The Music in Our Minds

New brain research shows not only that music is fun, but also that it improves our brain development and even enhances skills in other subjects such as reading and math.

There's a great deal of excitement over music research these days. Almost weekly, the popular press reports on new findings, such as the effects of listening to or playing music on child development, intelligence, cognitive abilities, and brain functions. The governor of Georgia believes that music is important enough to risk political embarrassment: He asked the state to pay to send a classical CD to every new mother in Georgia. He failed to get the appropriation but still received the CDs, courtesy of Sony. And in Florida, there is a move to require preschools to play at least 30 minutes of music each day. What's going on?

Many school administrators and teachers, faced with making difficult decisions about curriculum and school activities, need to know the new and significant research findings about music and education. Should schools reduce, dismantle, maintain, or increase music programs? As one who is involved in music research, I will summarize some of the most salient findings. However, I want to make clear that independent of research findings, I regard music and the arts as essential, not optional, components of education. We should not have to justify music in the curriculum only by citing its extra-musical benefits. But because the benefits are becoming increasingly apparent, educators need current information to make informed decisions about the place of music in schools.

What are the benefits? Music has the ability to facilitate language acquisition, reading readiness, and general intellectual development; to foster positive attitudes and to lower truancy in middle and high school; to enhance creativity; and to promote social development, personality adjustment, and self-worth (Hanshumaker, 1980).

Music and Behavior

The current excitement about music research is not simply due to a single new study about music and behavior, or even to a group of studies. Rather, three things have happened. First and foremost, the public realizes that research on music and behavior exists and is as serious an area of inquiry as any other field of science. Second, an increasing amount and breadth of research throughout the world has led to renewed interest in prior, often forgotten, findings. Third, researchers, educators, and legislators are now open to a broader view of the role of music in our lives.

Underlying these three factors is the spirit of a
multidisciplinary approach to music and behavior. This approach rejects a parochial view of disciplines in favor of mutual appreciation, communication, and collaboration among such disciplines as psychology, biology, medicine, education, computer science, and music therapy. All these have profited from two truly interdisciplinary fields—neuroscience and cognitive science. Soon, it will be commonplace to conduct experiments such as scanning the functional activity of the human brain during music cognition or mental rehearsal of music.

Looking into the future, we might discern the glimmerings of a multidisciplinary science of music.

These are promising times in the broad field of music research. But what are the implications for K-12 educators? Should we play Mozart in the cafeteria to increase SAT scores, as some wag has suggested and many have taken seriously? As most educators well understand, “learning pills” prescribed in the form of Mozart don’t exist. Learning how to listen to, understand, appreciate, and play music does have great value but can best be achieved through guidance and effort.

Single studies may attract our attention because our desire for information has outpaced the ability of the field to provide that information. We still need more related studies to provide multiple, converging findings. Fortunately, such studies are beginning to emerge.

Biological Roots

Traditionally, we have viewed music as the product of culture and social interactions, not as part of our biological endowment. However, scientific literature suggests otherwise. Four types of findings support the belief that music has strong biological roots.

First, if music had a strong biological component, then animals would have fundamental abilities in music—and this seems to be the case. For example, monkeys can think in terms of musical abstractions; they can determine, for instance, the fundamental frequency of a harmonic series.

Second, biological behaviors are universal. Music also satisfies this criterion. Although its uses may vary across cultures, music is ever-present. Parents and caregivers across cultures best communicate with infants through lullabies and musical baby talk.

Third, biological behaviors are often revealed early in life, before cultural factors influence and change behavior. Here, research has amply documented the extensive competency of young children to process musical elements and behave in musical ways. For example, toddlers spontaneously exhibit music behaviors, using music in their play and communication, composing songs, and inventing original musical notations (Moorhead, 1977).

Moreover, recent studies have revealed that infants have musical capabilities. For example, they can discriminate between two notes as well as adults can (Olsho, 1984); they can remember the contour or pitches of melodies (Trehub, Bull, & Thorpe, 1984); they can mentally segment, or “chunk,” extended melodies into smaller phrases, as do adults (Thorpe & Trehub, 1989); and they can comprehend rhythm (Trehub & Thorpe, 1989).

They can even use music to remember what happened earlier in the day (Fagen et al., 1997).

Fourth, we might expect the human brain to be organized to process musical activities. This has proven to be the case. The brain contains basic musical building blocks that are specialized to process fundamental elements in music. For example, neurons (brain cells) are specifically sensitive to pure tone pitch, complex harmonic relationships, rhythm, and melodic contour (Weinberger & McKenna, 1988). The brain’s right hemisphere processes melody, whereas the left hemisphere
processes language. The functional architecture of the brain honors music as much as it honors language.

Thus, the brains of children are well equipped to understand music, and, consequently, children enjoy and engage in music long before they reach kindergarten. If parents and caregivers would reinforce children’s spontaneous musical activities as much as they reinforce language behaviors, then children would develop this natural channel of communication, expression, and cognition. Teachers themselves might feel more comfortable with teaching music. Fortunately, given the endless curiosity of children and the fact that teachers do not need great expertise in music to effectively teach with it, plenty of opportunities to use music in the classroom still exist.

Music, the Brain, and Its Synapses

As long as educators and parents view music as relatively unimportant, schools will continue to adopt a take-it-or-leave-it philosophy. But because we know that musical competency is part of our biological heritage—part of human nature—we should not continue to treat it as a frill. In addition, when we consider the benefits of music for brain development, the act of reducing or even eliminating music from the curriculum becomes indefensible.

Learning and performing music actually exercise the brain—not merely by developing specific music skills, but also by strengthening the synapses between brain cells. Literature in neuroscience now strongly supports the conclusion that synapses grow stronger through use and become weakened through disuse. Which major functional systems of the human brain depend on synaptic strength?

- The sensory and perceptual systems: auditory, visual, tactile, and kinesthetic;
- The cognitive system: symbolic, linguistic, and reading;
- Planning movements: fine and gross muscle action and coordination;
- Feedback and evaluation of actions;
- The motivational/hedonic (pleasure) system; and
- Learning memory.

By making music, we engage all these systems. Simply consider the steps involved in reading a music score consisting of highly complex symbols, performing the piece, and correcting the performance after evaluating the results. Imagine ensemble playing, in which each student has to listen to his or her own performance while coordinating with others. Add to this learning and remembering the nuances of the score, or even playing from memory. What is important is not how well a student plays but rather the simultaneous engagement of senses, muscles, and intellect. Brain scans taken during musical performances show that virtually the entire cerebral cortex is active while musicians are playing. Can you think of better exercise for the mind/brain? In short, making music actively engages the brain synapses, and there is good reason to believe that it increases the brain’s capacity by increasing the strengths of connections among neurons.

Music and Reading Comprehension

Hurwitz and colleagues (1975) investigated whether music training improved reading performance in 1st graders. For 40 minutes daily for seven months, the experimental group learned how to listen to folk songs and to recognize melodic and rhythmic elements. The control group, similar in age, IQ, and socioeconomic status, received no special treatment. After receiving instruction in music listening, the experimental group exhibited significantly higher reading scores than did the control group, the former scoring in the 88th percentile and the latter scoring in the 72nd percentile. The differences in scores did not result from better reading instruction because the same teacher taught both groups.

These results raise two questions. First, was reading enhancement caused specifically by music or by the variety of
the school program? Second, because the experimental group did not learn to read music but rather learned to listen to it and to recognize musical ideas, how could music training possibly improve reading?

To understand how music education can benefit reading, we need to consider the three stages of learning to read (Frith, 1985): visually recognizing words; learning the correspondences between visual parts of words (graphemes) and their spoken sounds (phonemes); and achieving visual recognition of words without going through the earlier stages. The critical second, or phonemic, stage is most important. Music facilitates reading by improving this second, sounding-out stage.

Lamb and Gregory (1995) determined the relationship between musical sound discrimination and reading ability. In addition to taking standard reading tests, 1st graders were tested on their ability to sound out nonsense syllables, which they viewed on cards, and on pitch awareness, in which they heard pairs of musical notes or chords in sequence and reported whether they sounded the same. They were also tested on timbres. Finally, researchers assessed their phonemic awareness by having students listen to spoken words and tell whether the words began or ended with the same sound. The experimenters then determined the relationships among performance scores on the various tests. They found a high degree of correlation between how well children could read both standard and phonemic material and how well they could discriminate pitch. Timbre awareness was not a factor.

The findings suggest that good pitch discrimination enhances this second, phonemic stage of learning. Changing the pitch of words is the most important factor in conveying word information. The relationship between reading and music education is therefore straightforward because music training involves improving pitch discrimination. Timbre awareness, however, is unrelated to reading skills, thereby showing that the benefits are not caused by the increased richness of students' educational experiences, but by specific pitch training. No doubt, we will need more studies to further clarify our understanding. But the findings of both studies dovetail nicely and provide strong evidence that specific music experience facilitates reading.

Music and Reasoning

Another example of the beneficial effects of music concerns making rather than listening to music. Rauscher and her colleagues (1997) studied the effects of music keyboard training in preschool children (3- and 4-year-olds). A matched group received equally fundamental components of music. Parents and caregivers instinctively communicate with infants in a musical fashion because, although infants don't understand words, melodic stimulation always gets their attention. Young children clearly enjoy music, engaging in musical behavior spontaneously. In addition, the human brain contains identifiable musical building blocks.

This biological heritage broadens the common conception of human endowment and underscores the opportunities to teach through music. Music making appears to be the most extensive exercise for brain cells and their synaptic interconnections. Education in both music listening and music making facilitates students' intellectual development and even helps students learn other basic subjects, such as reading.

Although the increased use of music in K-12 is not yet widespread, the reactions of parents, teachers, and administrators who have been asked to participate in studies have been interesting. Parents often prohibit their children from participating in control groups because they would miss out on the full benefits of music in the classroom.

Sometimes I think that music is at a disadvantage because it is so much fun. Can anything so enjoyable really be important in education? Absolutely. Music offers great opportunities for communication and expression, for creativity and group cooperation—plus, it's good for the brain and can enhance learning and intellectual development. Instead of asking, "Why music?" perhaps we might ask, "Why not music?" and "How can I use music to my students' advantage to further my goals as an educator?"

Brain scans taken during musical performances show that virtually the entire cerebral cortex is active while musicians are playing.
We all agree that our greatest resource is the potential brain power of our children. We should strive to develop their intellects through all available means. Research now shows that music can play an important role in achieving that goal.

References


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