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## Assessment of the Impact of Music on Human Brain

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BY

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### ABSTRACT

*The study revealed the impact of music on human brain. In normal individuals as well as in patients with focal neurological lesions, reveal that music can change the state of large-scale neural systems of the human brain. The changes are not confined to brain sectors related to auditory and motor processing; they also occur in regions related to the regulation of life processes. Music is often thought of a nonverbal language, capable of communicating emotional messages. Areas of the brain have been identified that, when damaged, impact only musical skills. At the same time, while the initial sensation of the sounds that make up music is a predominantly auditory experience, the neural basis of music perception lies in several different areas of the brain and overlaps with those used in language, emotion, and motor tasks. Thus music is a complex experience that utilizes seemingly divergent abilities of the brain. The study concluded that relationship between music and human brain has become a frontier field in the study of brain science and music psychology. Music has outstanding impact on human brain development as well as cognitive and memory development. In addition, music also shows significant effect on memory enhancement in a clear molecular level. The study has further depended people's understanding of the value of music and show more in the broader development of human brain and human potential. The review of the literature warrants the conclusion that music positively impacts on human brain. One of the recommendation was that every individual, be it a child or adolescent or adult should make music part of his life.in order to enhance his brain functionality.*

**KEYWORDS: Music, Benefits of Music and Human Brain**

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### Introduction

Music has played an important part in every human culture, both past and present. People around the world respond to music in a universal way. (Deane 2019) and now, advances in neuroscience enable researchers to measure just how music impact on human brain. The interest in the impact of music on the brain has led to a new branch of research called neuromusicology which explores how the nervous system reacts to music. And the evidence of music activates every known part of the brain. (Alban, 2017). Playing, and even just listening to, music can make you smarter, happier, healthier, and more productive at all stages of life. Let's take a closer look at some of the latest findings about the ways music can

enhance the health and function of your brain. Music improves brain health and function in many ways. It makes you more productive at any age.

The rapid development of cognitive neuroscience and neuroimaging technology, there are more and more researches focused on exploring the relationship between music and its impact on the human brain. (Zhang 2018) Since music is fundamentally transmitted in the form of sound waves, its interaction with the brain waves has always been the center of many research fields. Research shows that the influence of music on people is not only emotional; it has a positive impact on brain development and cognitive development. Different states of the brain understand music in different ways, stimulating specific areas of the brain, causing corresponding physiological impact. As a result, many researchers see music as a potential therapeutic tool than a mere entertainment, for example, the potential impact of music therapy on Alzheimer's Disease, anxiety, and people with concentration deficiency. With more understanding of this research concentration, more therapeutic options could benefit a broader patient community by providing a higher living quality. Previous research shows that music can stimulate the areas relating to motor, language, and cognitive functions simultaneously, and effectively improve patients' cognitive and working memory. There's also evidence showing that music is closely connected to the stimulation of neurons and executive function of the prefrontal cortex. As a result, we seek to find out whether music could effectively improve the participants' memory function.

Since 2006, two UCF professors' neuroscientist Kiminobu Sugaya and world-renowned violinist Ayako Yonetani have been teaching one of the most popular courses in The Burnett Honors College. "Music and the Brain" explores how music impacts brain function and human behavior, including by reducing stress, pain and symptoms of depression as well as improving cognitive and motor skills, spatial-temporal learning and neurogenesis, which is the brain's ability to produce neurons. Sugaya and Yonetani teach how people with neurodegenerative diseases such as Alzheimer's and Parkinson's also respond positively to music. "Usually in the late stages, Alzheimer's patients are unresponsive," Sugaya says. "But once you put in the headphones that play [their favorite] music, their eyes light up. They start moving and sometimes singing. The effect lasts maybe 10 minutes or so even after you turn off the music." This can be seen on an MRI, where "lots of different parts of the brain light up," he says. We sat down with the professors, who are also husband and wife, and asked them to explain which parts of the brain are activated by music, (PEGASUS 2008).

### **Concept of Music**

Music, according to Alan (2009), is "the art by which a composer through a performer as an intermediary communicates to a listener, certain ideas, feelings or state of mind. It is an art of expression in sound, rhythm, melody and harmony which is pleasant to the ear. It may take the form of singing with or without an accompaniment in choral music, instrumentation or a combination of singing and playing instruments. Which has become an integral part of human emotion and could be used in advertising political campaign, radio/television, jingles and has a great influence on the lives of people". Onyeji (2012), has it that "music being a social art, it is intentionally structured to affect the people in certain

ways hence, its contribution to the construction of human social and cultural integrity". Music is a creative activity which stems from "human abilities whose raw materials of rhythm and tone awaken the sense of political awareness, religious, psychological and socio-cultural feelings" (Nwagboniwe, 2013).

Thesaurus dictionary (2019) stated that music is an art of sound in time that expresses ideas and emotions in significant forms through the elements of rhythm, melody, harmony, and color. Music is the tones or sounds employed, occurring in single line (melody) or multiple lines (harmony), and sounded or to be sounded by one or more voices or instruments, or both. musical work or compositions for singing or playing. the written or printed score of a musical composition. such scores collectively. any sweet, pleasing, or harmonious sounds or sound: the music of the waves. Music is the art of arranging sounds in time to produce a composition through the elements of melody, harmony, rhythm, and timbre. (Houghton Mifflin 2019). It is one of the cultural universal aspects of all human societies. General definitions of music include common elements such as pitch (which governs melody and harmony), rhythm (and its associated concepts tempo, meter, and articulation), dynamics (loudness and softness), and the sonic qualities of timbre and texture (which are sometimes termed the "color" of a musical sound

### **Concept of Human Brain**

The human brain is the central organ of the human nervous system, and with the spinal cord makes up the central nervous system. The brain consists of the cerebrum, the brainstem and the cerebellum. It controls most of the activities of the body, processing, integrating, and coordinating the information it receives from the sense organs, and making decisions as to the instructions sent to the rest of the body. The brain is contained in, and protected by, the skull bones of the head. (Wikipedia 2009). The brain is an amazing three-pound organ that controls all functions of the body, interprets information from the outside world, and embodies the essence of the mind and soul. Intelligence, creativity, emotion, and memory are a few of the many things governed by the brain. Protected within the skull, the brain is composed of the cerebrum, cerebellum, and brainstem.

The brain receives information through our five senses: sight, smell, touch, taste, and hearing often many at one time. It assembles the messages in a way that has meaning for us, and can store that information in our memory. The brain controls our thoughts, memory and speech, movement of the arms and legs, and the function of many organs within our body. The central nervous system (CNS) is composed of the brain and spinal cord. The peripheral nervous system (PNS) is composed of spinal nerves that branch from the spinal cord and cranial nerves that branch from the brain. (Mayfield Brain & Spine 2008). The brain directs our body's internal functions. It also integrates sensory impulses and information to form perceptions, thoughts, and memories. The brain gives us self-awareness and the ability to speak and move in the world. Its four major regions make this possible: The cerebrum, with its cerebral cortex, gives us conscious control of our actions. (Visible body 2018). The diencephalon mediates sensations, manages emotions, and commands whole internal systems. The cerebellum adjusts body movements, speech coordination, and balance, while the brain stem relays signals from the spinal cord and directs basic internal functions and reflexes.

### **Benefit of Music for the Brain**

The power of music reflects the ability to activate the emotional and reward benefit of the brain, its influence extends beyond its capacity to integrate multiple brain systems in the

unified act of music making. This integrative role may endow music with unique benefits not inherent in other activities, underscoring its evolutionary significance. Powerful amongst these is the ability of music to prime the brain for future learning, whilst more broadly promoting our individual and social wellbeing. Music benefits us by integrating the brain in unique ways, promoting our personal and social wellbeing. (Sarah 2013).

Rock and Roll Daycare (2018) Music has a power that's practically immeasurable. It transcends time and language, expresses and influences our emotions, educates and entertains, and so much more. Scientists are also beginning to understand the impact music has on our brains. Essentially, the effect is massive and it has a particularly strong influence on the brains of children.

**Enhanced Memory:** Links between music and memory are nothing new. It's been found that singing helps people learn a foreign language and that music can help bring back memories from those suffering with Alzheimer's and traumatic brain injuries; there are many more studies with similar findings. Recently, scientists have been looking at the effects of music on the brains of infants and children. Studies have found that even a year or two of musical training, such as learning to play an instrument, can improve both memory and focus in children.

Playing music with other people might be particularly influential, according to Laurel Trainor, who directs the Institute for Music and the Mind at McMaster University in Ontario, Canada. Her research indicates that musical training seems to modify the brain's auditory cortex. She suggests that playing music in concert with others requires a particularly high level of attention and memory, perhaps leading to greater effects.

**Improved Literacy:** The way that humans process sound is the same way that we process speech. Children who take music lessons can enhance their listening skills, which can then improve the way they process language. Studies have found that when children learn to play an instrument, they can gain the ability to hear and process sounds that they wouldn't hear without this training. This helps them develop "neurophysiological distinction" between certain sounds. Because the mechanisms for processing sound and speech are similar, this can lead to improve literacy as well.

**Better Spatial Reasoning Skills:** Research by psychologist Dr. Frances Rauscher and neuroscientist Gordon Shaw showed that preschoolers who took music lessons performed better on spatial and temporal reasoning tasks than preschoolers who took computer lessons instead. Similar research done by Brigham Young University indicates that engaging infants with music can have similar results. Classical music has been found to be particularly beneficial for special reasoning, in children and adults alike. For example, after listening to classical music adults can do a spatial reasoning task, such as putting a puzzle together, more quickly. This kind of effect is thought to be possible because classical music is mathematical and has a more complex structure than other types of music.

The pathways we use for classical music are the same pathways we use for spatial reasoning. However, simply listening to music—not playing it—only has temporary effects. Learning to actually play an instrument, on the other hand, has longer-lasting effects. It's

been found that children who took piano lessons for six months improved their ability to complete puzzles and do other spatial tasks by as much as 30%. It is believed that musical instruction creates new pathways in the brain.

**Increased Language Skills:** Some scientists believe that musical training can also help children learn a second language. One study suggested that music instruction could help extend the period of time that the brain is developing and processing complex auditory input. Moreover, it's known that music training enhances language-related networks in the brain and improves children's ability to detect subtle differences between sounds, which can help facilitate accurate pronunciation. Amazingly, this enhanced ability to learn another language isn't restricted to childhood; studies have found that adults who had musical training when they were children are able to learn foreign languages quicker and more easily than those who didn't have musical training in childhood.

**Higher IQs:** According to a 2006 study published in the Journal of Educational Psychology, music lessons appear to improve children's IQ and academic performance. What's more, the longer children study music, the larger the effect. This is not the first time this link has been found; it was also found that six year olds who had a year of voice or piano lessons had a larger increase in their IQ than another group who waited a year for music lessons.

The 2006 study found that for children, music lessons were positively correlated with higher school grades and higher scores on achievement tests. It also found that musical instruction was a predictor of higher IQs in young adulthood as well as higher high school grades. Music has a power that's practically immeasurable. It transcends time and language, expresses and influences our emotions, educates and entertains, and so much more. Scientists are also beginning to understand the impact music has on our brains. Essentially, the effect is massive and it has a particularly strong influence on the brains of children.

Baedeker (2013) recent research underscores how playing an instrument (sooner than later) bolsters kids' academic, social, and emotional lives. Such cuts to music education are particularly ironic given the growing body of research that underscores how music engages many of same areas of the brain involved in language processing, memory, and other critical thinking skills essential for academic success. Music also appears to benefit kids socially and emotionally.

**Language processing:** Multiple studies indicate that the brain processes music and language in similar ways, and that music training benefits the development of a variety of language-related skills, from vocabulary building to phoneme processing. The Neurosciences Institute reports that its research has "revealed a significant degree of overlap between music and language processing," and in a 2005 study, researchers at Stanford University found that mastering a musical instrument improves the way the human brain processes parts of spoken language. The findings suggested that students who are struggling with language and reading skills could especially benefit from musical training.

**Memory:** The benefits of music training appear to extend to memory, too. A study by

researchers at The Chinese University of Hong Kong found that children with musical training showed better verbal memory than their peers. “When these children were followed up after a year,” the study’s authors wrote, “those who had begun or continued music training demonstrated significant verbal memory improvement.” In other words, memorizing music pieces correlated with improvements in non-musical memory, too. The enhancement of working memory in young adults via music training was further validated in a 2018 study by researchers at York University.

The correlation may stem from particular ways that music “challenges” young minds. Takako Fujioka, a scientist at the Rotman Research Institute in Toronto, Ontario, Canada, and co-author of a study that found musically trained children showed greater improvement on memory tests throughout the course of a year than their non-musically trained peers, explains that playing music “requires the brain to solve the problems of how to allocate attention and memory toward complex tasks.”

***Self-Awareness:*** Dr. Frank Wilson, a neurologist and an authority on the relationship of hand use to human cognitive development, explains that the study of music teaches children to “self-assess,” rather than to rely on external rewards. While much of our schooling focuses on grades and prizes, music can foster an internal motivation. The precision and attention required to play an instrument — the instant feedback loop that requires you to adjust your own performance — encourages an “ongoing surveillance of yourself,” Wilson says. “It leads you to become a critic of your own work, to not be satisfied with anything less than achieving what it was you intended to do.”

***Academic success:*** With all the benefits that music brings to kids’ language, math, memory and self-assessment, it’s little surprise that there is a strong correlation between music and general academic success. Studies have shown that students in music programs scored higher in English and math than students who had no music at all, and high school students with music training scored higher than their non-musical peers on the SAT, according to the College Board. A 1994 survey even found that music majors, as a group, had the highest acceptance rate to medical school.

***Long-term success:*** Students with music training tend to rank higher in common measures of long-term success such as educational attainment and income: a 2007 poll by Harris Interactive found that nearly nine out of ten people with post -graduate education had participated in music while in school, and 83 percent of those with incomes of \$150,000 or more had had music education. The College Board’s 2006 study also found that high school students who participated in band or orchestra reported the lowest lifetime and current use of drugs and alcohol.

### **Impact of Music on Human Brain**

Music is considered as a popular source of enjoyment as well as a powerful motivation for the human brain waves. Nowadays, music can be easily accessed using the internet with the help of smart phones and other devices. Music features vary with type and genre of music and therefore produce different effect on the brain signals; for example, slow and

quiet classical music can be used for relaxation (Labbé, Schmidt, Babin, & Pharr, 2007). With the help of advanced techniques developed for neuro imaging, it is easy to understand the behavior of brain and the effect of music on the brain.

The brain is a special structure developed by human beings to adapt to the needs of survival. Its main task is to collect information about the internal and external environment of the body, and to process the information specifically to make decisions and responses that are suitable for the environment and for survival (Ferreri, & Rodriguez-Fornells, 2017). Music can enhance the interrelationship between EEG signals in each channel and build a network of brain functions, which can significantly improve the activity of the brain.

Music of varied kinds consistently triggers a large range of drives and emotions, which, in turn, induce a particular class of mental experiences known as feelings. The feelings are often pleasurable, though not necessarily. Neuroimaging and electrophysiological studies, in normal individuals as well as in patients with focal neurological lesions, reveal that music can change the state of large-scale neural systems of the human brain. The changes are not confined to brain sectors related to auditory and motor processing. The ease with which music leads to feelings, the predictability with which it does so, the fact that human beings of many cultures actively seek and consume music, and the evidence that early humans engaged in music practices lead us to hypothesize that music has long had a consistent relation to the neural devices of human life regulation. (Habibi, & Damasio, 2014).

Tabernacle Choir Blog (2018) stated that music has been scientifically proven to have a powerful impact on the brain. Recent research shows that music can help in many aspects of the brain, including pain reduction, stress relief, memory, and brain injuries. Scientists have found that music stimulates more parts of the brain than any other human function also music can aid in the healing and stimulation of the human brain. Music is a fundamental attribute of the human brain. Virtually all cultures, from the most primitive to the most advanced, make music. It's been true through history, and it's true throughout an individual's lifespan. In tune or not, we humans sing and hum; in time or not, we clap and sway; in step or not, we dance and bounce. The human brain and nervous system are hard-wired to distinguish music from noise and to respond to rhythm and repetition, tones and tunes. Is this a biologic accident? a varied group of studies suggests that music may enhance human brain and performance.

## **Conclusion**

The study concluded that relationship between music and human brain has become a frontier field in the study of brain science and music psychology. Music has outstanding impact on human brain development as well as cognitive and memory development. In addition, music shows significant effect on memory enhancement in a clear molecular level. The study has further presented people's understanding of the value of music and show more in the broader development of human brain and human potential. The study has also warranted the conclusion that music positively impacts on human brain.

## **Recommendations**



1. Every individual, be it child or adolescent or adult should make music part of his life.in order to enhance his brain functionality.
2. There should be application of music in every class especially the when teaching children.
3. There should be regular presentation of melody to the elderly in order to help prolong their health and lives.

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