Spring 2009

Brain-Based Education in Music: A New Science or Science-Fiction?

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A New Science or Science-Fiction?

By Diane Cummings Persellin

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We can see increased interest in the brain and brain-based education everywhere. Google turns up over one million hits on "brain-based education." Nearly every education and music education conference offers sessions that teach ways to utilize new research on the brain. Places like MIT and Stanford increasingly sponsor workshops and courses where teachers pay big bucks to attend "learning and the brain" conferences. They believe this research is substantial enough to use in classrooms.

The number of new books on brain-based education is also startling. *Musicophilia*: *Tales of Music and the Brain* by Oliver Sacks and *This is Your Brain on Music*: *The Science of Human Obsession* by Daniel Levitin have both recently hit the best-seller list. However, thus far, conclusions are conflicting. Parents are asking educators about what technology to purchase in order to increase their child's cognitive functions. In a Kaiser Family Foundation study conducted in 2004, more than half of the parents surveyed said that educational videos and toys are "very important to children's intellectual development."[1] Is this a marketing ploy, or can this be verified through research?

Parents have read articles in the popular press about the Mozart Effect making children "smarter" or at least temporarily increasing spatial ability scores.[2] Will classical music help build a better brain? We read that students who participate in band, orchestra, and choir have higher SAT scores than students who do not participate.[3] Does participation in the arts raise SAT scores? Furthermore, we read that children have "windows of opportunity" in which to learn music, language, and math and that these windows close before puberty.[4] Have repeated research investigations confirmed this critical period?

As educators we must ask ourselves if we're moving too fast in our use of brain-based education. Are we making assumptions based on slim evidence? While the field of brain research is making exciting discoveries, is it sufficiently substantiated to translate into the classroom? Is brain-based education a leap of faith, or can it be substantiated by current research? How do educators sort out information from misinformation and make solid decisions in their teaching? Although there are still no definitive conclusions, this article addresses some of the concerns about relying on preliminary research and presents some promising studies and their implications for music educators and their classrooms.

Brain Research Techniques

Recent sophisticated techniques for measuring brain activity allow us to study brain development to a degree never before possible. Investigators are able to measure electrical brain activity with the relatively simple and inexpensive EEG scan (electroencephalogram). Other means of viewing brain activity include MRIs (magnetic resonance imaging), which measure anatomic visualization, and PET scans (positron emission tomography), which measure blood flow to the brain (although generally the latter is rarely used on healthy children due to the required injection of radioactive substances).

Flohr, Miller, and Persellin used EEG scans to confirm that young children, after ten weeks of music instruction, became more efficient, that is, expended less electrical activity, when they assembled jigsaw puzzles (see figures 1 and 2).[5] Schlaug, Norton, Overy, and Winner demonstrated

significant changes in several parts of the brain of young children who participated in active music-making.[6] Efforts of these investigators and others provide a clearer picture of what the effect of music instruction may be on brain development. For years, we knew very little about the processes of the brain. Now, we can scan it for activity, changes in size, even tumors. Nonetheless, how the brain processes and retains music and music skills is still somewhat mysterious. And we don't yet know definitively how to teach based on what we see in the scans.

We must overcome formidable obstacles. Some things we will simply never know, as techniques would require applying invasive methods in the study of young children. Moreover, the study of human learning and behavior based on brain research requires that investigators maintain a logical and conservative perspective when drawing conclusions. Although measurement devices make it possible for researchers to pinpoint specific biological changes in the brain, long-term longitudinal studies are time-consuming and expensive. Moreover, many brain-based studies deal with a small number of subjects and have not been replicated.

We must also remind ourselves of the need to distinguish between correlation and causation. There is a correlation between high SAT scores and music study (College Board, 2008),[7] but we do not have a causal relationship. High SAT scores of band, choir, and orchestra high school students may be more the function of parental support than ensemble participation making students smarter.

Bruer warns that "brain-based education literature represents a genre of writing, most often appearing in professional education publications, that provides a popular mix of fact, misinterpretation, and speculation. This can be intriguing, but is not always informative…nor is it the way to present the science of learning."[8] Though Bruer's cautions need to be taken to heart, we can also have hope for the future. Valid studies, indeed, exist and seem promising for the field of music education, but these studies do need to be replicated with other populations.

Music educators are excited about the implications of brain-based research for our practice. At the same time, we are wisely hesitant to jump on the band-wagon. In what follows, I will summarize selected current studies and their implications for our classrooms. Some of this research will appear conservative compared with what the popular press and some current brain-based workshops are saying. But it is important that we as educators pay heed to the more responsible studies rather than basing our pedagogy on the popular press.

Research and Implications

Research: In 2008, the Dana Consortium released a three-year study of cognitive neuroscientists from seven universities across the United States.[9] These investigators came together to grapple with the question: Are smart people drawn to the arts, or does arts

Figure 1

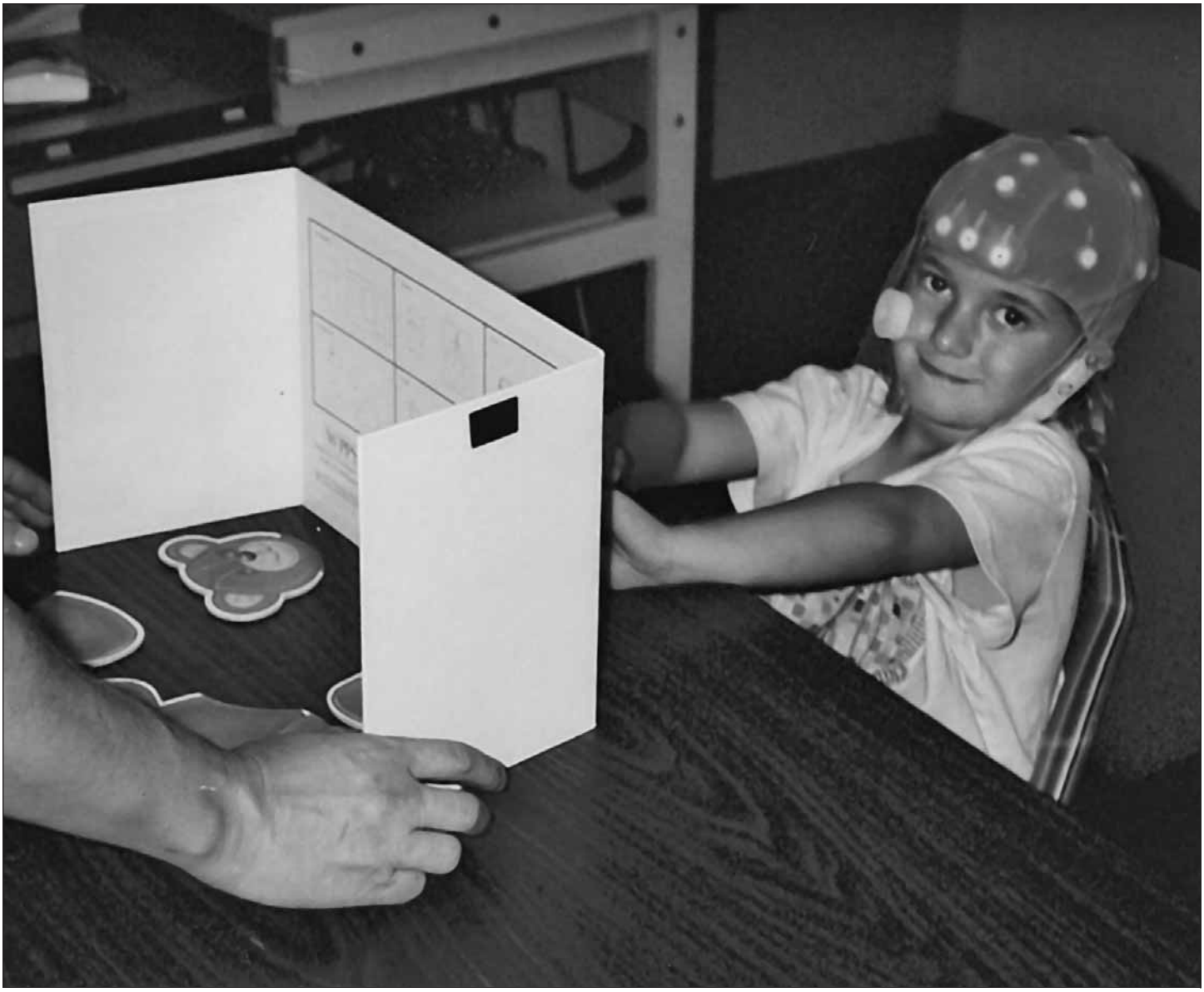

Figure 2

training make people smarter? Studies in their report include children and adults involved in music, drama, visual art, and dance instruction. The consortium found that children motivated in the arts develop attention skills and strategies for memory retrieval that can also apply to other subject areas. In addition, links appear between skills in music instruction and geometry as well as between music instruction and early literacy. While they caution that they cannot confirm if music instruction causes increased skills in these areas, they can confirm the correlations.

In a Florida study, 41 percent of potential dropout students said that some aspect of participating in the arts kept them in school. Furthermore, these students reported that they were more engaged in their art and music classes than in academic classes.[10]

Implications: The arts are highly motivating. We see how music, movement, dance, and drama activities in our classes help engage students and focus their attention. When our students develop music skills and knowledge in our classes they may be more inclined to continue to participate in the arts in high school and to ultimately stay in school. One local teacher who supervises some of my student-teaching interns makes it a personal goal to have 100 percent of her fifth graders enroll in a music elective in middle school, because she feels that this will help keep these students engaged in their education beyond elementary school.

Research: Neurons in a child's brain make many connections at an incredible pace. [11, 12] As a child reaches puberty, the pace slows and the brain keeps connections that it has found meaningful and prunes connections that are not useful. This process continues throughout life, but appears to be most intense between ages three and twelve. While this is a period of high brain activity, there is not yet neuro-scientific evidence that this is

a critical period of learning or window of opportunity for music.[13] Most other skills increase throughout a lifetime. Humans never finish their learning process. Because of the structural plasticity of the brain, learning continues.

Implications: As music educators, we can lobby principals to schedule music classes for pre-kindergarten and kindergarten children with certified music teachers. We can also hold workshops for parents of pre-schoolers and encourage informal music-making experiences in the home, such as singing, dancing, and listening to a wide variety of music. In-service workshops for pre-kindergarten and kindergarten teachers can also be organized to extend musical experiences throughout the day.

We can also remind parents that their children will continue to learn music throughout their lives. The early childhood years are an excellent time to learn music as the brain is more receptive; however, children will continue to learn music throughout their teen years and on into adulthood.

Research: Movement appears to improve mood, increase brain mass, and enhance cognitive processing. We increase blood flow throughout our body when we get up and move. Within a minute of moving, there is about 15 percent more blood in our brain than when we were sitting. By involving more movement and sensory input, students may be more attentive for longer periods of time and have better long-term recall.[14] Fox, Parsons, and Hodges have found that the area of the brain that controls movement is activated when listening to music.[15] It's no wonder that children begin to move when they hear music!

Implications: Educators are encouraged to involve more sensory input in their classrooms, such as moving and "hands-on" activities, which are likely to hold students' attention for a longer period of time. Moving large and small muscles through singing games and dances may lead to longer term recall and greater music.[16]

Research: The rate of growth of these connections (synapses) may be dependent upon the complexity and type of activity one regularly engages in. For example, when we engage in *novel* motor learning, new connections appear to be generated. And when we engage in repeated motor learning (or exercise) our brain develops greater density of blood vessels.[17] So the brain appears to need a balance between both new or novel experiences and opportunities to practice familiar motor learning. Arnold Schiebel, director of the Brain Research Institute at UCLA, says, "Unfamiliar activities are the brain's best friend."[18]

Implications: This research fits well within our discipline of music education. We know that children may appear to be more engaged when we incorporate new music, strategies, and ways of interacting in our teaching. Children also appear to be more focused when we teach from several places in the room, include them in large and small group activities, and use a variety of modalities to teach. Research is beginning to support using teaching strategies that balance new activities with reviewing or rehearsing previous skills and concepts.

Research: Two recent investigations have concluded that we tend to remember information or experiences best that are presented first. We remember second best that which is presented last and least that which comes just past the middle.[19, 20]

Implications: Music teachers can capitalize on this information and teach the most important things first. The beginning of class can be the best time to reinforce a new concept or skill as retention appears to be the greatest. These investigations also underscore the importance of closure at the end of class to help cement the learning. Practicing skills, small group work, and announcements can be scheduled during the middle of class.

The many variables in studying children, such as home environment, require large sample sizes. These investigations are expensive and long-term interaction is necessary. Nevertheless, the research we currently have is valuable. The arts play an important role in human development, enhancing growth of cognitive, emotional, and psychomotor pathways. Schools have an obligation to introduce children to music and the arts at the earliest possible time and to treat the arts as fundamental—not optional—curriculum areas. Learning the arts provides a higher quality of human experience throughout a person's lifetime. We are at the threshold of utilizing developing technology to study how the brain functions and analyzing which teaching strategies are most effective. It promises a fuller understanding of learning and will guide us in more effective teaching strategies.

Note: The author expresses her appreciation to her husband, Robert Persellin, M.D., for his assistance in preparing this article.

Endnotes

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There's music in the sighing of a reed;
There's music in the gushing of a rill;
There's music in all things, if men had ears:
Their earth is but an echo of the spheres.

—Lord Byron