

Published Online: December 1, 2011

Published in Print: December 7, 2011, as **Building STEAM: Blending the Arts With STEM Subjects**

STEAM: Experts Make Case for Adding Arts to STEM



As the school day ends, students leave the Dayton Regional STEM school in Kettering, Ohio. Student work that combines arts and STEM teaching is displayed throughout the building.

Goals are creativity and engagement

By [Erik W. Robelen](#), Education Week

The acronym STEM—shorthand for science, technology, engineering, and mathematics—has quickly taken hold in education policy circles, but some experts in

the arts community and beyond suggest it may be missing another initial to make the combination more powerful. The idea? Move from STEM to STEAM, with an A for the arts.

Although it seems a stretch to imagine STEM will be replaced in education parlance, momentum appears to be mounting to explore ways that the intersection of the arts with the STEM fields can enhance student engagement and learning, and even help unlock creative thinking and innovation.

In fact, federal agencies, including the U.S. Department of Education and the National Science Foundation, are helping to fuel work in those areas.

The NSF has provided research grants and underwritten a number of conferences and workshops around the nation this year, including a forum hosted by the prestigious Rhode Island School of Design, titled "Bridging STEM to STEAM: Developing New Frameworks for Art-Science-Design Pedagogy."

Picking up on the Rhode Island institution's push for STEAM, in late September, a lawmaker from that state, U.S. Rep. James Langevin, a Democrat, introduced a House resolution to highlight how "the innovative practices of art and design play an essential role in improving STEM education and advancing STEM research."

On-the-ground examples of bringing the arts and STEM learning together abound, from Philadelphia and Boston to San Diego.

For instance, the Philadelphia Arts in Education Partnership, with support from a \$1.1 million Education Department grant, is working with city schools to help elementary students better understand abstract concepts in science and mathematics, such as fractions and geometric shapes, through art-making projects.

High school students in several U.S. cities, meanwhile, compete for an annual **ArtScience** Prize. First launched in Boston in 2008, the contest fuses concepts in the arts and design with the sciences. The theme of last school year's curriculum and contest was the Future of Water. This year, it's Virtual Worlds, and next, the emerging field of synthetic biology.

One advocate of the STEM to STEAM push is Harvey Seifter, the director of the [Art of Science Learning](#), a project financed by an NSF grant that organized three conferences last spring in Washington, Chicago, and San Diego that brought together scientists, artists, and researchers, as well as educators, business leaders, and policymakers to explore how the arts can be engaged to strengthen STEM learning and skills and produce a more creative American workforce.



In an art class at the Dayton Regional STEM School in Kettering, Ohio, teachers incorporate art and biology to enhance student engagement and learning.

—Andrew Spear for Education Week

“For me, it is about connecting—or reconnecting—the arts and sciences in ways that learning can happen at the intersection of the two,” said Mr. Seifter, an expert in arts-based learning who also consults with Fortune 500 companies on business creativity. “We believe there is a powerful opportunity here to use the arts and arts-based learning to spark transformational change in science education.”

One core idea Mr. Seifter and other STEAM advocates emphasize is that the arts hold great potential to foster creativity and new ways of thinking that can help unleash STEM innovation.

“There is creativity in STEM itself, super genius in it, ... but in arts education, it really is the *raison d’être* to be out of the box, to accept the chaos,” said John Maeda, the president of the Rhode Island School of Design, in Providence.

Artists and designers, he said, are “risk takers, they can think around corners.”

Mr. Maeda invokes STEAM as a pathway to enhance U.S. economic competitiveness, citing as an example the late Apple co-founder, Steve Jobs, a leading force behind the iPod, iPhone, and other electronic devices.

“What STEAM means, it should feel like Steve Jobs, what he did for America,” Mr. Maeda said. “It is an innovation strategy for America.”

In da Vinci’s Footsteps

To be sure, the idea of integrating the arts with learning in other fields, including the stem disciplines, is not new. In fact, some observers have noted an increase of late in activity more broadly to promote arts integration across the curriculum, at a time when the arts struggle to keep a foothold in classrooms amid school budget cuts and the pressure for academic gains in subjects like reading and math. ([“Schools Integrate Dance Into Lessons,”](#) Nov. 17, 2010.)

But some experts perceive a special connection between the arts and the STEM fields. Mr. Seifter, for instance, points to a 2008 [study](#) led by Robert Root-Bernstein of Michigan State University, which found that Nobel laureates in the sciences were 22 times more likely than scientists in general to be involved in the performing arts. Others note that Albert Einstein was an accomplished violinist. And then there’s the Renaissance figure who some view as the personification of STEAM: Leonardo da Vinci, the Italian painter and sculptor who also made a name for himself as a scientist, engineer, and inventor.

Whether integrating the arts with STEM education enhances student learning is not exactly a settled matter, as even advocates like Mr. Seifter acknowledge.

“There is no question, to me, the critical missing piece is the data,” said Mr. Seifter. He adds that even as he’s witnessed the power of the intersection, he sees a critical need for a “solid body of empirical knowledge about what the arts bring to the STEM equation.”

Indeed, research examining the effect of arts integration on student achievement across disciplines appears to show mixed results.

Leaving the research question aside, however, some experts stop short of embracing a change from STEM to STEAM.

Alan J. Friedman, a former head of the New York Hall of Science, said it's crucial for students not to lose sight of the differences, for example, between art and science.

"One crucial point at which they part ways is the act of deciding, 'Is it good art? Is it good science?' " said Mr. Friedman, a member of the National Assessment Governing Board who holds a doctorate in physics. "Science and art have a lot to learn from each other, a lot of inspiration to share, a lot of commonality. They also have some very essential differences that are at the core of what they are, which is why I have trouble with STEAM."

Susan R. Singer, a biology professor at Carleton College in Northfield, Minn., echoes the point.

"Not to devalue the symmetry, but they are very different ways of knowing the world," said Ms. Singer, who previously served on the National Research Council's Board on Science Education. "I would stop short of STEAM, but celebrate the ways that they work together."

'Fraction Mural'

What the intersection of the arts with STEM learning looks like in practice varies widely.

The Philadelphia Arts in Education Partnership is focused on math and science instruction in the elementary grades, with support coming from its four-year grant from the Education Department's Arts in Education Model Development and Dissemination program. For example, through art-making projects, students at one school manipulated the abstract concepts underlying fractions for a more concrete understanding of how they work. The students even created a "fraction mural" displayed at the school.

"We match arts skills and processes to a specific learning goal in math and science," said Raye Cohen, the education director at the Philadelphia arts group.

She said that work with the visual arts is especially promising. “Visual arts just seems to really be able to home in on the concept, taking it from the abstract to the concrete, so students are really able to understand it,” she said.

Ms. Cohen says the project involves an “intense research component” and will look at a variety of effects, including student test scores, suspensions, and unexcused absences, as well as parent engagement in homework and changes in teaching practices.

In California, a \$1.1 million grant last year by the state’s Postsecondary Education Commission, using federal teacher-quality aid, is supporting the 134,000-student San Diego school district’s work linking the arts with science in grades 3-5.

“It’s not just teaching science through the arts, but teaching science and the arts together, and what comes from that is more than either of them standing alone,” said Karen Childress-Evans, the district’s director of visual and performing arts.

The Wolf Trap Foundation for the Performing Arts, based in Vienna, Va., has recently developed early-childhood initiatives that blend STEM learning with the arts. The work—supported in one instance by a 2010 federal Education Department grant, in another by the philanthropic arm of aerospace giant Northrop Grumman—involves performing artists in theater, music, dance, and puppetry working alongside classroom teachers in preschool and kindergarten settings.

The ArtScience Prize, meanwhile, is built around the ideas of Harvard University professor David A. Edwards, the author of *ArtScience: Creativity in the Post-Google Generation*. High school students work in small teams on projects over a year’s time in an after-school or in-school setting. The program has quickly expanded beyond Boston to include Minneapolis and Oklahoma City, as well as international locations.

The winning team in Oklahoma City earlier this year developed a biodegradable water bottle, while the top-rated Boston team is creating public art installations that communicate how people around the world struggle to gain access to fresh water.

“We’re empowering young people to come up with their own ideas while exploring and playing in the arts and science,” said Carrie Fitzsimmons, the executive director of ArtScience Labs, the Cambridge, Mass.-based organization that manages the

ArtScience Prize. "It's all fun, experiential learning, but we're teaching them to be critical thinkers and problem-solvers."

In Ohio, the [Dayton Regional STEM School](#) takes the integration of subjects, including the arts, seriously.

RELATED BLOG

Jenny Montgomery, an art teacher at the school, said her colleagues in other disciplines often approach her about working together. Last month, for instance, she team-taught with a biology teacher as part of a project in which students made watercolor paintings of cells.

"We were studying cell structure," she said, "and we were looking at paintings [the students created], these beautiful artistic renderings, and students could pick out the structures that they had been studying."

Ms. Montgomery said her work with science teachers has helped her make connections between the disciplines.

"One thing we looked at ... was how artists and scientists have common methodologies in observing the world around them," she said.

At the same time, Ms. Montgomery said, even in a STEM school, it's important for art not simply to be valued for its application to other disciplines.

"I also uphold the value of making art for art's sake," she said, "that students have an opportunity just to engage in art for the sheer joy of it."