

# High School Brain Health: How Sports and Music Can Form a More Brain-Healthy Student Experience

Aarith Veerabhadran<sup>1</sup> and Harris Eyre<sup>#</sup>

<sup>1</sup>Ann Arbor Pioneer High School, USA

<sup>#</sup>Advisor

## ABSTRACT

This paper investigates the link between adolescent mental health and involvement in sports and music. With a focus on preventive measures, it introduces the concept of brain health, a holistic framework intersecting cognitive development and mental health. The paper explores the roles of music and sports in enhancing high school students' brain health. Music, encompassing instrument training, therapy, and listening, proves beneficial cognitively and clinically. However, accessibility challenges, particularly for lower-income students, underscore the need for affordable education and increased support for music therapy. Parallel insights into sports highlight cognitive and mental health benefits but underscore information barriers hindering student participation. The paper proposes practical solutions, including beginner music courses, affordable instrument access, increased support for music therapy, increased access to non-competitive sports, and improved communication regarding high school sports and music. The research urges a change, recognizing brain health as integral to holistic well-being, and calls for actionable integration of music and sports into high school environments for lasting positive impact.

## **Brain Health in High School: The Importance of Music and Sports Access**

Adolescent mental health stands as a pivotal determinant shaping the future trajectory. Statistics reveal that 75% of mental health disorders manifest before the age of 25 (Kessler et al., 2007), making this age group highly susceptible to mental health struggles. Notably, a 2010 study by Merikangas et al unveiled that almost one-third of children would meet the criteria for an anxiety disorder by age 18. Moreover, it estimates that nearly half of adolescents experience a mental health disorder at some point in their lives. Adolescent mental health struggles are especially apparent in high school students, with data from the CDC indicating that over 40% of high school students express feelings of sadness or hopelessness, with 29% reporting subpar mental health, a situation that has only been exacerbated in the COVID epidemic (2021).

While there has been a sharp increase in mental health services such as counseling and therapy, there has been less discussion on how to prevent mental health struggles using proactive approaches during adolescence, especially in environments like high schools. High school environments prioritize physical fitness through improved cafeteria offerings and avenues for physical exercise, however, mental health is primarily addressed by a limited number of counselors or youth networks, such as peer-to-peer support systems.

These networks, while beneficial, are reactionary in nature. If a student is self-aware enough to ask for help, they have the current means to access a wide range of different supports. However, by focusing more on preventive solutions, schools can reduce the number of students who require these supports. Using the concept of brain health as a framework for solutions, high schools can take a number of preventive and reactionary steps to improve student mental health— especially in the areas of sports and music.

Brain health, as defined by the WHO, is the functional state across cognitive, sensory, social-emotional, behavioral, and motor domains, facilitating an individual's realization of their full potential throughout

life, regardless of the presence or absence of disorders. Brain health constitutes the intersection between mental health—pertaining to an individual’s emotional well-being—and cognitive skills, denoting the versatile abilities the brain employs for learning and problem-solving (n.d.). Prioritizing brain health is a pathway toward improving the mental health of the student population while increasing their cognitive fitness in the process.

This paper looks at the use of both sports and music as tools to improve the brain health of the high school population. It describes various benefits of both music and sports, outlines the difficulties associated with the accessibility of different aspects of both activities and proposes simple solutions that schools can put in place to counteract the difficulties encountered.

## Music and High School Brain Health

The incorporation of music into students' lives can directly impact brain health and can take on various forms through a range of approaches. The three that will be looked at in this paper are music instrument training, music therapy, and music listening.

Engaging in the process of learning a musical instrument is a multifaceted experience that involves various bodily processes working together simultaneously. One of the striking aspects of this endeavor lies in the significant cognitive workload it demands. Aspiring musicians find themselves navigating a complex mental landscape where they must concentrate on several distinct elements concurrently. Beyond the physical coordination required to manipulate the instrument itself, musicians are tasked with honing their auditory perception, deciphering musical notation, and synchronizing their movements with the rhythm and tempo of the piece. This intricate usage of cognitive functions underscores the unique mental demands placed on individuals trained in music and is supported by various studies.

One such study, conducted by James et al. in 2020, demonstrated the substantial influence of string instrument training on cognitive and sensorimotor skills. This study focused on cognitive aspects and emphasized that music learning not only has mental implications but also physical ones. Assessments involving cognitive skill tests—such as the Digit Span Test (assessing short-term and working memory), Attention Test (evaluating selective attention), Matrix Reasoning Test (measuring fluid intelligence), Color Trails Test (examining processing speed), and the Rey Auditory Verbal Test (assessing verbal memory)—showed that the experimental group, which underwent instrument learning, exhibited greater improvement over time than the control group. Researchers attributed this to the complexity of learning a string instrument, fostering cognitive development by necessitating active listening and adaptation within a group setting.

Already, many high schools around the country offer both orchestra and band programs for the students, in which students progress from basic training toward complex ensemble performances. These courses, while not explicitly focused on the areas of cognitive skill development, strengthen the cognitive foundation in the students that take it, due to the cognitive demands required of instrument playing. High schools can expand the accessibility of these courses, however, by giving more exposure to the general student population. Often, musical instrument training is highly expensive, making it significantly harder for lower-income families to access quality instruments and teachers. The effects of this are that students of lower socioeconomic status simply have less access to a process beneficial to their brain health.

Clinically, music engagement can serve as a powerful tool in mental health interventions, gaining increasing recognition within the field of psychiatry. The application of music therapy, involving both active participation and passive exposure to music, has emerged as an innovative therapeutic approach for addressing various mental health conditions, including schizophrenia. A comprehensive literature review conducted by Geretsegger et al. in 2017 underscored the substantial benefits of music as a clinical tool. Their findings revealed a significant reduction in depression and anxiety symptoms, coupled with improvements in cognitive functioning among participants who partook in music therapy.

Despite the promising outcomes of music used in a clinical context, its widespread accessibility remains a challenge. Geretsegger et al. emphasize the need for broader availability of music therapy interventions in their paper, recognizing its potential to contribute positively to mental health outcomes. Currently, the limited accessibility of diverse therapeutic options for high school students remains a pertinent issue. While traditional forms of therapy are relatively accessible to many students, music therapy is still in its early stages and lacks consistent implementation across the nation.

Simply listening to music, with no therapeutic lens, can significantly impact day-to-day mental health. Music can stimulate the reward system of the brain, which can affect the levels of the neurotransmitter dopamine. (Gustavson et al., 2021). The stimulation of the brain's reward system through music can potentially reduce the severity of mental disorders, such as depression or schizophrenia, by influencing dopamine levels. Furthermore, this stimulation of the brain's reward system can lead to motivational effects felt from engaging with music.

An article in Harvard Health penned by Lorrie Kubicek demonstrated how listening to music aids sleep, boosts motivation, facilitates self-expression, and fosters social connections. For numerous high school students, music serves as a coping mechanism during emotionally challenging situations and alleviates the monotony of daily tasks. Although these effects are challenging to study, they undeniably contribute to music's efficacy as a mental health tool.

While many high schoolers have access to day-to-day music, they are rarely allowed to use it in a classroom setting, having to relegate listening to passing time and after-school time- a time when they could in fact be connecting socially with others.

## **Sports and High School Brain Health**

Sports participation can also be linked to better brain health, and its effects can be seen as a result of the differing effects of both the physicality required, which result in cognitive development, and the athletic environment fostered, which can lead to positive changes in mental health.

Playing a sport, just like the complex process of learning a musical instrument, demands a wide range of cognitive abilities to reach proficiency. Sports require the processing of a multitude of stimuli, engaging various senses simultaneously. They must then use this sensory input to make split-second decisions under massive pressure. This process involves not only immediate reactions but also strategic thinking, as athletes usually anticipate and plan their moves. This fusion of real-time sensory processing and strategic planning makes sports a great tool for building brain health.

Even just the simple physicality required of organized athletic activity can be enough to evoke significant cognitive improvement. Research by Esteban-Cornejo et al. in 2015 establishes positive associations between physical activity and academic performance, particularly among girls. Furthermore, studies underscore that participation in team sports can predict high school students' grade point averages (Fox et al., 2010). This link shows the impact of physical activity on the cognitive skills required most often in the classroom, which in turn leads to improved academic performance.

A review by Herting and Chu (2017) further accentuates the cognitive benefits of physical activity, extending beyond academic enhancement to encompass the development of attention, planning, problem-solving, working memory, and inhibitory control skills. The review emphasizes a strong correlation between physical activities and cognitive development, substantiating the profound impact of physical activity on brain health. Beyond simply the effects of the physicality required in athletic participation, the required skills are also important in cognitive development. Tomporowski and Pesce found in 2019 that while exercise had a wide array of cognitive benefits, the skill acquisition gained independently or in tandem with the exercise in question was necessary for maximizing the cognitive benefits of sports.

Athletic participation in both competitive and non-competitive sports can also result in significant mental health improvement (Breistøl et al., 2017). In many high schools, team sports foster an immediate sense of community among members who share a common interest. The extensive time dedicated to high school sports allows ample bonding opportunities among teammates, cultivating friendships and support networks within these communities. Engaging in high school sports generates a pervasive sense of belonging among students, fostering a collective identity associated with representing the school.

A longitudinal study done by Jewett et al. in 2014 found significant improvement in the mental health of students who did sports in their adolescence. The study was done through a survey, where students reported their sport participation for 5 years through secondary school and their early adulthood mental health. The authors' results showed a statistically significant improvement in depressive symptoms, perceived stress, and self-rated mental health.

It is also important to acknowledge that competitive sports come with a sense of intense competition, especially in high school athletics. Even with a supportive team environment, which is never a guarantee with any student athletic program, athletes can often feel a sense of immense pressure to win for their team. This can induce deep-seated stress in them, ultimately harmful to their health. Despite the fact that these cases are common around the high school sports scene, they are highly dependent on things like team environment, and should not detract from the other benefits gained through athletic participation and both competitive and non-competitive sports must be encouraged.

Unfortunately, despite high school sports being generally well-funded and popularized, access to them can vary based on the affluence of the school system, the socio-economic status of the student, and simple awareness. Information about available programs can be often difficult to obtain, making it the prerogative of the student to reach out to coaches and captains, and students with few social connections can find it difficult to join a sport.

## Conclusions and Potential Solutions

Accepting brain health to be as important as physical health is a key shift that we need to make in the high school narrative. Taking care of physical, mental, social, and cognitive health within the curriculum, outside the curriculum, and throughout the high school environment can have significant benefits both short term and long term. Given the body of evidence around music (listening/playing/therapy) and sports (competitive/non-competitive) benefits to brain health, high schools must take actionable steps to integrate them into the day-to-day lives of their students.

The impact of music on brain health can be seen using various approaches, including music instrument training, music therapy, and music listening. Learning a musical instrument involves a complex cognitive workload, requiring simultaneous engagement of various bodily processes. The substantial influence of string instrument training on cognitive and sensorimotor skills has been proven, emphasizing the multifaceted benefits of music learning. Additionally, music serves as a powerful tool in clinical mental health interventions, with music therapy demonstrating significant reductions in depression and anxiety symptoms. Listening to music also contributes to day-to-day mental well-being, serving as a coping mechanism and impacting sleep, motivation, self-expression, and social connections. Music can also stimulate the brain's reward system, influencing dopamine levels, and holds potential therapeutic value for mental disorders, contributing to its efficacy as a mental health tool.

Unfortunately, there is a wide array of accessibility issues plaguing music in high school. With regard to instrument training, while many school districts around the country have music programs, music training remains inaccessible to many people, particularly those with lower socioeconomic status. This unavailability of proper musical education can be rectified by having structures in place for beginner music courses, with instruments that are free or of little charge. This would allow any interested student to learn an instrument,

setting them up to gain the brain health benefits that result from instrument training. These in-class measures can be supplemented with better support for music therapy. As it stands, music therapy is not very common in high schools, despite the numerous benefits it can have on the student population. Improving this prevalence is a long-term process that relies on the popularity of the form of therapy itself. Even so, it is a process that high schools should be actively engaged in in order to bring music therapy closer to high school students. In stark contrast to the long-term planning needed to improve student accessibility to music therapy, high schools can bring music into the classroom with relative ease. Allowing students to listen to music during working time, or outright making music a part of a teacher's classroom could help students reap the benefits of music while keeping it in a controlled environment. Students could be taught about which pieces of music are more conducive to the learning environment, without eliminating it from classrooms altogether.

Along with encouraging different forms of musical engagement, schools must also actively promote sports as a key component of high school life. Participating in sports, akin to learning a musical instrument, impacts brain health through diverse cognitive demands and a supportive environment. Organized athletic activities significantly contribute to cognitive improvement, positively linking physical activity to enhanced academic performance and various cognitive skills. Sports foster a sense of community among high school athletes and demonstrate long-term mental health benefits, including reduced depressive symptoms and stress levels, according to longitudinal studies. On the other hand, the inherent competition and pressure to win in sports may pose potential challenges to mental well-being making it important to prioritize non-competitive sports as well.

However, even with the well-funded and popularized nature of high school sports, limited accessibility persists due to a lack of information and socio-economic barriers. This can be done by simple strategies like consistent update emails to all students that involve current information about athletic programs as well as relevant dates. These updates should include things such as tryout dates, upcoming games, and how to get in touch with each sports team. With this information, the accessibility of sports to the general student would improve significantly, paving the way for students across the board to get involved in organized athletic programs, and immensely benefitting their brain health.

In summation, schools should foster an environment where music and sports are seen as key elements of brain health that aid with academic achievement as well as mental health and are integrated into the day-to-day lives of students via available infrastructure, affordable programs, and ample communication. Practical solutions include beginner music courses, affordable instrument access, increased support for music therapy, increased access to sports, and improved communication.

## Acknowledgments

I would like to thank my advisor for the valuable insight provided to me on this topic.

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