aggregate(data1$`Low-Income` ~ Vocal, data = data1, FUN = sd)
print(sd3)

mean4 <- aggregate(data1$`Budget per Student` ~ Vocal, data = data1, FUN = mean)
print(mean4)

```

```

sd4 <- aggregate(data1$`Budget per Student` ~ Vocal, data = data1, FUN = sd)
print(sd4)

mean5 <- aggregate(data1$`FTE Allocation` ~ Vocal, data = data1, FUN = mean)
print(mean7)
sd5 <- aggregate(data1$`FTE Allocation` ~ Vocal, data = data1, FUN = sd)
print(sd5)

mean6 <- aggregate(data1$`Total Budget` ~ Vocal, data = data1, FUN = mean)
print(mean6)
sd8 <- aggregate(data1$`Total Budget` ~ Vocal, data = data1, FUN = sd)
print(sd6)

median1 <- aggregate(data1$`Black or African American Students` ~ data1$`Vocal`, data =
data1, FUN = median)
print(median1)

median2 <- aggregate(data1$Homeless ~ data1$`Vocal`, data = data1, FUN = median)
print(median2)

median3 <- aggregate(data1$`Teaching FTE` ~ data1$`Vocal`, data = data1, FUN = median)
print(median3)

median4 <- aggregate(data1$`Non-White` ~ data1$`Vocal`, data = data1, FUN = median)
print(median4)
...

# High school and instrumental music

## Shapiro-Wilk test
```{r}
shapiro_test_group1 <- shapiro.test(data1$`Non-White` [data1$`Instrumental Music Presence`
== "0"])
shapiro_test_group2 <- shapiro.test(data1$`Non-White` [data1$`Instrumental Music Presence`
== "1"])
print(shapiro_test_group1)
print(shapiro_test_group2)

shapiro_test_group3 <- shapiro.test(data1$`Black or African American Students`
[data1$`Instrumental Music Presence` == "0"])

```

```

shapiro_test_group4 <- shapiro.test(data1$`Black or African American Students`
[data1$`Instrumental Music Presence` == "1"])
print(shapiro_test_group3)
print(shapiro_test_group4)

shapiro_test_group5 <- shapiro.test(data1$Homeless [data1$`Instrumental Music Presence` ==
"0"])
shapiro_test_group6 <- shapiro.test(data1$Homeless [data1$`Instrumental Music Presence` ==
"1"])
print(shapiro_test_group5)
print(shapiro_test_group6)

shapiro_test_group7 <- shapiro.test(data1$`Low-Income` [data1$`Instrumental Music Presence`
== "0"])
shapiro_test_group8 <- shapiro.test(data1$`Low-Income` [data1$`Instrumental Music Presence`
== "1"])
print(shapiro_test_group7)
print(shapiro_test_group8)

shapiro_test_group9 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch`
[data1$`Instrumental Music Presence` == "0"])
shapiro_test_group10 <- shapiro.test(data1$`Students Receiving Free and Reduced Lunch`
[data1$`Instrumental Music Presence` == "1"])
print(shapiro_test_group9)
print(shapiro_test_group10)

shapiro_test_group11 <- shapiro.test(data1$`Teaching FTE` [data1$`Instrumental Music
Presence` == "0"])
shapiro_test_group12 <- shapiro.test(data1$`Teaching FTE` [data1$`Instrumental Music
Presence` == "1"])
print(shapiro_test_group11)
print(shapiro_test_group12)

shapiro_test_group13 <- shapiro.test(data1$`FTE Allocation` [data1$`Instrumental Music
Presence` == "0"])
shapiro_test_group14 <- shapiro.test(data1$`FTE Allocation` [data1$`Instrumental Music
Presence` == "1"])
print(shapiro_test_group13)
print(shapiro_test_group14)

```

```

shapiro_test_group15 <- shapiro.test(data1$`Total Budget` [data1$`Instrumental Music
Presence` == "0"])
shapiro_test_group16 <- shapiro.test(data1$`Total Budget` [data1$`Instrumental Music
Presence` == "1"])
print(shapiro_test_group15)
print(shapiro_test_group16)

shapiro_test_group17 <- shapiro.test(data1$`White` [data1$`Instrumental Music Presence` ==
"0"])
shapiro_test_group18 <- shapiro.test(data1$`White` [data1$`Instrumental Music Presence` ==
"1"])
print(shapiro_test_group17)
print(shapiro_test_group18)

shapiro_test_group19 <- shapiro.test(data1$`Budget per Student` [data1$`Instrumental Music
Presence` == "0"])
shapiro_test_group20 <- shapiro.test(data1$`Budget per Student` [data1$`Instrumental Music
Presence` == "1"])
print(shapiro_test_group19)
print(shapiro_test_group20)

## Independent samples t test
```{r}
t_test_result1 <- t.test(data1$`Low-Income` ~ Instrumental, data1 = data)
print(t_test_result1)

t_test_result2 <- t.test(data1$`Students Receiving Free and Reduced Lunch` ~ Instrumental,
data1 = data)
print(t_test_result2)

t_test_result3 <- t.test(data1$`FTE Allocation` ~ Instrumental, data1 = data)
print(t_test_result3)

t_test_result4 <- t.test(data1$`Total Budget` ~ Instrumental, data1 = data)
print(t_test_result4)

t_test_result5 <- t.test(data1$`Non-White` ~ Instrumental, data1 = data)
print(t_test_result5)

t_test_result6 <- t.test(data1$`White` ~ Instrumental, data1 = data)

```

```

print(t_test_result6)

t_test_result7 <- t.test(data1$`Budget per Student` ~ Instrumental, data1 = data)
print(t_test_result7)

## Mann-Whitney U test results
```{r}
mann_whitney_test_1 <- wilcox.test(data1$`Black or African American Students` ~
Instrumental, data = data1)
print(mann_whitney_test_1)

mann_whitney_test_2 <- wilcox.test(data1$Homeless ~ Instrumental, data1 = data1)
print(mann_whitney_test_2)

mann_whitney_test_3 <- wilcox.test(data1$`Teaching FTE` ~ Instrumental, data = data1)
print(mann_whitney_test_3)

## Means, Medians, and standard deviations
```{r}
mean1 <- aggregate(data1$`White` ~ Instrumental, data = data1, FUN = mean)
print(mean1)
sd1 <- aggregate(data1$`White` ~ Instrumental, data = data1, FUN = sd)
print(sd1)

mean2 <- aggregate(data1$`Students Receiving Free and Reduced Lunch` ~ Instrumental, data =
data1, FUN = mean)
print(mean2)
sd2 <- aggregate(data1$`Students Receiving Free and Reduced Lunch` ~ Instrumental, data =
data1, FUN = sd)
print(sd2)

mean3 <- aggregate(data1$`Low-Income` ~ Instrumental, data = data1, FUN = mean)
print(mean3)
sd3 <- aggregate(data1$`Low-Income` ~ Instrumental, data = data1, FUN = sd)
print(sd3)

mean4 <- aggregate(data1$`Budget per Student` ~ Instrumental, data = data1, FUN = mean)
print(mean4)
sd4 <- aggregate(data1$`Budget per Student` ~ Instrumental, data = data1, FUN = sd)

```

```

print(sd4)

mean5 <- aggregate(data1$`FTE Allocation` ~ Instrumental, data = data1, FUN = mean)
print(mean7)
sd5 <- aggregate(data1$`FTE Allocation` ~ Instrumental, data = data1, FUN = sd)
print(sd5)

mean6 <- aggregate(data1$`Non-White` ~ Instrumental, data = data1, FUN = mean)
print(mean6)
sd8 <- aggregate(data1$`Non-White` ~ Instrumental, data = data1, FUN = sd)
print(sd6)

mean7 <- aggregate(data1$`Total Budget` ~ Instrumental, data = data1, FUN = mean)
print(mean6)
sd8 <- aggregate(data1$`Total Budget` ~ Instrumental, data = data1, FUN = sd)
print(sd6)

median1 <- aggregate(data1$`Black or African American Students` ~ data1$`Instrumental`, data
= data1, FUN = median)
print(median1)

median2 <- aggregate(data1$Homeless ~ data1$`Instrumental`, data = data1, FUN = median)
print(median2)

median3 <- aggregate(data1$`Teaching FTE` ~ data1$`Instrumental`, data = data1, FUN =
median)
print(median3)

## Correlation
```{r}
library(corrplot)
library(psych)
corrdata1$=data.frame(data1$`FTE Allocation`, data1$White, data1$`American Indian or Alaska
Native`, data1$Asian, data1$`Black or African American Students`, data1$`Hispanic or Latino`,
data1$`Native Hawaiian or Other Pacific Islander`, data1$`Two or more races`,
data1$`Non-White`, data1$`Total Budget`, data1$`Budget per Student`, data1$`Teaching FTE`,
data1$Low Income`, data1$`Students Receiving Free and Reduced Lunch`, data1$`Homeless`)
corr.test(corrdata1)
```

```



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Nicole Kuo Stankovic