

Additional Research Information Compiled by Roger Maxwell

This information, which has been presented, has led me to further examine whether there exists a correlation or association of cognitive skills between music, mathematics, reading and writing. After reading “This is Your Brain on Music” by Dr. Daniel J. Levitin, I contacted him in order to seek his advice on this question. (Dr. Levitin is a neuroscientist at McGill University, Montreal, Canada. In addition, he manages the Laboratory for Musical Perception, Cognition, and Expertise at the University. He also serves as the Bell Chair in the Department of Psychology of Electronic Communications.)

In correspondence with Dr. Levitin, he informed me that “cognitive skill can be either a collective or a specific term. He states “I think of “cognition” as information processing and all those subprocesses related to it: memory, attention, planning, perceiving and “motor action plans” – preparing and implementing muscle movement to achieve some goal.” He continues, “We talk about cognitive ability or cognitive processes when referring to the collective, and about cognitive skill when referring to a specific skill such as math, reading, etc....It’s safe to say that math, music, visual intelligence, athletics, spatial intelligence, social intelligence are all independent mental faculties.”

Simultaneously I contacted Dr. Randall Hamilton, a graduate of the University of Iowa, Department of Neurology. While at the university he studied under Drs. Antonio and Hannah DaMassio. Dr. Hamilton is a neurologist at the Mercy Medical Center, Mercy Clinics in Des Moines, Iowa. Dr. Hamilton, in attempting to answer the same the question, referred me to the peer – reviewed studies that follow. (These studies are used with the permission of The International Music Products Association (NAMM) formerly known as the American Music Conference.)

1. Studies conducted in Georgia and Texas found that middle school and high school students who participated in instrumental music scored significantly higher than their non-band peers in standardized tests. The studies found a significant correlation between the number of years of instrumental instruction and academic achievement in math, science and language arts.

Source: University of Sarasota Study, Jeffrey Lyn Kluball; East Texas State University Study, Daryl Erick Trent

2. Students who were exposed to music-based lessons scored a full 100 percent higher on fractions tests than those who learned in the conventional manner. Second – grade and third – grade students were taught fractions in an untraditional manner by teaching them basic music rhythm notations.

Source: Neurological Research, March 15, 1999

3. Music majors were found to be the most likely group of college grads to be admitted to medical school. Physician and biologist Lewis Thomas found that 66 percent of music majors who applied to medical school were admitted, the highest

percentage for any group. A study of 7,500 university students revealed that music majors scored the highest reading scores among all majors including English, biology, chemistry and math.

Source: "The Comparative Academic Abilities of Students in Education and in Other Areas of a Multi-focus University," Peter H. Wood, ERIC Document No. ED327480. "The Case for Music in the Schools," Phi Delta Kappan, February, 1994

4. Music study can help students understand advanced music concepts. A grasp of proportional math and fractions is a prerequisite to math at higher levels. Music involves ratios, fractions and proportions and thinking space and time. Second-grade students were given four months of piano keyboard training, as well as time using newly designed math software. The group scored over 27 percent higher on proportional math and fractions tests than children who used the math software.

Source: Neurological Research, March, 1999

5. Piano students are better equipped to comprehend mathematical and science concepts. A group of preschoolers received private piano keyboard lessons and singing lessons. A second group received private computer lessons. Those children who received piano/keyboard training performed 34 percent higher on tests measuring spatial-temporal ability than the others. This concept has long been considered a major obstacle in the teaching of elementary math and science.

Source: Neurological Research, February 28, 1997

6. High school music students score higher on SAT's in both verbal and math than their peers. In 2001, SAT takers with coursework/experience in music performance scored 57 points higher on the verbal portion of the test and 41 points higher on the math portion than students with no coursework/experience in the arts.

Source: Profile of SAT and Achievement Test Takers, The College Board, compiled by Music Educators National Conference, 2001

7. Music training helps under-achievers. In Rhode Island, researchers studied eight public school first grade classes. Half of the classes became "test arts" groups, receiving ongoing music and visual arts training. In kindergarten, this group had lagged behind in scholastic performance. After seven months, the students were given a standardized test. The "test arts" group had caught up to their fellow students in reading and surpassed their classmates in math by 22 percent. In the second year of the project, the arts students widened this margin ever further.

Source: Nature, May 23, 1996

8. A 2004-2005 study found that students in high – quality school music education programs score higher on standardized tests compared to students with deficient music education programs. The study conducted by Dr. Christopher Johnson, Professor of Music Education and Music Therapy and Associate Dean of the School of Fine Arts, University of Kansas analyzed test scores from 4,739 elementary and middle school students in four regions in the United States – South, East Coast, Midwest and West Coast. The breakdown of participants was 1,119 in either third or fourth grade and 3,620 in either eighth or ninth grade.

Results from the elementary schools indicated that:

- a) Students in top-quality music programs scored 22% better in English and 20% better in mathematics than students in deficient music programs.
- b) These academic differences were fairly consistent across geographical regions.
- c) Students at the four elementary schools with high quality programs scored better than students participating in programs considered to be of lower quality.

Results from the middle schools indicated that:

- a) Students in top-quality instrumental programs scored 19% higher in English than students in schools without a music program, and 32% high in English than students in a deficient choral program.
- b) Students in top-quality instrumental programs scored 17% higher in mathematics than children in schools without a music program, and 33% higher in mathematics than students in deficient choral programs.

Source: Journal for Research in Music Education, June 2007

9. A McGill University study found that pattern recognition and mental representation scores improved significantly for students given piano instruction over a three-year period.

Source: Dr. Eugenia Costa-Giomi, "The McGill Piano Project: Effects of three years of piano instruction on children's cognitive abilities, academic achievement and self-esteem," presented at the meeting of the Music Educators National Conference, Phoenix, AZ, April, 1998

10. A ten-year study, tracking more than 25,000 students, shows that music-making improves test scores. Regardless of socioeconomic background, music-making students get higher marks in standardized tests than those who had no music involvement. The test scores studied were not only standardized tests, such as the SAT, but also in reading proficiency exams.

Source: Dr. James Catterall, UCLA, 1997

ADDITIONAL IMPORTANT RESEARCH STUDIES

11. In May 2007, nearly 9,500 fourth graders in 42 of Florida's 67 counties took a first-of- its kind Florida Music Assessment (FMA) test developed by The Florida Music Educators Association and the Florida School Music Association under the guidance of the Florida Department of Education. Results of Florida's standardized test found that among music, reading, writing and math, music was the only subject in which students had an equal chance to succeed regardless of ethnicity. "Schools with higher music scores tend to have higher reading, math and writing scores," reports Timothy Brophy, associate professor of music education at the University of Florida's

school of Music and chairman of the project. The study found that the better a school performed on the FMA, the better it performed on the Florida Comprehensive Assessment Test (FCAT). James Perry, executive director of the Florida Music Educators Association commenting on the correlation between reading and particularly math scores on the FCAT and the FMA test states, "While we expected a correlation, we had no idea the correlation would be that high."

Source: Florida School Music Association as reported in the MENC publication, June 2008

12. Psychologists at the Chinese University of Hong Kong studied 90 boys between the ages of 6 and 15 to determine whether children with music training had significantly better verbal memory than their counterparts without such training. The researchers led by Agnes S. Chang, PhD, found that half of the students who had musical training as members of their school's string program, "recalled significantly more words than the untrained students."

Source: American Psychological Association, July 27, 2003

13. A special section of USA Today identified members of its 18th annual ALL-USA College Academic First Team. The 20 undergraduates were selected from 600 students nationwide and were nominated by their colleges and Universities. Five (25%) of these students were involved in music.

Source: USA Today, February 15, 2007

14. A 1973 study found 18 Iowa high school bands reducing their sight reading errors by 74% after seven weeks in reading Alfred Reed's "A Jubilant Overture." The bands concentrated their efforts to playing one rhythmic figure per week, a rhythmic figure being defined as (examples; two eighth notes, a dotted eighth followed by a sixteen, four sixteenths, a dotted quarter followed by an eighth etc.) At the conclusion of the study, bands had played eleven rhythmic figures 13,244 times. **Further, seven of the nine bands playing "Third Set for Band –E&M" by Jared Spears, did not make a sight reading error on their third reading of the work. This is a significant as there was a two week interval between each reading. Directors did not rehearse the work during these times.**

A follow up study conducted in 2003 using 9 similar type of Iowa high school bands found these bands reducing their reading errors by only 21% after seven weeks. (A condition for being accepted in the study was these bands could not have used either the junior high nor the senior high school edition of "Fourteen Weeks to a Better Band" during the previous five years). These bands made almost twice as many sight reading errors as did 18 bands thirty years earlier. Students participating in the pilot study were able to develop their cognitive skills both individually and collectively as evidenced by bands being able to reduce their reading errors by 74% in seven weeks.

Source: Roger Maxwell, November 2008

To quote Dr. Hamilton "repetition is important as it strengthens the synapses connections." (A synapse is where a nerve impulse passes from one nerve cell to another.) Dr. Levitin on p. 196 of "This is Your Brain on Music" states, "Like experts in mathematics, chess or sports, experts in music require lengthy periods of instruction

14weekstoabetterband.com

and practice in order to acquire the skills necessary to truly excel.”
Source: Roger Maxwell 2008.

15. The Wednesday March 10, 2010 issues of the Oregonian (Oregon’s major newspaper) highlights an article written by Melissa Healy (McClatchy-Tribune). She reports on research conducted by Dr. Laura Trainor, professor of psychology, neuroscience and behavior, and director of the auditory development lab of McMaster University in Hamilton, Ontario. Dr. Trainor’s research indicates “there is evidence that music changes the brain in positive and permanent ways.” Moreover, “in kids chosen randomly to get a tightly structured instrumental training called the Suzuki method, brain responses were two to three years more mature on average than those in children not taking music lessons.”

Trainor’s studies further indicate, “Electrical signals traveled more swiftly and efficiently through the brains of the Suzuki-trained kids, who also showed improved performance on tasks that required sustained attention and the ability to hold information in memory long enough to execute complex tasks-what neuroscientists call working memory.”

Ms. Healy in her article states that Dr. Gottfried Schlaug, a Harvard University neurologist found a glaring and suggestive difference between the brains of 30 professional musicians and 30 non-musician adults of matched age and gender. In the musicians, the bundle of connective fibers that carry messages between the brain’s right and left hemispheres – a structure called the corpus callosum – was larger and denser on average than that of their non-musical peers. She continues that Schlaug and colleagues also found that the musicians who had their musical training before the age of 7 showed the most pronounced differences – suggesting an early start might rewire the brain most dramatically.

Source: The Oregonian –Wednesday March 10, 2010

16. The May , 2010 issue of the Chicago Tribune listed Chicago’s All-State Academic Team which was comprised of 10 students 7 of whom were involved in music.

Source: The Chicago Tribune – Sunday May 2, 2010

17. The St. Louis Post Dispatch announced that research would begin soon to map the brain. The plan estimated to take five years is being undertaken by a consortium of scientists at the Washington University School of Medicine and the University of Minnesota. The project known as the Human Connectome, will attempt to diagram all the major circuits in a healthy brain. David Van Essen, head of the department of anatomy and neurobiology at Washington University stated, “This will give us a vastly better understanding of brain connectivity that is sorely lacking.”

Source: The St. Louis Post Dispatch via the Des Moines Register’s Wednesday October 13, 2010 edition

CONCLUSIONS:

Due to the intricate workings of the human brain, some known and some unknown, one can understand the hesitation of brain level researchers to equate causation of music with that of mathematics, writing, reading, spatial concepts etc.

One would be remiss however in not recognizing the research studies mentioned in this paper. These studies strongly support the theory that a correlation or association does exist between music, mathematics, reading and writing. School boards, school administrators and teachers must become more informed regarding this new information before modifying or even eliminating school music programs in order to achieve academic goals as set forth under the "No Child Left Behind Act." School music programs are not a detriment but a major contributor to the educational development and achievement of young people in the United States and abroad.

Roger Maxwell a graduate of the University of Northern Iowa in Cedar Falls IA was one of the founding fathers of its "Dimensions in Jazz" program. He is the composer and arranger of many works for bands and choirs. He served as chief arranger for the U.S. Army Band of the Pacific while stationed in Honolulu, Hawaii. In 1982 he conducted an orchestra and 1965 singers in an unrehearsed presentation of "Everyone Sings the Messiah." He is the writer of "Fourteen Weeks to a Better Band – Books I & II." He retired in 1995 from the Iowa State Board of Regents having served as its Equal Opportunity Compliance Officer. He and his wife Arenda Randolph Maxwell reside in Windsor Heights, Iowa.