

THE LINK BETWEEN MUSIC LESSONS AND IQ IN CHILDREN

For years, supporters of music education have touted the benefits of musical study for the developing brain and academic performance. The notion is, that by studying music, children will see improvement in other areas of their education. Some of the statements in popular

literature are well-founded. Others are exaggerations or lack causation, providing only correlative data. Some are determined to prove that musicians are intellectually advantaged, while others seek to disprove any connection between music and increased cognitive abilities.

Significant findings to show positive relationships between musical training and other cognitive skills have been made. Individuals with musical training tend to score better than their nonmusical counterparts on tests measuring the ability to remember lists of words¹ and prose.² There is a positive link between music lessons and reading ability,³ the sequencing of verbal information and vocabulary⁴ as well. These studies are not limited to language-related skills and show positive associations between music and spatial reasoning,⁵ math skills,⁶

nonverbal abilities,⁷ short-term memory,⁸ working memory,⁹ visual memory,¹⁰ reaction time¹¹ and tactile acuity.¹²

When intelligence is assessed by IQ, this measurement tends to remain quite stable over the course of a lifetime, and nearly half of the variance in scores can be credited to genetics.¹³ This information already suggests that a variable like music lessons (or any other isolated type of training such as math or science) is unlikely to have a substantial impact on IQ scores. More specifically, any environmental or “nurture” variable is unlikely to have much of an impact. Most studies attempting to link musical study and elevated IQ find it easy to show a correlation but nearly impossible to show causation. While a number of studies can illustrate higher IQs among children with musical training than a

Heather Nicole Winter received her doctorate, master's and bachelor's degrees in vocal music from the Indiana University Jacobs School of Music. She is an associate professor, director of lyric theater and coordinator of vocal studies.





control group not in music training, many other factors are at play: often those same children in music lessons and with higher IQs are also involved in other additional extracurricular activities, come from parents with elevated IQs and the like. The best these studies can show is a link between the two, but it may simply suggest that children with higher IQs are more likely to enroll in musical training.

In 2004, however, E. Glenn Schellenberg of the University of Toronto conducted a study with 144, 6-year-olds. These children were randomly assigned to free lessons for a period of one year. The children were divided into four groups—two music groups (keyboard lessons or vocal lessons) and two non-musical groups (drama lessons or no lessons). The children were given the Wechsler

Intelligence Scale for Children—Third Edition (WISC-III)¹⁴ before beginning lessons and prior to entry into the first grade, as well as standardized tests of academic achievement. After a year, the same children were again given the WISC-III and standardized achievement tests. The results showed higher increases in both IQ and achievement test scores among the students in music lessons than those in drama lessons or in no lessons. These appear to be the only results thus far that show music lessons actually *cause* an increase in IQ and academic performance.

Schellenberg's work is not without critics. Other psychologists have lined up to argue with his methodology and/or analysis of results.¹⁵ In 2011, Schellenberg said in response to these critiques:

On the one hand, then, there is a mountain of evidence indicating that high-functioning children are more likely than their peers to take music lessons. On the other hand, a single well-designed but artificial experiment provided evidence that one year of music lessons enhances IQ slightly among young children. Because *parsimony* and *random assignment* are both central tenets of the scientific method, must we choose between the two alternative explanations? No, because both perspectives could be correct. The available data indicate that high-functioning children are more likely than other children to take music lessons, which, in turn, exaggerate pre-existing individual differences in cognitive ability.¹⁶

THE LINK BETWEEN
MUSIC LESSONS AND IQ
 IN CHILDREN



Since the 2004 study in which he demonstrated causation, Schellenberg has continued to study the link between musical study and the brain. In 2006, he administered Wechsler Intelligence tests to 150 children and 150 adults.¹⁷ Both groups had varied amounts of musical training. Even when accounting for parents' education, family income and duration of involvement in non-musical out-of-school activities, the children in the study showed a positive correlation between months of music lessons and cognitive performance via the IQ test. It also showed a correlation between musical study and academic performance in school. Even when taking IQ out of the equation, students in music lessons showed better performance in school than nonmusical students.

But is there still something interfering with proving causation—something that makes the link between musical training and IQ indirect? In 2011, Schellenberg sought to answer that question.¹⁸ In this study, he sought to determine if the increased cognitive ability is mediated by executive



function. Executive function, which can also go by the terms executive functioning, executive control, cognitive control or the supervisory attentional system, is “a loose construct that allows for conscious, goal-directed problem solving, and, when impaired, leads to failures to make wise judgements, cognitive inflexibility, poor planning of future actions, and difficulty inhibiting inappropriate responses.”¹⁹ Increased executive functioning will improve nearly all cognitive tasks and, therefore, could be the mediator between music lessons and cognitive improvement. This would make sense because executive functioning is highly modifiable, unlike IQ, particularly in childhood,²⁰ and executive function is shown to have a positive correlation with IQ.²¹

In the 2011 study, 106 children, ages 9–12 were selected as participants, including 54 boys and 52 girls. They were recruited from a middle-to upper-middle class suburb of Toronto. Roughly half (50) were musically trained while the rest (56) were musically untrained, other than whatever musical training they had received in school. Those considered “trained” had at least two years of lessons among the 9- and 10-year-olds or at least three years of lessons among the 11- and 12-year-olds. The type of musical lessons among the trained children varied. IQ was measured via the Wechsler Abbreviated Scale of Intelligence²² and executive functioning was measured through five different tests intended to measure the different aspects of executive functioning—working memory, verbal fluency, ability to ignore conflicting information, problem solving and planning.

Preliminary analysis of the test results showed that, in general, the entire sampling of children had IQ scores higher than norms whether musically training or untrained (presumably because of the neighborhood from which the sample was derived and because these were Canadian children compared to American norms) and that the musically trained students had more highly educated parents and were engaged in more nonmusical out-of-school-activities. But, still, the principle analysis showed higher IQs among the musically trained children than their nonmusical counterparts, even when accounting for family income and involvement in nonmusical out-of-school activities.

Higher IQs were also predictive of better performance on the executive functioning tests. But, when comparing musical to nonmusical children and the executive-functioning scores were held constant, the results showed *no evidence to support the hypothesis that the link between musical training and IQ is mediated by executive functioning*. In other words, musical training had a *direct, positive* impact on IQ scores.

Why would music lessons cause an increase in IQ and/or improvement in academic achievement? The field of music neuroscience has really taken off in the last 20 years, thanks to the use of magnetic resonance imaging (MRI) technology. Scientists are regularly monitoring brain activity while individuals listen to or make music. While even listening to music lights up brain activity like a fireworks display, the *making* of music activates a multitude of neurons across the corpus collasum, which connects the two hemispheres of the brain, creating more optimal communication between the two hemispheres. Music has also been shown over and over again to have the ability to alter one's state of consciousness, change mood and energize or relax the body.²³ This puts individuals in an optimal state to tackle cognitive and other functions. How often do we see Olympic athletes with their headphones on, getting geared up to succeed? How many times do professionals sit down and listen to calming music to recharge their brain to tackle the rest of the day?

This is a lot of information for a music teacher or caregiver contemplating investing in music lessons to sift through to get to the bottom of the story. It seems that music lessons can, in fact, have some effect on IQ.²⁴ However, this is slight. The notion that higher-IQ children gravitate toward musical activities in addition to their other

activities is much clearer because IQ is quite largely based on genetics; therefore, environment has a relatively small impact. IQ as measured by standardized tests, however, is merely one possible factor in the future success of the child, and quite often considered to be far from the most important factor. The Terman Study of the Gifted²⁵ has been ongoing since the 1920s and will continue until the death of all the original participants. Following a group of 1,500 children with IQs of 140 or higher (affectionately referred to as "Termites"), Terman and those who continued his research after his death discovered some impressive ways in which certain participants excelled in life. However, those Termites were the same high-IQ individuals who were also noted as children for being goal-oriented and having perseverance. Many of those high-IQ children lacking these other qualities showed later in life to have higher rates of alcoholism and divorce and tended to make an average salary, as compared to the general population. This and other similar studies show that while high IQ can be a boost, it is not a necessarily a causative predictor of success in life. Angela Duckworth's research on "grit" show it being as essential to success—if not more so—than IQ or talent. Grit is defined as one's ability to persevere until achieving mastery. She says of grit: "the gritty individual approaches achievement as a marathon; his or her advantage is stamina."²⁶ The very nature of musical study, particularly advanced musical study, and performance leads this author to feel confident hypothesizing that there would be a strong positive correlation between musical study and grit and likely causation as well.

There is yet another critical factor that is shown to be predictive of adult success: one of the most

important findings regarding music study and the brain is that even when IQ is held constant, musical lessons are *still* connected to high academic achievement.²⁷ Simply put: **children who take music lessons are good students.** Doing well in school translates to many possible influences on success later in life. The National Association for College Admissions Counseling published a study entitled "Defining Promise: Optional Standardized Testing Policies in American College and University Admissions." The study showed that doing well in school, as evidenced by grades, was the best predictor of future success, as opposed to other admissions criteria including the various types of standardized tests—SAT, ACT and the like. While many would argue that greater success in school and music lessons are a "chicken and egg" example, Schellenberg's 2006 work shows causation for this as well—music lessons *cause* greater academic performance. Much like his 2011 response regarding IQ, the same is true regarding academic performance in school. One does not have to choose between whether better students enroll in music or music creates better students—both can be, and are shown in studies to be, true. Good students tend to enroll in music lessons then their involvement in music enhances their academics even more. An existing "good student" is often personally drawn to music for increased mental stimulation.

Music lessons are one of many extracurricular options for young children during their development. There are arguments for many other activities as critical during the development of a child. It is not the intent of this article to discredit any of these options but, rather, to illustrate some of the benefits of engaging in the music-making process as a child. It clearly has a unique and

exceptional impact on the brains of young children, leading to improved IQ, improved academic performance and improved executive functioning *in addition* to the impact it can have in physical development, discipline, social interactions and self-efficacy. Do music lessons improve IQ? Yes, they do, but this is only one small piece in the larger puzzle of how musical training in childhood shapes an individual to be primed for success later in life. ♪

Notes

1. Susanne Brandler and Thomas Rammsayer, "Differences in mental abilities between musicians and non-musicians," *Psychology of Music* 31 (2003): 123–138.
2. Lorna S. Jakobson, Samantha T. Lewycky, Andrea R. Kilgour and Brenda M. Stoesz, "Memory for verbal and visual material in highly trained musicians," *Music Perception: An Interdisciplinary Journal* 26, no. 1 (2008): 41–55.
3. Sylvain Moreno, Carlos Marques, Andreia Santos, Manuela Santos, São Luis Castro and Mireille Besson, "Musical training influences linguistic abilities in 8-year-old children: More evidence for brain plasticity," *Cerebral Cortex* 19 (2009), 712–723.
4. Joseph Piro and Camilo Ortiz, "The effect of piano lessons on the vocabulary and verbal sequencing skills of primary grade students," *Psychology of Music* 37 (2009): 325–347.
5. Vanessa Sluming, Jonathan Brooks, Matthew Howard, John Joseph Downes and Neil Roberts, "Broca's area supports enhanced visuospatial cognition in orchestral musicians," *Journal of Neuroscience* 27 (2007): 3799–3806.
6. N. Bahr and C. A. Christensen, "Inter-domain transfer between mathematical skill and musicianship," *Journal of Structural Learning and Intelligence Systems* 14 (2000): 187–197.
7. Marie Forgeard, Ellen Winner, Andrea Norton and Gottfried Schlaug, "Practicing a musical instrument in childhood is associated with enhanced verbal ability and nonverbal reasoning," *PLoS ONE* 3, no. 10 (2008): 3566.
8. A. T. Tierney, T. R. Bergeson, and D. B. Pisoni, "Effects of early musical experience on auditory sequence memory," *Empirical Musicology Review* 3 (2008): 178–186.
9. Michael Franklin, Katherine Sledge Moore, Chun-Yu Yip, John Jonides, Katie Rattray and Jeff Moher, "The effects of musical training on verbal memory," *Psychology of Music* 36 (2008), 353–365.
10. Jakobson et al.
11. Charmayne Hughes and Elizabeth Franz, "Experience-dependent effects in unimanual and bimanual reaction times tasks in musicians," *Journal of Motor Behavior* 39 (2007): 3–8.
12. Patrick Ragert, Alexander Schmidt, Eckart Altenmüller, Hubert R. Dinse, et al, "Superior tactile performance and learning in professional pianists: Evidence for meta-plasticity in musicians," *European Journal of Neuroscience* 19 (2004): 473–478.
13. Ulric Neisser, Gwyneth Boodoo, Thomas J. Bouchard, Jr., A. Wade Boykin, Nathan Brody, Stephen J. Ceci, Diane F. Loehlin, John C. Perloff, Robert Sternberg and Susana Urbina, "Intelligence: Knowns and unknowns," *American Psychologist* 51, no. 2 (1996): 77–101.
14. David Wechsler, *Wechsler Intelligence Scale for Children—Third Edition* (San Antonio, TX: 1991.)
15. S. L. Black, "Hath Music Charms to Boost the Average IQ?," *Scientific Review Of Mental Health Practice* 4, no. 2 (2005): 3–5.
16. E. Glenn Schellenberg, "Examining the association between music lessons and intelligence," *British Journal of Psychology* 102, no. 3 (2011): 287.
17. E. Glenn Schellenberg, "Long-term positive associations between music lessons and IQ," *Journal of Educational Psychology* 98 (2006): 457–468.
18. Schellenberg, "Examining the association between music lessons and intelligence."
19. Ibid., 287.
20. M. R. Rueda, M. K. Rothbart, L. Saccamanno and M. I. Posner, "Training, maturation and genetic influences on the development of executive attention," *Proceedings of the National Academy of Sciences* 102 (2005): 14931–14936.
21. Timothy A. Salthouse, "Relations between cognitive abilities and measures of executive functioning," *Neuropsychology* 19 (2005): 532–545.
22. Wechsler.
23. Yuna L. Ferguson and Kennon M. Sheldon, "Trying to be happier really can work: Two experimental studies," *The Journal of Positive Psychology* 18, no. 1 (2013): 23–33.
24. E. Glenn Schellenberg, "Music lessons enhance IQ," *Psychological Science* 15 (2004): 511–514.
25. Lewis Terman, *The Gifted Group at Mid-Life* (Stanford, CA: Stanford University Press, 1959).
26. Angela Duckworth, Christopher Peterson, Michael Matthews, and Dennis Kelly, "Grit: Perseverance and Passion for Long-Term Goals," *Journal of Personality & Social Psychology* 92, no. 6 (2007): 1087–1101.
27. E. Glenn Schellenberg, "Long-Term Positive Associations between Music Lessons and IQ," *Journal of Educational Psychology* 98, no. 2 (2006): 457–468.