

MUSIC LEARNING HELPS LEARNING DIFFICULTIES

Music processing has been used as a tool to better understand Autism, Attention Deficit Hyperactivity Disorder and Dyslexia from a neural perspective. The way in which the human brain processes sound has led to a greater understanding of how the human brain processes sensory information.

In all three disorders, the identification of inconsistencies and deficiencies with sound processing have enhanced our understanding of the neural behaviours associated with Autism, ADHD and Dyslexia. These fields of research are still fairly new but point to why music therapy and learning may have been effective in treating these three disorders.

Music Education and Autism (ASD)

Autism Spectrum Disorder (ASD) is a developmental disability that can cause significant social, communication and behavioural challenges. There is often nothing about how people with ASD look that sets them apart from other people, but people with ASD may communicate, interact, behave, and learn in ways that are different from most other people.

The combination of music and movement activities¹ over 8 week to 6 month periods have shown measurable improvements for children with Autism. Music interventions which combine music therapy with music learning have been found to:



Improve **communication** skills and **a family's quality of life**²



Enhance **nonverbal methods of gaining attention** such as eye gaze (joint attentions skills)⁷



Assists in improving **reward** and **emotion responses**³



Improve **social responsive** behaviours⁸



Assists in the **assessing neural circuitry** of people with ASD⁴



Decrease **social avoidant** behaviours⁹



Improve **attention** and **motor control**⁵



Facilitate **expressive language** in children with ASD¹⁰



Improve **social-emotional** development⁶



Improve **speech production** and **perception of speech prosody** and **semantics**¹¹

Music learning can be effective for ASD children for both therapeutic and educational outcomes. Children with Autism, as well as their families and carers, may benefit enormously from music learning as a therapy and these benefits have the capacity to transfer to improvements in learning outcomes.

Music Education and ADHD

Attention Deficit Hyperactivity Disorder (ADHD) is a chronic condition that affects millions of children and often continues into adulthood. ADHD includes a combination of persistent problems, such as difficulty sustaining attention, hyperactivity and impulsive behaviour.

ADHD is now understood as a mistiming between the auditory, motor and visual cortices¹². Music learning, especially on an instrument, has been found to greatly improve the timing and data processing between these three areas of the brain.

Music learning has been investigated as an effective intervention for ADD & ADHD and has found that learning on a musical instrument may:



Improve **neural connectivity** associated with **perceptual** and **sensorimotor tasks**¹³



Decrease **variability in behaviour**¹⁶



Improves **auditory processing deficits** associated with **language disorders**¹⁴



Improve **neural processing** of competing **sensory input**¹⁷



Improves **gray matter volumes** associated with **attention** and **literacy issues**¹⁵

The length of music training has a significant impact on these findings, **the longer children learn, the better**. The improvements in auditory processing on reading skills are most significant when formal music learning is commenced **between the ages of 4 and 9 years of age**.

Here is a summary of research into the typical neural development of a person with ADHD and the corresponding neural developments that have been found in musicians.

	Cognitive Function	Sensorimotor Timing	Rhythm Perception	Neural Dynamics	Neural Pathways	Neuromodulatory systems
ADHD	Deficits in attention, inhibitory control and working memory.	Increased motor timing variability, linked to poor inhibitory control.	Difficulties with beat perception and duration estimation.	Abnormal patterns of oscillatory activity across multiple frequency bands.	Decreased volumes in frontal, parietal & motor regions, including cerebellum & basal ganglia. Decreased connectivity within motor and cognitive control networks.	Disrupted dopaminergic signaling, linked to genetic variation in dopamine receptors and transporters.
Musicians	Enhanced attention, inhibitory control and working memory.	More consistent sensorimotor timing, correlated with enhanced inhibitory control.	Improved accuracy in beat perception and duration discrimination tasks.	Functional changes in oscillatory activity linked to music training, including increased coherence between frequencies.	Increased cerebellar and basal ganglia volumes. Increased connectivity within motor and cognitive control networks.	Preliminary evidence for increased dopamine receptor expression in musicians (potentially indicating genetic predisposition to music).

Source: Slater, J. L., & Tate, M. C. (2018). Timing deficits in ADHD: Insights from the neuroscience of musical rhythm. *Frontiers in Computational Neuroscience*, 12, 51.

Music Education and Dyslexia

Dyslexia is a general term for disorders that involve difficulty in learning to read or interpret words, letters, and other symbols, but that do not affect general intelligence.

Dyslexia is predominantly identified and diagnosed after a child begins to experience difficulties with reading between the age of 5-7 years old. Music has been used as a tool to help identify bio and behavioural markers for dyslexia prior to the reading age. The reason for this is because music learners exhibit enhanced processing in many of the same areas that dyslexic children have deficiencies. Music therapy and learning may:



Improve **auditory perception abilities** connected with reading difficulties¹⁸



Improve **impaired perception of speech** in background noise²¹



Locating a **biomarker for dyslexia**¹⁹



Improve **difficulties directing and switching auditory attention**²²



Amend **abnormal neural representation** of speech²⁰

It has also been suggested that in the research that the study of music processing and Dyslexia may enhance our understanding of the disorder. It has also be suggested that the use of music learning, especially rhythm learning, may be an effective intervention tool for dyslexic children in their pre-literacy and initial literacy periods of learning.

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