The Science of the Arts

When education resources ebb, the arts are the first things to be cut from the curriculum. But research suggests that the benefits of the arts are priceless.

By Eric Jensen

Many reasons have been given over the years to support the arts, including that they are our cultural heritage and that they are socially inclusive. But are there any brain-based studies to support arts education? Yes. You can build a compelling biological case for the value of arts, but scientific research is only one of the many reasons to support the arts as an integral part of education.

Arts at a Disadvantage
Most of what the brain learns—such as fine and gross motor coordination, emotional intelligence, complex knowledge, stress mediation, and relationship skills—requires maturation and refinement. If schools value a narrow range of specific test scores—and if those tests measure only math, problem-solving, and verbal skills—arts are at a clear disadvantage. And if we only value immediate results, arts are at a disadvantage.

Because the value of arts is both generally distributed across the range of human performance and because they are time-consuming, they are effective, not efficient. Students of the arts develop neural systems that often take months and years to fine tune, and the benefits students experience range from enhancement in fine motor skills to better emotional regulation, so there is a lack of immediate and obvious causal effects. This inefficiency is often considered sinful in a climate that treats student test scores as products and looks for cost-cutting measures at every corner. In such a climate, the arts come up short because they are nonspecific and long-term.

Important, but Not Measured
Champions of Change: The Impact of the Arts on Learning (Fiske, 1999) highlights some of the nonacademic benefits of the arts that carefully controlled studies demonstrate:

- The arts reach students not ordinarily reached, with methods not normally used, which keeps tardy, truancy, and dropout rates down.
- Students connect to one another better and experience greater camaraderie, fewer fights, and less racism and sarcasm.
- Arts education requires an environment of discovery that can rekindle the love of learning in students who are tired of being filled up with facts.
- The arts provide challenges for students at all levels, from delayed to gifted. Everyone can find their own level of performance.
- The arts connect learners to the world of real work in which theater, music, and products appeal to a growing consumer public.

The Visual Brain
All areas of the brain are involved in cognition: frontal lobes for processing, occipital lobes for visual input and visualizing, parietal lobes for sensory sorting, the cerebellum for movement, and the midbrain area for emotional response. The visual system engages more of our brains than any other of our five senses. It is a good starting place to link learning to the arts.
The visual arts include print, film, video, editing, computer-based graphics design, art multimedia, website development, and communication and marketing materials. They also include design, art production, paper and canvas work, photography, drawing, illustration, and painting. The visual arts are demonstrated by technical theater work that includes costume design, make-up, lighting, and scenery. Many students use technology as a visual medium. Other ways to use the visual arts include architecture, graphic organizers, mind maps, exploratoriums, and galleries.

Studies support the use of visual arts in schools. In one example, students who were labeled as disadvantaged became part of a cross-cultural study of preschoolers. A total of 215 prekindergartners and 228 kindergartners from schools in Tel Aviv, Israel, and Columbus, OH, participated in a project to discover the value of visual arts instruction. Some students were merely given art tools with no instruction. The others received four-part instruction using discussion, observation, touch, and technical training. The researchers used specialized instruments to assess both artistic development and cognitive changes. The results were significant, with the experimental groups producing large gains in both countries. The authors concluded that drawing is an effective tool for improving cognition (Mooney & Smilansky, 1973). Studies also report strong links between visual learning and improvement in reading and creativity (Eisner, 1998). While learning to critique art, students increase their vocabulary and language skills. Drawing forces students to visualize and plan. Drawing figures helped improve thinking skills and verbal skills in learning disabled children (Jing, Yuan, & Liu, 1999). As one student put it, "When we do art, we represent what we want to see. When we do science, we only get what someone else wants us to see." Visual arts allow students to express pent-up feelings and validate them in the material world. Art lets students give their feelings a form that they can control and shape. Encouraging art encourages students' self-expression.

**Music and the Growing Brain**

How does music enhance cognition? Physicist Gordon Shaw, at the University of California-Irvine, hypothesizes that the activation between family groups of cortical neurons assists the cortex in pattern recognition. This multiple-site, crossactivation may be necessary for higher brain functions, including musical arts, cognition, and memory. Musical arts means much more than playing or listening to music. Singing, including rapping and musical theater, is also part of the musical arts, as are reading music, composing, analyzing, arranging, notating, and playing instruments.

We've all heard of the so-called Mozart effect, but what of all the other effects of music? An interesting study (Malyarenko, et al., 1996) suggests that listening to music for just an hour a day changes brain organization. In the experiment, a group of four-year-olds listened to classical music for one hour a day. When later measured, their EEG results showed greater brain coherence and more time spent in the alpha state. Another study suggests that playing piano strengthens spatial awareness and the ability to think ahead—both important math skills. Student in a group that played a math video game increased their spatial-proportional skills and boosted math scores by 36% over the control group. But the group that also took piano lessons scored an additional 15% higher than the first experimental group, which received no music instruction (Graziano, Peterson, & Shaw, 1999).

Making music may also improve listening and memory skills. In a college study, 60 students were tested for verbal memory. The ones who had music training before age 12 recalled much more than those who did not (Chan, Ho, & Cheung, 1998). In one study, researchers from North Texas University reviewed 25 vocabulary words with two groups of college students. Members of the control group heard no music during their review, but members of the experimental group heard Handel's *Water Music*. The experimental group had significantly higher scores than the control group (Stein, Hardy, & Totten, 1984). Both of these studies offer supportive evidence that using music can influence memory, a key to success in school.

An ethnically diverse group of 78 preschool children (42 boys and 36 girls) in Southern California was in the normal range of intelligence and had no prior musical background. During a two-year period, the children took one or two one-hour piano keyboard lessons, computer training, or singing lessons per week. In the area of spatial-temporal reasoning (object assembly), the results were dramatic. The keyboarding group scored 30% higher than the control group (children who received no lessons) and well outpaced the computer and singing groups (Rauscher, et al.,...
This suggests that long-term music instrument instruction can contribute to academic success.

In another study, an experimental group who heard fast music experienced increased levels of stress hormones (Brownley, McMurray, & Hackney, 1995). Evidence suggests there may be a universal response to many beats per minute of music: a rise in stress levels. Fortunately, other studies support the hypothesis that music can enhance the immune system responses through lowered heart rate, as well as increase parasympathetic activity. Music can allow students to reduce anxiety and school stress levels (McCraty, Atkinson, Rein, & Watkins, 1996). UCLA Professor of Education James Catterall studied the relationship between music and overall academic achievement. In particular, he was interested in comparing test scores from students from lower socioeconomic status who took music lessons in grades 8-12, to scores from other students from similar backgrounds who didn't take music lessons. First, the students who took music lessons increased their math scores significantly as compared with the nonmusic control group. But as important, the reading, history, geography, and social skills of the experimental group soared by 40%. Music supports the development not only of math skills but also all skills, for all kinds of students (Catterall, Chapleau, & Iwanaga, 1999). Taken as a whole, the studies suggest that integrating music into the curriculum can contribute to better academic scores and enhanced neurobiological development.

**Kinesthetics and the Learning Brain**

The brain is a system of systems, and there is no allowing for a kinesthetic brain without considering the brain as a whole. Mark Hallet, chief neurologist of the human motor control section of the National Institute of Neurological Disorders and Stroke, says athletes use most of their brains, not just the cerebellums. A strong kinetic arts program will activate multiple systems in students’ brains. The kinesthetic arts can be dramatic (e.g., dance, drama, mime, theater, and musicals); industrial (e.g., sculpting, auto repair, design, electronics, building, and metal and wood working); or recreational (e.g., recess, classroom games, physical education, sports, and active health programs).

School is far too sedentary. We offer students too much content per hour, especially when cramming for tests. Cranz (1998) points out that sitting for more than 10 minutes at a time reduces students’ awareness of physical and emotional sensations. Chairs with rolled front edges and footrests will help students’ circulation, and slanted tabletops will increase eye comfort. Bjorklund and Brown (1998) recommend that young students in particular be given breaks from seatwork and frequent changes in activities. But can physical movement actually benefit student learning?

In one study in Seattle, WA, students in grade 3 studied language arts concepts through dance activities. Although the districtwide reading scores decreased 2%, the students involved in the dance activities boosted their MAT reading scores by 13% in six months (Gilbert, 1977). Playtime and dance often include spinning, leaping, crawling, rolling, rocking, pointing, and marching. Lyelle Palmer of Winona State University documented significant gains in attention and reading from those stimulating activities (Palmer, 1980). Kinesthetics can help creativity, too. After 20 days of instruction, students took the Torrence Test of Creative Thinking. The group that received the highest scores was the music and dance group (Mohanty & Hejmadi, 1992).

Despite this research, recreational play for all ages is going out of style. It seems that we are forgetting how play can influence our lives for the better. Beyers (1998) notes that animals repeat new skills during play, which strengthens the neurological structures that support the skills and creates opportunities for additional learning.

Eliminating physical education and recess may be a poor decision for another reason. The exciting new discoveries in neurogenesis tell us that humans can and do grow new brain cells daily. Using rats in different experimental conditions, Salk Institute of Neuroscience researchers discovered that running is a strong new brain cell producer (van Praag, Kempermann, & Gage, 1999). Many of those new cells also became fully functional. In fact, animal studies suggest that neurogenesis may be correlated with reducing depression (Jacobs, van Praag, & Gage, 2000) and improving memory.

At one Chicago elementary school, 84% of the students come from families below the poverty line and 30% do not speak English. Before arts were introduced, a measly 38% were reading at grade level and 49% were doing math at grade level. Instead of spending more time on drills in
reading and math, administrators and teachers added the arts. With a strong arts program, things have changed. Sixty percent now read at grade level and 68% do math at or above grade level. Reading rates have nearly doubled (Leroux & Grossman 1999). Research, theory, and classroom efforts support sustaining or increasing the role of movement in learning. Movement has strong positive cognitive, emotional, social, collaborative, and neurological effects. It makes sense that a variety of movement activities should support and sustain every child's education. It is imperative that all children be taught the movement arts.

**Arts and the Assessment Issue**

Plenty of insightful, well-disciplined academics and other assessment consultants have created thorough arts rubrics. But there is a middle ground between matching the assessment methods of the other major disciplines and no accountability. Making arts courses pass-fail allows educators to emphasize feedback, rather than grades.

Our art-related biological systems are discrete and implicit processes with minimal short-term gain. Those systems cannot be measured with today's technology. Efforts to measure the results of those systems miss the point: the results are too time- and context-dependent to measure. In six months, keyboard instruction may provide better spatial skills; after five years, you may get a better listener with stronger math skills, more confidence, and greater self-discipline. What kind of test measures the latter benefits—the real benefits of music instruction?

The dilemma facing educators today is simple: Is our social, moral, and ethical mandate to maximize test scores or to prepare the citizens of tomorrow? Let's pass on the narcotic of short-term test score fixes and go for the long-term benefits of the arts.

**The Arts At Risk**

If you focused heavily on the arts could the other disciplines suffer? The evidence suggests no. One model that has been running for more than 50 years is the Waldorf schools. These independent, arts-centered learning institutions are among the fastest-growing schools in the world: 130 in America and 700 worldwide. Teachers in Waldorf schools focus on the arts and avoid textbooks. Students give oral presentations nearly every day. Schools offer jazz, choir, orchestra, and more.

Something must be working. On SATs, Waldorf students outperform national averages. In fact, they often pass achievement tests at double or triple the rate for public school students (Oppenheimer, 1999). College professors remark on the humility, sense of wonder, concentration, and intellectual resourcefulness of Waldorf graduates. The Waldorf model suggests that a strong arts curriculum will not cause standardized test scores to plummet as some fear but may, in fact, increase test scores. The arts should be supported not only because research supports their value but also because they are as dynamic and broad-based as more widely accepted disciplines. They contribute to the development and enhancement of multiple neurobiological systems, including the cognition, emotional, immune, circulatory, and perceptual-motor systems. Ultimately, the arts can help make us better people.

**References**


*Eric Jensen* has taught in elementary, middle level, and high schools, as well as at three California universities. He cofounded SuperCamp, a brain-compatible learning program for students, in 1982. He is a staff developer and member of the Society for Neuroscience.