The Benefits of Musical Training on Musicians

Nigel Willacy

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Musical training is a part of many people's lives, and has improved neurological functions for musicians of various ages and experiences. Using a range of scientific research from around the world, this paper demonstrates how musical training is beneficial to musicians in physical, psychological, and biological ways. The purpose of this paper is to make research on music training more easily digestible for the average reader. Many scientific papers are difficult to comprehend, and this paper is meant to facilitate understanding the benefits of musical training. In general, with few exceptions, the findings are that musical training has a variety of effects on the brain, many of which relate to working memory and executive function. This paper will discuss the meaning of these findings, how these findings can affect musicians on a daily basis, and examine the connection between these findings and musical education.

Definitions

We define a nonmusician as less than 1 year of musical training, and musicians as people with 3 or more years of training, unless otherwise noted. An octave is a series of notes that are twelve chromatic steps between each other. An octave of a note is either half or double the pitch of the note. A chord is multiple musical pitches played simultaneously. Many of the papers read were found on Nina Kraus and Northwestern University's Brainvolts website. Brainvolts explores the way that the brain behaves in daily situations, and has an assortment of scientific papers relating to musical training.

Overview

For thousands of years, music has been used to display human emotion and to bring people together. People have always found ways to connect and have fun through creating music. Music plays a big role in human life as a storyteller, a way to speak to an audience, a mode of communication, and entertainment. While Owen (2021) shows that historians have found that the first musical instruments were flutes made from vulture bones 40,000 years ago, they also believe that humans have been making music with their voices long before the creation of the flute. Since that first flute, musical instruments and music have evolved alongside human life. Different groups have been creating different sounds with various instruments, putting music to diverse uses across the world. Studies which connect music to human biology have found that cultures often favor music that mimics human speech, and that human desire for music is based on a desire to understand speech and emotions attached to speech (Bates, 2009). This paper shows that music is linked to human life, and explains further how the study of music leads to increased life skills.

This paper answers the following research question: In what ways do the benefits of musical training on the brain affect musicians? This question encompasses a lot of things: What type of musical training has what benefits? How do age and experience affect the wide range of effects of musical training? What purpose do these studies serve in society? It will also connect the psychological, neurological, biological and physical aspects of music training to real life skills. Additionally, we can draw conclusions about what aspects of musical training might lead to these beneficial effects.

Contextualizing Research

While biological findings are less common in our research, some studies point to a biological connection between interaction with music and instrument playing. Kanduri et al. (2015) examines how 20 minutes of listening to Mozart affects musicians and nonmusicians' blood and RNA. They found that both groups had a response to the music listening, but in different ways. After listening, Musicians had 45 differentially expressed genes from nonmusicians, and more experienced musicians had 97. These results pointed to different distributions of genes between musicians and nonmusicians when listening to music. Kawasaki and Hayashi (2022) also points to biological effects of playing music. It measured the musicians' blood flow velocity to their brains during their performances of pieces with varying difficulty and familiarity levels. They found that there was the most increased velocity of blood flow when they were playing a piece for the first time.

Many of the psychological benefits of musical training are related to skills developed in musical training, so one could draw a direct connection between these benefits and a part of musical learning. In Zendel and Alain (2009), they played a buzz sound and the mistuned octave of this buzzed sound, and had participants identify when they could hear two sounds as opposed to only one. Musicians took less time to figure out when one sound versus two sounds were playing compared to nonmusicians. This could be related to the idea of chords and the fact that musicians have to identify what they are playing while there are other concurrent notes and sounds going on around them at the same time. Kraus et al. (2014) tested how musical training for 1 or 2 years affected children. They found that children who had trained for longer were better at distinguishing between hard consonant sounds like "ba" and "ga". This might also be related to musical training because musicians have to be able to identify the differences between similar sounds while playing. For example, in an orchestra or band, different instruments may be playing similar melodies, but they begin to play at different times, so it would help to be able to separate the sounds from each other.

Musical training can also aid with sound identification and one's response to sound. In Tierney et al. (2015) a 40-minute sound was played in participants' ears and the subcortical responses were monitored. Musicians had more consistent responses to the sound than nonmusicians. In Parbery-Clark et al. (2009), the sound "da" was played to participants in both noisy and quiet environments and the responses were also monitored. Musicians exhibited quicker response timing to hearing the sound than nonmusicians did.

Musical training also has links to speech and language recognition. Strait et al. (2008) monitored neurological response to human speech to determine if musicians responded differently. They found that musicians had a higher perception of emotion in speech than nonmusicians. Kraus and Nicol (2017) examines the connections between musical playing and the brain in the context of studies done by the same author and contemporaries. They put musical training into the same group as bilingualism because they are both ways of sound training that have effects on the brain. Chaddock-Heyman et al. (2021) compared musical experience and brain tissue to make analyses about connections between musical training and which parts of the brain were stronger in those with more musical experience. While many of their findings will be talked about later in this paper, the one relevant to speech and language recognition is that higher musical experience was linked to higher volume of tissue in the pars opercularis. The pars opercularis is found to be connected to language production and phonological processing, but they couldn't draw conclusions from just one MRI scan about what effects this increased volume have on the participants. While this study is linked to the proof of music experience being connected to word recognition, musical training is not linked to all

speech and language recognition skills. In Stewart and Pittman (2021), participants were given a series of tasks pertaining to new words and were tested based on how they remembered these words and then evaluated to identify a link between musicianship and performance in these tasks. The findings did not demonstrate any connection between music experience and retention of new words, possibly because musical training and semantic memory use different parts of the brain.

Lastly, musical training may aid with delaying mental decay and encouraging brain growth. Because elderly people experience brain decay at a higher rate, these studies focused on people above the age of 60. Chaddock-Heyman et al. (2021) found a plethora of results including the fact that musicians have an increased bilateral brain volume, which means they lose brain tissue at slower rates than non musician counterparts. In the Jünemann et al. (2022), elderly nonmusicians were placed into one of two classes, in which they learned to play the piano or listen to music. They were then assessed with a variety of physiological and behavioral tests. The findings showed that playing the piano for six months led to less degeneration in the fornix, which is involved in memory formation, emotional behavior, and recollection.

Although there seem to be numerous benefits to musical training, it does not always affect people in the same manner. One recurrent counterargument is that people who have more musically-inclined brains might be more drawn to music because they are better at it. If someone is skilled at identifying sounds, then they might do music that involves sound identification. Others who are not as skilled in this area might not pursue music. While this is true, there were various studies in which everyone had little to no music experience and they were randomly assigned into groups, such as Kraus et al. (2014) and Chaddock-Heyman et al. (2021). There was also a potential flaw of confirmation bias. The scientists were seeking to prove something, so they may have interpreted the data differently to prove their point. Many of the scientists believed in music education or the power of music before starting their studies, so they may have gone into an experiment with a mind searching for positive results. Another potential flaw could be publication bias, meaning that only data that showed positive effects of musical training were selected for publication.

Discussion and Conclusion

Musical training is becoming more accessible. For example, CreateCA (2019) shows that the percentage of music education enrollment in California schools grew by 1 percent over five years. Training that was once reserved to just people who had the means is now being opened up to everyone with a passion for music. Despite the increased accessibility, people are still choosing to classify music education as an insignificant part of society. Pellegrinelli (2012) shows that schools have used music education as a way to improve school rating and not to actually improve the education of students. Schools often underfund music classes with a high student to teacher ratio that is not conducive to learning (Koc & Celik, 2014). In California, “90% of elementary schools… 96% of middle schools… and 72% percent of high schools fail to provide a high quality course of study across arts disciplines” (Beutner, 2021). Even as it grows in enrollment number and accessibility, music education is being disregarded as a legitimate course of study.

The studies presented in this paper have shown that music is beneficial to society because playing music improves brain strength for musicians in various ways. Musical training helps with sound identification, speech and language recognition, and slowing mental decay. These benefits are connected to useful life skills– having strong hearing, being able to

differentiate sounds, and maintaining a sharp mind. Musical training should be an integral part of everyone's life because of these effects. In a world where musical education is often the first subject to be cut from schools due to lack of funding and resources, it is important to remember that music can make important changes to a musician, and that the effects of musical training are felt in all parts of life.

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