



Nature versus Nurture and the Role Music Plays in Brain Development

CLINICIANS:

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Music and the Brain: The Cognition of Music

Scientific Research and Data

- Recent data has shown that music positively influences the brain of young children and the structural changes that develop persist over time.
- Research has shown that there are positive correlations between musical training and reading, music influences spatial-temporal abilities, improves speech prosody, increases verbal memory, contributes to second language phonological proficiency, and increases general intelligence.
- There is data to support that all areas of the brain are involved and that these areas cross talk with each other when music is being learned and practiced.
- There is also evidence stating that music learning can protect cognition against normal decline in older age as well as protect or even delay the onset of dementia, enhance writing performances in children with developmental dyslexia and non-dyslexic children, and can even contribute to regeneration of brain function after neuro-devastating illnesses such as strokes.
- While there is much research conducted as to how music enhances cognition, much is still not known exactly how this occurs.
 - o Main theory: Brain plasticity- communication of neurons with each other that changes with time and experience; the brain adapts and these structural adaptations can be imaged and statistically measured.
- Efforts have been made to try to measure the effects of music: the volume of grey matter or brain has been shown to be increased relative to musicians and non-musicians, and even relative to amateur musicians to those who are experienced: more practice = more neurons.
- Molecular techniques using animal models as a method of study have shown that certain genes and their downstream regulators and proteins are up-regulated with the learning and practice of music.
 - o These include:
 - NMDA Receptor 2 B (NR2B)- has been shown to be involved in long-term potentiation of learned skills. Its ligand is the neurotransmitter glutamate, which is released in response to learning and memory.
 - Tyrosine kinase receptors A and B (TrK A/B) and their ligand Brain-Derived Neurotrophic Factor (BDNF)- involved in growth of neurons and their development with learning.
 - N-acetyl-aspartate (NAA)- synthesized in the mitochondria and is a contributor to energy production in cells→ increased as more cells are using more energy with music learning; has been shown to be a marker for creativity.
- A recent study found 454 genes in cortex (200 genes up-regulated and 254 genes down-regulated) and 437 genes in hippocampus (256 genes up-regulated and 181 genes down-regulated) were significantly affected in music-exposing mice, which mainly involved in ion channel activity and/or synaptic transmission, cytoskeleton, development, transcription, hormone activity supporting that multiple cellular processes are involved and may be more than was previously thought

Integrating Science and Music Education

- May be prudent to:
 - o Accept that most people don't understand the WHYs and HOWs of music education
 - o Work to educate:
 - Other individual music educators
 - Students
 - Administrators/Decision-makers
 - Parents/Community
- Individual Educator:
 - o Be informed: Know the research. The data concerning cognitive and other benefits of music education is impressive.
 - o Be able and willing to clearly and concisely articulate a realistic rationale for teaching music
 - o Cite the benefits of what we do and why we do it engaging in critical thinking and meaningful problem solving
 - o Don't argue your points based on feelings and emotions
- Students: Add academic rigor and comprehensive musicianship to rehearsals
 - o Explain how you're adding difficult lessons- parents and administrators respond well to this (especially in competitive districts)

- Evaluate: What are you teaching? What are they learning?
- How do these skills relate to the students' real world – school, work, and life? Inform them.
- Are your students passing their other courses? This goes beyond being eligible for your next contest or performance.
- Administrators: know the “State of your Program”
 - Compile and provide an annual report to communicate the goals and accomplishments of your music program
 - This should be more than just ratings and all-staters and include student academic accomplishments, leadership accomplishments, community involvement, ACT/SAT results, college acceptances, etc
 - Use standardized test results to help tell your story. Are band, choir and orchestra students scoring better than the general student population? Have your testing department help you do the research
 - Present your data in an organized form- spread sheet/word document
 - Know the people, know the processes, know the environment and know what is happening
 - Be ready to respond quickly with knowledgeable and accurate information.
- Parents: Provide opportunities for people to see and learn about the process of music making
 - Be creative
 - Engage people in the process. Anyone can be a potential constituent
 - Remember: It's about the students and their music education
 - HOW music will make them smarter, more compassionate, help with grades, etc→ you need to be ready to articulate this
 - Become a public relations / advertising specialist
 - Tell your positive music education story at every opportunity

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