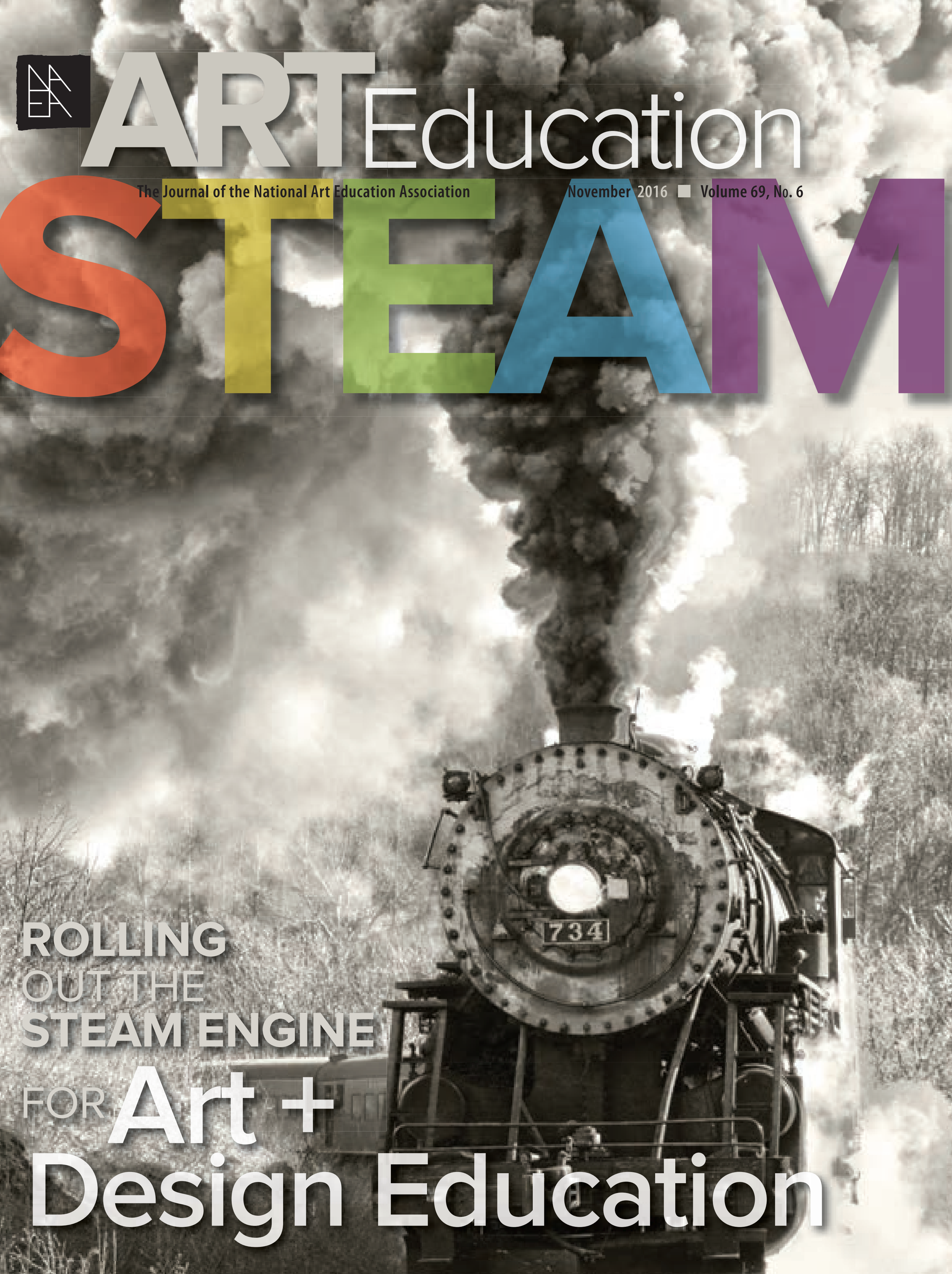
ART Education
The Journal of the National Art Education Association
November 2016 ■ Volume 69, No. 6



STEAM

ROLLING OUT THE STEAM ENGINE FOR Art + Design Education

JOIN the movement!

CREATE a Professional Learning Community focused on creativity as a 21st Century skill.

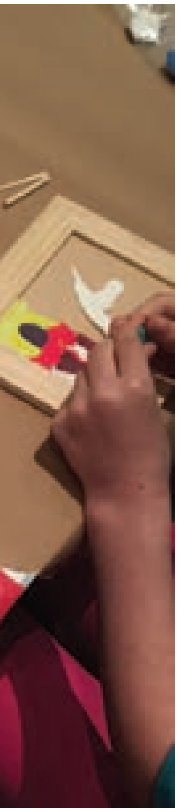
BUILD creative capacity school-wide.

TRANSFORM your school with art integration, design thinking, and project-based teaching strategies.

Become a Crayola Creativity Champion today.
www.crayola.com/champions

The Journal of the National Art Education Association
November 2016 ■ Volume 69, No. 6

ART Education



Art Education is the official jo nal of The National Art Education Association.

Manuscripts are welcome at all times and on any aspect of art education. Please send double-spaced file , prepared in accordance with the Publication Manual of the American Psychological Association and guidelines found below, to Dr. James Rolling, Editor, *Art Education,* at: arteducationjournal@gmail.com

For guidelines, see *Art Education* under "Writing for NAEA" at www.arteducators.org/writingfornaea.

Authors are encouraged to submit photographs with their manuscripts. To facilitate the process of anonymous review, the author's name, title, affil tion, mailing address, and phone number should be in a separate one-page fil , and not on the manuscript file itsel .

Art Education is indexed in the Education Index, and available on microfilm f om University Microfilm , Inc., 300 North Zeeb Road, Ann Arbor, MI 48106.

Art Education (ISSN 0004-3125) is published bimonthly: January, March, May, July, September, and November by Taylor & Francis Group, LLC, 530 Walnut Street, Suite 850, Philadelphia, PA 19106, on behalf of the National Art Education Association, 901 Prince Street, Alexandria, VA 22314-3008. Phone: (703) 860-8000; Fax: (703) 860-2960. Website: www.arteducators.org

Production and Advertising Offices: Taylor & Francis Group, LLC, 530 Walnut Street, Suite 850, Philadelphia, PA 19106. Phone: (215) 625-8900; Fax: (215) 207-0047. Production Editor: Nathan Clark. Membership dues include $25.00 for a member's subscription to *Art Education* and *NAEA News.* Member inquiries can be sent to Members@arteducators.org, or call 800-299-8321. Non-member subscription rates are: Institutional $114.00; Personal $72.00. Call for single copy prices. Subscription Offices. USA/North America: Taylor & Francis Group, LLC, 530 Walnut Street, Suite 850, Philadelphia, PA 19106. Phone: (215) 625-8900; Fax: (215) 207-0050. Periodicals postage is paid at Herndon, VA, and at additional mailing offices. Printed in the USA. Additional information can be found online at www.tandfonline.com/UARE

POSTMASTER: Send address changes to *Art Education,* c/o Taylor & Francis Group, LLC, 530 Walnut Street, Suite 850, Philadelphia, PA 19106.

STEAM LOCOMOTION

This is the second of two special issues of *Art Education* scheduled for the calendar year of 2016, articles that have been assembled to help our readers reinvent and roll out the STEAM engine for art + design education (Rolling, 2016). In this November 2016 issue, a cohort of authors has been assembled to present articles on the theme of STEAM locomotion, modeling classrooms and spaces for learning that are already powered by STEAM energy. STEAM is an acronym for a growing movement exploring science, technology, engineering, art, and math in public education (The Congressional STEAM Caucus, 2013).

STEAM is an adaptable and networking approach to the art + design education—one that not only recognizes the arts as necessary in general education, but favors no one model for teaching art nor any particular STEM subject knowledge base as more valuable than the arts. Rather, STEAM curriculum-making "provides greater adaptability for connections across content areas and disciplines, and the opportunity to ***transcend*** the concepts and limitations in any one area" of the sciences, technology, engineering, math or art as applied to creative problem solving (Rolling, 2011, p. 10).

In this sense, at the center of any plan for STEAM curriculum-making there must be an adaptable system for integrating arts-based disciplinary content together with the humanities and other subject areas in education. STEAM curriculum-making behaves like the classic railroad switching station of yesteryear—junctions that often contained hundreds of railroad switches, mechanical installations enabling railway trains to be guided with little effort from one track, main line branch, or spur to another.

Locomotion toward new interdisciplinary learning objectives is best enabled collaboratively rather than by individual teachers working in isolation, powered by a time-tested engine—a Round Robin of stakeholders in the creative enterprise. In artists' workshops throughout the Renaissance era, a creative practitioner might be exposed to the skills and techniques in a plurality of disciplines as varied as drafting, chemistry, metallurgy, metal working, plaster casting, leather working, mechanics, carpentry, drawing, painting, and sculpting ("Leonardo da Vinci," n.d., para. 10). Similarly, present-day educators, art + design practitioners, learners, and other allied human resources may join forces to participate in STEAM-powered Round Robins, a humanizing and empowering interrelational process illuminated in a brief commentary by ceramist and Penn State University art faculty member **Chris Staley**.

Don Glass and **Colleen Wilson** share outcomes from the development of a STEAM program for 5th- and 6th-grade students by a Philadelphia-based foundation utilizing artwork in their private collection to explore light and shadow, color and light physics, geometric shapes, and coordinate planes in an exploration of the connections between the art, science, and math. **Sarabeth Berk** advocates for design thinking as a core competency and for design education as key driver of STEAM curriculum-making. **Julia L. Hovanec** has developed instructional strategies for integrating English Language Arts learning objectives into art classroom study that have the potential to transform the intersection between art and words into a switching station toward multiple creative literacies.

Maggie Leysath and **Chad Bronowski** detail their collaborative effort to create fully integrated art and chemistry activities through the means of ceramic learning objectives at a small East Texas high school. **Kelly Gross** and **Steve Gross** tell the story of their experiences running an optional elementary school STEAM club for a multigrade group of K-5 learners, based on the principles of constructivism and design thinking. **Christine Liao** champions a new transdisciplinary method of arts integration made possible by a shift in emphasis to STEAM in contemporary art education. Finally, this month's Instructional Resource, by **Sharon Vatsky**, documenting three artists' approaches to the theme of *identity* in an exhibition by the Guggenheim Museum's UBS MAP Global Art Initiative, serves as a metaphor for border-crossing locomotion and is presented here as a prompt for art classroom STEAM explorations with various possible material outcomes.

The announcement of the rapidly approaching 2017 National Art Education Association Convention's theme, ***The Challenge of Change***, begins with the acknowledgment that "Change is a difficult, unpredictable and unwieldy process, yet it is inevitable." The next two issues of *Art Education* will investigate how we might collaboratively proceed to fast-track mutually advantageous changes within our field of creative education and practice, changes that can alter the map of the nation as effectively as our railway system once did. STEAM charts one pathway forward. ■

—James Haywood Rolling Jr., Editor

References

Leonardo da Vinci. (n.d.). In Wikipedia. Retrieved from https://en.wikipedia.org/wiki/Leonardo_da_Vinci

Rolling, J. H., Jr. (2011). Art education as a network for curriculum innovation and adaptable learning. In *Advocacy white papers for art education, Section 1: What high-quality art education provides.* Reston, VA: National Art Education Association. Retrieved from www.arteducators.org/advocacy/advocacy-white-papers-for-art-education

Rolling, J. H., Jr. (2016). Reinventing the STEAM engine for art + design education. *Art Education, 69*(4), 4-7.

The Congressional STEAM Caucus. (2013, February 7). *Americans for the Arts Action Fund.* Retrieved from www.artsactionfund.org/news/entry/the-congressional-steam-caucus

James Haywood Rolling Jr. is Dual Professor and Chair of Art Education in the School of Art/College of Visual and Performing Arts, and the Department of Teaching and Leadership/School of Education, Syracuse University, New York. E-mail: jrolling@syr.edu

COMMENTARY

ROUND

Round Robin

Chris Staley

Chris Staley, making a covered jar with clay that will fi e black.

After going "Round Robin" in class, a student asked me where the phrase came from. The phrase "Round Robin" seems to have originated in the British Royal Navy in 1731. Out at sea if the sailors wanted to file a omplaint with their captain they felt more comfortable signing a round ribbon so the captain would not know who signed firs . Any plans of mutiny in the British Navy during the 18th century could be a hanging offense, so disguising who signed first as a matter of self-preservation.

As a college professor I have been teaching college students to center and throw pots for over 35 years. It's a challenge to hold one's hands steady and center a spinning lump of clay and then shape a round symmetrical pot. Yet for the potter the circle is seminal.

As an educator, I have found the circle seminal to my teaching as well.

The simple process of going "Round Robin" and having every student share their thoughts has profound pedagogical signifi ance. Nothing creates a greater sense of community in a class than honoring the simple notion that each student is worth listening to. When all students are

ROBIN

given an opportunity to speak they feel valued and respected. In addition this process provides students an invaluable opportunity to learn from each other.

In classrooms today there seems to be a dearth of interest in hearing from every student present. As teachers we are expected to be authorities in our respected disciplines. And in the current academic culture of evaluation and assessment teachers feel compelled to demonstrate their command of subject matter, so teachers talk, sometimes ad nauseam.

It is revealing that in 2012 Finland was ranked number one in the world in high school education, and the United States was ranked 17th. In the documentary *Th Finland Phenomenon* (Compton, Ellis, Faust, & Woodard, 2011), a study by John Goodlad was cited, revealing that in the United States high school teachers on average speak 85% of class time, while in Finland teachers on average speak just 40% of the class time. Finland's teachers encourage their students to think by facilitating group discussions. Too often in the US teachers are preoccupied with their students memorizing key points in their lectures. An academic culture preoccupied with grades undermines the importance of engaging students to become active participants in their own education.

The use of "Round Robin" is benefic al for all kinds of meetings. In my experience, a few loquacious individuals often dominate faculty meetings. Th s lack of inclusion can be demoralizing, leading to apathy. However, when everyone has his or her opportunity to speak each person feels respected and appreciated.

Nothing creates a greater sense of community in a class than honoring the simple notion that each student is worth listening to.

Once I was asked to quickly write 10 reasons why I made pottery. One of my responses surprised me: "I make pots so someone will listen to me." As a young man I thought I did not do anything very well. I somehow reasoned if I created dynamic pots someone might be interested in what I had to say.

Our desire to be heard has existed since our distant ancestors fi st gathered around the circular ring of a campfi e to share stories. Sitting in the physical presence of others and participating in the circularity of sharing, we feel a sense of belonging. Often, shared laughter and tears bring people closer together. Going "Round Robin" in person is a humanizing counterpoint to the digital age of communication.

Being the captain of a British frigate in the 18th century and a college professor in 2016 are similar in that they are both positions of power and influence. I once read that people who have real power give it away. In trying to practice this aphorism, I give up some of my talking time to students. In doing so, I hope to empower students to be leaders and thinkers in their own right.

It is amusing to think of sailors in 1731 discussing a way to have their views collectively heard. Could these sailors have ever imagined that going "Round Robin" would enable so many others to be heard as well? ■

Chris Staley is Distinguished Professor of Art at Penn State University, University Park, Pennsylvania. E-mail: cxs41@psu.edu

Reference

Compton, R. A., Ellis, B., Faust, S., & Woodard, E. (Producers), & Faust, S. (Director). (2011). *Th Finland phenomenon* [Motion picture]. USA: New School Films & True South Studios.

Charles Demuth (American, 1883–1935). *Two Trapeze Performers in Red*, c. 1917. Watercolor and graphite on wove paper, 8 × 13 in. (20.3 × 33 cm). BF644. Image © 2015 The Barnes Foundation.

The Art and Science of Looking: Collaboratively Learning Our Way to Improved

AS A FINE ART COLLECTION FOUNDED BY A SCIENTIST WITH A PASSION FOR ART AND A VESTED INTEREST IN EDUCATION, THE BARNES FOUNDATION IS IN AN EXCITING AND UNIQUE POSITION TO EXPLORE AND DEVELOP EDUCATIONAL PROGRAMMING AROUND SCIENCE, TECHNOLOGY, ENGINEERING, ART, AND MATH (STEAM). The education staff determined that using science and math in the context of our art collection may be a promising vehicle for teaching problem solving and creative, critical thinking. However, after refle ting on several iterations of our *Art of Looking* program, as well as the findings of an external evaluation, we recognized a few issues around student understanding of these curricular connections. We determined that for our institution, the art and visual analysis should be the core of every aspect of the program and that scientific and mathematical thinking should be used as tools in service of this goal. In response, our program design challenge was to address this curricular connection issue by collectively learning our way toward an improved program design. **The outcome of our collaborative efforts was a shift in the focus of the program—from an integration of math and science *content*, to a foregrounding of math and science *practices*.**

Vincent van Gogh (Dutch, 1853–1890). *The Postman (Joseph-Étienne Roulin),* 1889. Oil on canvas, 25 7/8 × 21 3/4 in. (65.7 × 55.2 cm). BF37. Image © 2015 The Barnes Foundation.

Don Glass and **Colleen Wilson**

d STEAM Integration

Background Information

The Barnes Foundation embodies STEAM connections at its core. Founder Dr. Albert C. Barnes created a space for logical thinking within the realm of creativity; a place where every viewer enters with all of the tools they need to successfully engage with art, if they understand how to use them. Dr. Barnes's (1990) philosophy, strongly influenced by educational philosopher John Dewey in his role as the Barnes Foundation's fi st director of Education, emphasized the scientific ature of using keen observation to determine meaning in art, asserting that:

> To see as the artist sees is an accomplishment to which there is no short cut, which cannot be acquired by any magic formula or trick; it requires not only the best energies of which we are capable, but a methodical direction of those energies, based on the scientific understanding of the meaning of a t and its relation to human nature. (p. 7)

Paul Cézanne (French, 1839–1906). *Ginger Jar (Pot de gingembre)*, c. 1895. Oil on canvas, 28 7/8 × 23 3/4 in. (73.3 × 60.3 cm). BF23. Image © 2015 The Barnes Foundation.

The challenge for visual arts educators is to make rich and valid cross-curricular connections...

In the spirit of Dr. Barnes's educational objectives, The Barnes Foundation pioneered *The Art of Looking* in 2012, a STEAM-based program for 5th and 6th grades in the School District of Philadelphia that focused on the connections between art, science, and math. Th s wrap-around program included an outreach classroom lesson by a Barnes educator before the guided tour of the collection with a hands-on activity in the gallery classroom. Over several versions of the program between 2012 and 2014, the content focused on using artwork in the collection to explore light and shadow, color and light physics, geometric shapes, and coordinate planes.

The fi dings from an external evaluation[1] found that while students made connections between art and science and math, they rarely used science and math vocabulary when discussing art. Additionally, students spent signifi antly more time listening to a guide rather than actively engaged in higher order thinking. A recommendation from the report suggested further examination of grade-level standards in math and science, as well as a collaboration with content area specialists to develop knowledge and confide ce in the integrated subject areas. In addition, developing an embedded assessment, rather than using an external evaluation instrument, might be useful for monitoring the impact of the program.

A Collaborative Improvement Process

In arts education discourse, the arts are often described as having many "instrumental" benefits including improvements in academic performance in math and reading. The instrumental versus intrinsic argument has played itself out in the arts education fi ld with Elliot Eisner's (1998) thoughtful article, "Does Experience in the Arts Boost Academic Achievement?," and then revived with a meta-analysis by Winner and Cooper (2000) that found no evidence in studies to show that arts learning contributes to achievement in other subject areas. In response to these debates, Burnaford, Brown, Doherty, and McLaughlin (2007) created a literature and research review of arts integration that traced cross-curricular design from John Dewey to current day arts integration defin tions, frameworks, and practices that include students as artist/scientists.

Although arts integration has long been a key feature of many arts education and museum programs, cross-curricular design is a growing strategy in general education as the Common Core State Standards (CCSS)[2] and Next Generation Science Standards (NGSS)[3] are being implemented. These new sets of standards demand curricular design where literacy, numeracy, and cross-cutting concepts and practices are used across subject areas. Th s expansion of what it means to read, write, communicate, and reason demands that curricular connections across subject areas are conceptually coherent, appropriate for and relevant to disciplinary knowledge, and scaffolded and flex ble enough to support the general transfer of knowledge and practices to other contexts. In their report on the alignment of the National Core Arts Standards[4] and the CCSS, the College Board notes the "similarities in habits and processes described in standards across subject areas" and advocates for a systematic process to put them into practice (The College Board, 2014, p.12).

Many STEAM programs are designed around Project Based Learning (PBL), which features student choice in creatively and collaboratively solving relevant design problems with real world products. The instructional activities scaffold over a sustained period of time allowing practice and feedback toward a fi al authentic product or assessment task. Frequently, STEAM programs feature "maker" projects with a strong engineering and design focus, rather than a straight visual arts one (Clapp & Jimenez, 2015). Integrating curriculum across disciplines, while honoring the distinctions of disciplinary knowledge and practices, can be difficult to pull off uccessfully—especially if you have limited content and pedagogical content knowledge in the integrated content area. The challenge for visual arts educators is to make rich and valid cross-curricular connections that recognize the potential transfer of skills and knowledge, but be wary of possible limitations because of the specific d sciplinary knowledge and processes in science or math. Ideally, a strong connection can be made around big ideas (Wiggins & McTighe, 2005), fundamental concepts (Scripp & Reider, 2007), practices, and habits of mind (Hetland, Winner, Veenema, & Sheridan, 2007) that validly connect aspects of the arts and sciences.

Th s requires a level of content knowledge and comfort with multiple subject areas, and in some cases, the pedagogical content knowledge of how to teach specific c ntent to a range of students. For example, to connect the arts with math requires not only comfort and fluency with mathematical processes and thinking, it also requires at least an awareness of instructional methods typically used to teach and give assessment feedback on math problem solving. If a student cannot do the math, and the math is a strategy to make sense of the art, then the potential learning connection will not be made.

To address this, the Barnes invited participants with expertise in arts education, science, and math from the School District of Philadelphia and beyond to play key roles in the optimization of the new program. To support a re-thinking and remix, we used a set of improvement processes (Bryk, Gomez, Grunow, & LeMahieu, 2015), and set up a series of design study groups facilitated by a curricular coach with developmental evaluation (Patton, 2011) experience. The initial meetings were face-to-face at the Barnes Foundation. Later, we met remotely using a conference calling service, and shared via online collaboration tools. Each of the meetings featured a routine of examining program data to generate discussion around a guiding question, as well as protocol-driven sharing and feedback on curriculum, results from testing of activities and materials, or student work examples. The guiding questions systematically took us through a design trajectory that began with clarifying worthwhile learning goals and standards, designing assessments, and piloting scaffolded learning activities (Wiggins & McTighe, 2005).

Drivers for Improvement

- **Cross-Disciplinary Design Team** consisting of museum educators, arts specialists, a district math/science curriculum supervisor, and a curricular coach.
- **Practical Measurement with Peer and User Feedback** from brief surveys, activity testing, and protocol-driven document and student work reviews.
- **Standards Alignment** using a few relevant National Core Arts Standards (NCAS), NGSS, and CCSS.
- **Assessment Design** of a summative performance assessment task with formative assessment evidence along the way.
- **Scaffolded Learning Activities** providing practice at applying knowledge and routines towards a novel performance assessment task.

Improving Our Curricular Knowledge

Prior to starting our meetings, we all took a brief self-survey that rated our content knowledge across several relevant topics in visual art, science, and math. At the beginning of our fi st meeting we looked at our responses, which gave us an opportunity to visually see what expertise and knowledge we had around the table. It seemed that we had mid to high levels of math and science content knowledge in the group, but the science educators had lower levels of art content knowledge. To help us all get on board about what the arts education experience at the Barnes was like, we fi st went down into the galleries to look, think, and talk about what we saw in a few pieces of art. After having an experience in the galleries similar to what the students experience, the museum educator then showcased a few of the arts activities, materials, and models that were currently being used.

The concept of *wonder* quickly became a key part of the conversation. Seeing the world through the eyes of an artist may seem magical on the surface, but our science curriculum experts agreed with Dr. Barnes that the particular specialness of artworks can be examined and revealed through close analysis. Furthermore, repeated engagement with an artwork will continually reveal new observations. Far from "debunking the magic," this response to *wonder* instead empowers the viewer and enhances their connection to the artwork. By giving students the tools to think critically and draw from their curricular and extracurricular experience when looking at artworks, we are allowing students to become part of the power of art. Th ough our collective work, we generated the following design principles for our STEAM program.

Our STEAM Design Principles

- Ground everything in the artwork in the Barnes Foundation collection.
- Start with wonder and be discovery-oriented.
- Establish and practice looking strategies and routines for making inferences based on evidence (Claim-Evidence-Reasoning).
- Experiment with materials and effects.
- Scaffold Investigate-Plan-Make activities and practice toward a novel performance assessment task or design challenge.
- Pitch content at the appropriate developmental, interest, and background knowledge levels of students.

Making Stronger Curricular Connections

One of the most critical issues to address was the strength of the curricular connections between the visual arts represented in the collection with relevant science and math content. Luckily, many of the new sets of standards demand a cross-curricular design orientation. Prior to our second meeting, we all took another survey asking us to rate the strength of the curricular relationships among arts, science, and math content, and then rank the relevance of a related set of National Core Arts Standards and Next Generation Science Standards. Reviewing the fi dings of this short survey jump-started a discussion about the curricular focus that continued between our meetings, and enabled us to quickly select a small number of key standards to guide our assessment and curricular design decision making. The two main arts standards related to *Responding* to art in the collection, and then *Creating* with art to apply concepts and demonstrate understanding.

The school district science specialist advised us to focus on incorporating the science practices rather than spending a lot of time on the physical science concepts, "The practices are more timeless and universal and will be something that students are covering throughout each grade." Consequently, we decided to focus on the *NGSS Science and Engineering Practice of Engaging in Argument from Evidence*. Th s seemed to strongly relate to the

By giving students the tools to think critically and draw from their curricular and extracurricular experience when looking at artworks, we are allowing students to become part of the power of art.

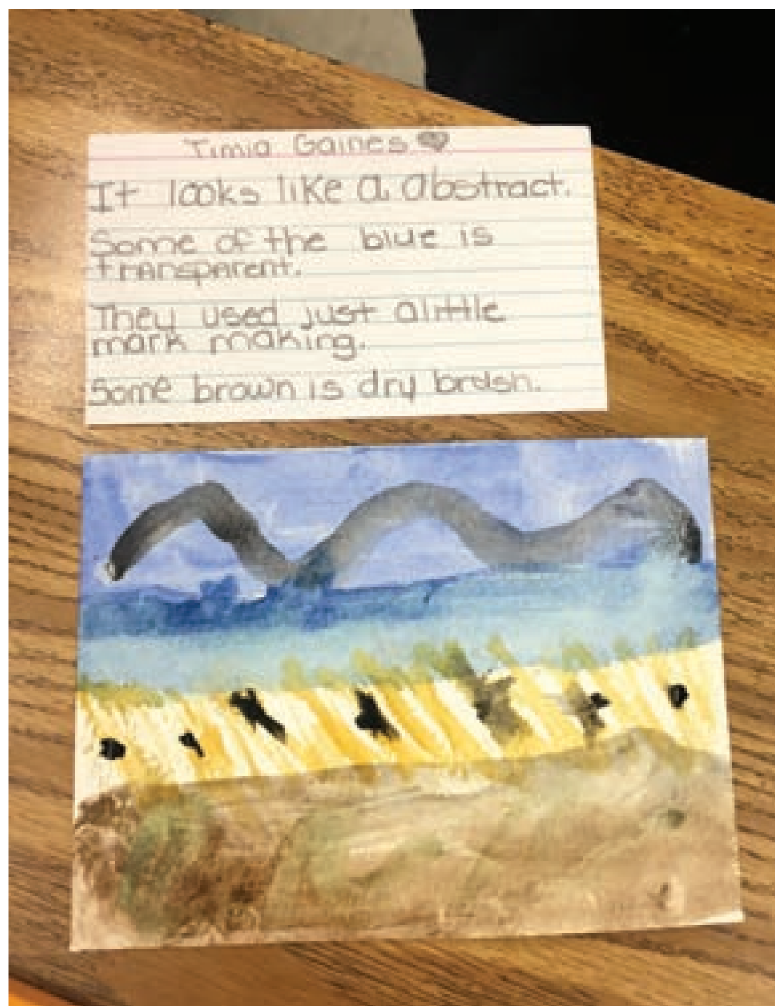
In the first *Art of Looking* Outreach Lesson, 5th-grade students at Benjamin Franklin Elementary observe and record evidence about a partially concealed artwork from three squares revealing parts of the artwork. As a group, the students will then make a claim about whether the painting is a portrait, landscape, or still life based on the evidence. Regardless of the veracity of their claim, students will refle t on the nature of collecting evidence and defending a claim. Photo © 2015 The Barnes Foundation.

types of art looking, observational analysis, and inference-making with evidence routines that are similar to the Barnes method. It also helped us to think about how we can establish and practice looking strategies and routines, as well as set up a process of investigation, planning, and then making.

Designing an Assessment System

The study group decided that the guided artmaking model would not best suit our new goals. In response to the aims of more student-led thinking, we agreed that every lesson in the program would be based on a series of scaffolded learning activities that culminated in a making project framed as a *design challenge*. Th s fi al project was to be a creative summative performance assessment task aligned with the learning goals and standards.

In order to best understand what we were asking students to do, the *Art of Looking* study group staged a short *design challenge* for ourselves. A quick and simple paper airplane design challenge gave us insights into the intended and unintended outcomes of the design challenge model. The key ingredient was time; we needed time to settle into a group dynamic, time to brainstorm, time to test, time to revise designs, and time to refl ct. Th s informed us that direct instruction in our new lessons would be minimized to allow time for students to commit to the challenge.



In the second *Art of Looking* Outreach Lesson, after the students' visit to the Barnes Foundation, a 5th-grade student from Hope Partnership School has created an artwork using watercolor. The artwork was based on the written description of a watercolor from the Barnes Foundation Collection as well as techniques learned through scientific xploration of watercolor as a medium. Photo © 2015 The Barnes Foundation.

Th ough this experiment, it also became apparent that the external evaluation method of testing learned content knowledge before and after the program was not always needed if we had students record their thinking as they progressed through the challenges. Th s assessment tool, a worksheet with space for students to write observational evidence and claims, became an important part of the challenge structure and was repeated

After the Design Study Group submitted the first d aft of the *Art of Looking* lesson plans, 5th-grade students from the Franklin Institute Summer Camp tested drafts of the tour and the second outreach lesson. Based on student feedback, the air-dry clay used for the second outreach lesson was replaced with watercolor to better respond to the gallery tour goals. Photo © 2015 The Barnes Foundation.

throughout the program. Th s resolved another struggle in assessment and evaluation of extracurricular programs, that students did not enjoy being tested. Th s embedded assessment produced a more authentic illustration of student engagement and comprehension without losing the spirit of creativity and fun.

In the previous iteration of the program, one lesson included a guided pastel still life activity meant to reveal the relationship between tinting and shading and light and shadow. Th s activity was performed in the fi al few minutes of the pre-visit outreach lesson after a presentation and discussion of the scientific ethod and the basic science of light, shadow, and color. While the outcome was signifi ant for the limited time, the strictly guided experience left l ttle room for gauging levels of student engagement with the concepts and creative thought. Additionally, its placement before their visit meant that students were creating before they had a chance to explore how other artists solved the same problem or used the same techniques. In the gallery classroom during their visit, students were again guided to create a shaded still life, this time using iPads as their medium. Th s gave us a better understanding of student improvement through the course of the program, but the learning curve of using the technology became a barrier that often prevented success or creativity in student work.

Developing and Testing Learning Activities

With the resources and lessons learned from previous iterations, we were primed for creating new, more effectively connected STEAM learning activities. With a design challenge model in mind, our task was to create a series of five scaffolded activities for each grade level progressing through a new structure that included a pre-visit outreach lesson, a lesson administered by the classroom teacher, a fi ld trip with a gallery tour and a gallery classroom activity, and a post-visit outreach lesson. Each activity had to build on an arts, scientific, r mathematics concept used in the previous activity, and then culminate in a novel design challenge project.

Like a jigsaw puzzle, each component had to be tested in the context of the surrounding activities, and then evaluated for its strength to the program as a whole and likelihood of student success. Each draft f activity was constrained by time, concerns for complexity of materials set-up, clean-up, and ease of use. Our initial tests were actually using the art materials to do the activities ourselves. We used our virtual study group meetings to share the curricular activities and provide peer feedback on design, as well as used resulting student work, observations, and student feedback to appraise our efforts and refi e our work.

The revised pre-visit outreach lesson now introduces scientific observation, evidence gathering, and claim-making through a *mystery painting* challenge. In this challenge, students are presented with a painting that has been concealed except for a few small sections. Using observation of the exposed sections of the painting, groups of students are asked to gather good evidence, make claims about what the painting looks like, revise their claims based on new evidence, and then refl ct on the process once the complete painting is revealed. Th s activity encourages creative, student-led thought, while building important evidence-based argument skills for future art and science investigations. Th s Claim-Evidence-Reasoning method is a structured way to guide observation and argumentation, and is used repeatedly throughout the program, building student confide ce in their own thinking process.

Over the summer before implementation of the revised program, we had an opportunity to test a few of these draft activities with students and get feedback. One example proved that although the structure of the activity succeeded, the materials used were not contributing to the program goals. Initially, students were asked to write evidence about an artwork from the Barnes collection on a note card, then swap cards with another student and create an artwork of their own design with quick-dry modeling clay based on the evidence provided on their partner's note card. As the students had spent a long time using the Claim-Evidence-Reasoning method to learn about different artmaking materials, students were then disappointed not to use the materials that they had learned about. In changing the material to watercolor, we were able to add in a science experiment portion of the lesson in which students explored the effects of using watercolor with different variables, and then were able to conclude by making their own watercolor artwork informed by the new techniques.

Conclusion

Our design study group represented educators with diverse and relevant expertise, working collaboratively to design, test, and get feedback on the revision of the *Art of Looking* program. We used practical measures, art experiences, and student work to fuel our design discussions and decision making. Th ough the revision process it became clear that the primary objective should be to engage students in art analysis complemented by relevant mathematical and scientific ractices, with artmaking as a secondary goal used to demonstrate student understanding. In the end, we came up with a new set of learning opportunities that help to show what arts integration and the new standards look like in practice—something that both our students and Dr. Barnes might consider "seeing how the artist sees." ■

ORCID

Don Glass
http://orcid.org/0000-0001-6280-1944

Acknowledgments

We dedicate our article to the life and educational work of Don McKinney who helped us see real science in real art.

Design Study Group

Jennifer Nadler, K-12 and Educator Programs Manager, The Barnes Foundation

Kristy Len, Curriculum Specialist, K-8 Science, Office f Curriculum, Instruction and Assessment, The School District of Philadelphia

Erin Riley, Art Specialist and Director Engineering and Design Lab, Greenwich Academy

Don McKinney, Program Coordinator, Math + Science Coalition, Philadelphia Education Fund

Don Glass is an independent learning designer and developmental evaluator based in Washington, DC.
E-mail: donglass@gmail.com

Colleen Wilson is the Outreach Coordinator: Art of Looking at The Barnes Foundation in Philadelphia, PA.
E-mail: cwilson@barnesfoundation.org

References

Barnes, A. C. (1990). *The art in painting*. Merion Station, PA: The Barnes Foundation Press.

Bryk, A. S., Gomez, L. M., Grunow, A., & LeMahieu, P. G. (2015). *Learning to improve: How America's schools can get better at getting better*. Cambridge, MA: Harvard Education Press.

Burnaford, G., Brown, S., Doherty, J., & McLaughlin, H. J. (2007). *Arts integration frameworks, research, and practice: A literature review*. Washington, DC: Arts Education Partnership.

Clapp, E. P., & Jimenez, R. L. (2015, March/April). STEAM not stickers: Creating a meaningful role for the arts in STEM learning. *Harvard Education Letter*, *31*(2), 4. Retrieved from http://hepg.org/hel-home/issues/31_2/helarticle/steam-not-stickers

Eisner, E. W. (1998). Does experience in the arts boost academic achievement? *Art Education*, *51*(1), 7–15.

Hetland, L., Winner, E., Veenema, S., & Sheridan, K. M. (2007). *Studio thinking: The real benefits of visual arts education*. New York, NY and London, England: Teachers College Press.

Patton, M. Q. (2011). *Developmental evaluation: Applying complexity concepts to enhance innovation and use*. New York, NY: The Guilford Press.

Scripp, L., & Reider, D. (2007). New ventures in integrated learning: Working toward a model of general symbolic literacy based on the growing understanding of fundamental literacy skills shared between music and language in grades K-2. *Journal for Music-in-Education*, *2*, 337-380. Retrieved from http://musicineducation.org/mienc-site/journal

The College Board. (2014). *Th arts and the Common Core: A comparison of the National Core Arts Standards and the Common Core State Standards*. New York, NY: The College Board.

Wiggins, G., & McTighe, J. (2005). *Understanding by design* (expanded 2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Winner, E., & Cooper, M. (2000). Mute those claims: No evidence (yet) for a causal link between arts study and academic achievement. *Journal of Aesthetic Education*, *34*(3/4), 11-75.

Endnotes

[1] Dr. Patti Saraniero, Moxie Research: http://moxieresearch.com

[2] Common Core State Standards: www.corestandards.org/read-the-standards

[3] Next Generation Science Standards: www.nextgenscience.org

[4] National Core Arts Standards: www.nationalartsstandards.org

Designing for the Future of Education Requires Design Education

Sarabeth Berk

"**Design** used to be the seasoning you'd sprinkle on for taste; now it's the flour you need at the start of the recipe," tweeted John Maeda (2015), former president of Rhode Island School of Design. One of his followers, Andy Jakubowski, replied, "@JohnSandel @johnmaeda don't you think design has always been the fl ur, it's just we started acknowledging that fi ally?" Consequently, there were 544 retweets and 463 favorites, including my own, of Maeda's initial tweet. For a moment across the twittersphere, Maeda's tweet captured a sentiment shared by many in the fi lds of art, education, business, and design. As art educators, we know that design is essential beyond the art classroom, although its fundamental application to student learning has largely been ignored.

Future educational models should focus less on teaching a body of knowledge and more on teaching habits and skills that pertain to how to solve complex, system-level problems that cross disciplinary boundaries (Senge, 1995). As mentioned above, design is still treated as the seasoning in K-12 education instead of the fl ur learners need to consider at the start of any project or lesson. Design education exists in pockets of K-12 curriculum, but not to the depth that is necessary for today's society if we are to prepare students to become competitive, competent workers.

The tweet by Maeda acknowledges that design is more than an aesthetic decision; rather, it is a foundational ingredient of inventing new processes, products, and experiences, and it is driving the economy. In fact, design is becoming so essential to business, especially in the tech industry, that in recent years "27 start-ups that were co-founded by designers have been acquired since 2010 by companies such as Google, Facebook Adobe, LinkedIn, Dropbox, and Yahoo" (McFarland, 2015) and all of the top 10 business schools have student-led design clubs (Maeda, 2016). Further evidence of the need to embed design into K-12 curriculum is that the Bureau of Labor Statistics projects a boom in design-based jobs. For instance, web development (a fi ld that includes UX [user experience] designers, web designers, and webmasters) anticipates a 27% increase between 2014-2024, a much faster than average forecast (Bureau of Labor Statistics, 2015).

For students to be successful in the workplace, they need to explicitly learn design skills and habits, and that means design needs to exist across the curriculum in art and non-art classrooms. Just as Rolling (2016) and others argue for the importance of STEAM in the arts classroom since the arts and sciences are inherently part of a system of techniques, design education is also complementary to artistic and scientific ractices. Art educators do not need to teach students to become designers, but they should introduce design as a critical creative problem-solving tool that weaves together multiple disciplines.

Let us recognize that design, as a fi ld, is driving innovation as much as science, technology, engineering, and math (STEM). The complex challenges of today require solutions that are found as a result of interdisciplinary and hybrid interactions between diverse methodologies and skills. I already flagged the current business landscape that signals the need for an even greater design savvy workforce, but in order to understand the importance of design in art education, contemporary pedagogy, and for students, I will outline what design education and the fi ld of design means, and explain the unique skill sets that designers possess. As we attempt to make educational experiences more relevant, design must be leveraged as a key component of teaching and learning in all of today's classrooms.

Design Education Defined

Design education in K-12 manifests in two forms. The fi st being aesthetic forms of design, which relates to the arts, and the second is functional design, which relates to engineering and STEM disciplines (Bequette & Bequette, 2012). In the past, design education in K-12 was something to appreciate, the noun form of design, yet designers today use design as a verb, they live the processes and qualities of designing.

Design as a verb, and the method known as design thinking (Brown, 2008a), aligns with the highest level of the revised version of Bloom's Taxonomy (Krathwohl, 2002). The term *creating* is the label chosen for the top level of Bloom's, and, like the term design, it refers to the acts of planning, problem solving, and putting together meaning to make improvements or radical innovations. As Jones (2008) elaborates, "Design is both a way of thinking about the world and a methodology for building new things" (p. 1). Likewise, authentic design education should encompass both the noun and verb defin tions of design.

We want students to explore, experiment, and arrive at unique solutions on their own. Design methodologies allow students to practice becoming problem solvers because the act of designing follows a repeatable process for solution fi ding. While there are many versions of the design process, often the design thinking model by d.school (Figure 1)[1] at Stanford is referenced, they tend to follow a cycle of specific a tions such as: empathize, defi e, ideate, build, test, and iterate. Entrepreneurs, educators, and workers of all backgrounds report obtaining more innovative solutions by following these steps because "design thinking allows high impact solutions to bubble up from below rather than being imposed from the top" (Brown & Wyatt, 2010), which is the more traditional way of problem solving.

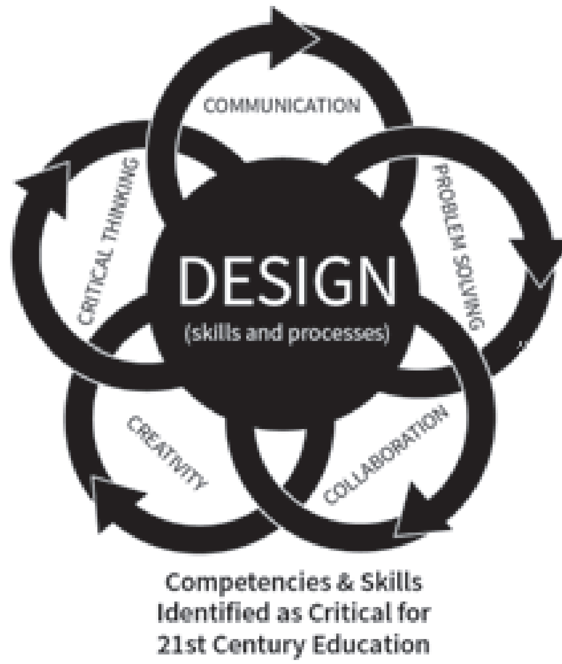


Figure 2. Design as a core competency (Berk, 2016).

In the last five years, design thinking has made traction in K-12 classrooms where educators see it as a new innovation in curriculum and teaching. As defi ed by Kwek (2011), "Design Thi king is an approach to learning that focuses on developing children's creative confide ce through hands-on projects that focus on empathy, promoting a bias toward action, encouraging ideation and fostering active problem-solving" (p. 4).

Th s implies that design education encompasses a variety of skills and abilities both technical and non-technical that apply directly to other content areas and leverage higher-order thinking. While design is a fi ld of study, design education also pertains to a set of competencies (Figure 2) that transfer across subjects and have deep relevance to the modern workforce and encompasses 21st-century learning.

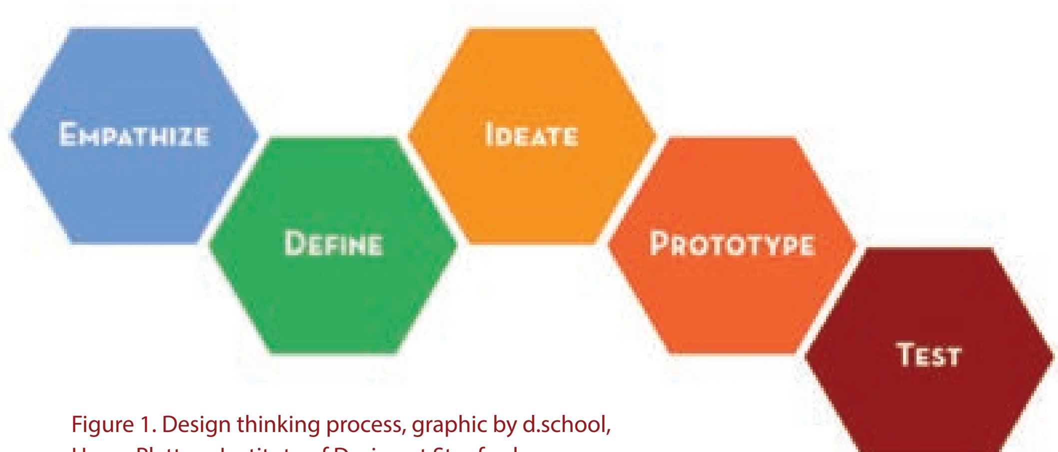


Figure 1. Design thinking process, graphic by d.school, Hasso Plattner Institute of Design at Stanford.

The Field of Design

The field of design is rapidly expanding. New disciplines are appearing within design as new technology develops, widening the scope and role of designers. Today, architects, fashion designers, software developers, animators, app designers, game designers, product developers, user experience designers, and many other careers fall under the field of design (Lawson, 2006).

It is easy to take for granted that design spans every inch of our human experience from products to processes and services, so much so that oftentimes as art educators and as citizens, we forget about its significance or become desensitized to the integral role it plays. For instance, IDEO, a leading design firm, worked with Shimano, the bike component manufacturer, to discover why 90% of American adults do not ride bikes. What they found was that the bike buying process intimated adults, and adults were concerned about traffic. This led the design team to: (1) create a new brand concept called "Coasting," (2) enhance the in-store strategies, and (3) develop a campaign to remind adults how pleasurable biking can be (Brown, 2008b).

In many circumstances, design has become the regular way of doing business and part of daily operations. Airbnb uses a design device called Snow White to create storyboard cartoons of intended customer experiences before they launch new products (Kessler, 2012). When Apple was developing the Genius Bar, they studied concierge services at the Four Seasons to determine what makes for a great customer experience (Gallo, 2011). Even Kaiser Permanente, a national healthcare provider, used design thinking to re-engineer shift changes for nursing staff to streamline transitions between shifts (Brown, 2008b). Design is literally at the foundation of major decisions, and it enables companies and organizations to find better solutions to complex processes and systems that change customer experiences. This type of design is known as human-centered design. It follows the steps outlined in Figure 1, and it aims at developing strong ideas rather than making ideas look more aesthetically pleasing.

Interestingly, as a field, design is relatively new and only became embedded as a discipline in universities and colleges during the 1970s (Lawson, 2006). Up until that point, design had been in service of technical education or within elements of general education but had not stood on its own. Even though K-12 is a pipeline for college and career, and some classrooms are beginning to experiment with design methodologies and mindsets outside of arts classrooms, it has not been widely adopted in general education. With recent educational trends in the United States heading toward interdisciplinarity, STEM, and project-based learning, design education is a discipline that remains underrepresented in K-12 schools, yet it is already an instrumental force among businesses, business schools, and is a desired skill set among employers.

The Work of a Designer

As educators, it is our duty to make explicit the implicit and bring deeper understanding about the field of design and design skills to our students. Just as society is shifting, so too is the work of a designer. In a recent survey of designers, "93.5 percent were in favor of designers learning to code, which wasn't the case when he (Maeda) first entered design" (McFarland, 2015). This points to the idea that designers work at the intersections of disciplines by experimenting with mixtures of methods to create hybrid points of integration. A designer is someone who is constantly learning various crafts and technical skills because he or she "must learn to appreciate or exploit new technology as it develops" (Lawson, 2006, p. 6).

To describe what a designer is, it helps to consider how they work. Designers have a specific way of working, and it is distinctly separate from scientific or scholarly ways of working (Cross, 1982), or even when compared to artists. Artists can be designers and designers can be artists, but they do work differently. Artists focus on the act of making, follow rules that are self-imposed, and ponder the possibilities of an idea. On the other hand, designers focus on developing solutions within a set of rules or constraints (Duvall, 2014). At times, designers and artists are not aligned and have different aims, an area that is ripe to be discussed and debated further in the literature.

The problem-solving strategies of designers are what make them unique. In a study of architects and scientists, the findings revealed, "that while the scientists focused their attention on discovering the rule, the architects were obsessed with achieving the desired result" (Lawson, 1980 as cited in Cross, 1982, p. 225). In sum, architects, and by extension designers, are solution-oriented and learn about the rules governing a problem while attempting solutions. In contrast, scientists focus entirely on studying the rules underlying the problem. This means that the work of designers is about developing multiple solutions to problems within predetermined constraints while learning as much as they can about the problem along the way. This type of work ethic is crucial since today's problems are increasingly more complex and wicked (Churchman, 1967).

Design education is a discipline that remains underrepresented in K-12 schools, yet it is already an instrumental force among businesses, business schools, and is a desired skill set among employers.

If design challenges permeate our daily existence, then how might we, as art educators, encourage students to design original solutions to major and minor dilemmas such as climate change, homelessness, making friends, finding the astest route to school, or managing excess homework?

Deepening Design Education in K-12

The act of learning is essentially a type of design problem. Designers use the question stem "How might we…" to establish a mindset of possibility and curiosity, which is akin to how teachers set about teaching. For instance, art educators might frame art assignments with, "How might we create better signage around access to public transportation?" Or, "How might we share information about local environmental issues to non-English speakers?" Curricula that is framed through opportunity statements allows for the design process to be activated and for interdisciplinary connections to be easily woven.

Nationally, there are K-12 schools that are already moving toward a design-centric educational model or culture. Zhao (2012) studied High Tech High's use of project-based learning and found it to be an extremely design-centric model. Zhao (2012) states that High Tech High "follows four design principles distilled from the fi dings of the New Urban High School Project: personalization, adult world connection, common intellectual mission, and teacher as designer" (p. 194), and this permeates the pedogogy and school culture. Imagine if art educators embodied one, two, or even all four of these principles in their classrooms. Then design would be infused into the classroom culture as well as in the learning experience.

Additionally, engineering and design are closely related in the creation of products as well as in systems development. There are educational movements that attempt to disrupt the binary between arts and sciences in order to emphasize interrelationships across disciplines. Science, technology, engineering, art, and math (STEAM) and science, engineering, art, and design (SEAD) are two efforts aimed at reinforcing more interdisciplinary studies and synthesizing "what we now know about the role of art and design into the practices of science and engineering" (Harp, 2012). Art educators are one element of a national effort to integrate the arts and design into general education.

It is essential that we provide real world topics to students both inside and outside of the art room and allow them to problem solve and grapple with (re)designing solutions. Everything in our lives has been designed to serve a purpose or meet a need either by humankind or by Mother Nature. If design challenges permeate our daily existence, then how might we, as art educators, encourage students to design original solutions to major and minor dilemmas such as climate change, homelessness, making friends, fi ding the fastest route to school, or managing excess homework? The art studio is a prime space to incubate and taste test being an artist as well as being a designer.

In an era where educational systems are increasingly focused on standardization and core competencies (Heilig, Cole, & Aguilar, 2010), the adoption of design education as more than a technical discipline or aesthetic device means that we also need to develop and cultivate a pipeline of art and non-art teachers who are able to model the habits of designers as problem solvers as much as creators. Since the role of the arts in 21st-century education is being re-visioned (Beghetto, 2015; Gude, 2013; Inhulsen & Reeve, 2014) now is a ripe time to imagine how arts educators can be exemplars, advocates, and early adopters who both receive design-specific rofessional development and/or guide schools and other teachers in how to leverage design education and mindsets across their schools and K-12 education.

Conclusion

Maeda's tweet is but one of many leaders signaling that the era of design education as a core competency of P-20 has arrived and that the future workforce will be well served if they can work and think like designers. It is time to prominently position design as a central underpinning of educational knowledge and ability. The world is increasingly becoming a place of interdependencies where fragmented specializations reduce our ability to work across disciplines. Neither K-12 or higher education can teach enough knowledge anymore, but the ability to be an autodidact and use higher order thinking is one of the most important attributes for life outside of formal education.

The trends are clear. Primary and secondary education need to widely recognize that design is a critical fi ld and economic driver, so much so that major companies such as Airbnb, YouTube, and Flickr have designers as co-founders (McFarland, 2015; Yeezy, 2014). As esteemed design advocate Ralph Caplan purports, "Thi king about design is hard, but not thinking about it can be disastrous" (as cited in KREATIVE, 2015). The fi ld of design is changing, the role of designers is becoming more prominent, and the need for design education in K-12 is greater than ever.

Many art educators teach design in some form, but to what extent are they teaching it? Are they teaching it as an innovative approach to problem solving, or showcasing how it is embedded in operational systems and structures of global industries? Furthermore, how well are art educators collaborating with non-art colleagues to influence and impact the use of design as a methodology that can be applied across disciplines? Last, how knowledgeable are art educators already about using design as a problem-solving process, or is there a deep need for training and professional development for the art education community in how it applies beyond traditional design projects? By posing these questions, I hope to expand awareness about this topic and encourage art educators and K-12 classrooms to inquire into the signifi ance of design in their curriculum and in society. ■

ORCID

Sarabeth Berk

http://orcid.org/0000-0001-6999-7230

Sarabeth Berk, PhD, is the Assistant Director for the CU Boulder Innovation & Entrepreneurship Initiative at the University of Colorado Boulder. E-mail: Sarabeth.Berk@colorado.edu. Twitter: @sbberk11

References

Beghetto, R. A. (2015). Teaching creative thinking in k12 schools. In R. Wegerif, L. Li, & J. C. Kaufman (Eds.), *The Routledge international handbook of research on teaching thinking* (pp. 201-211). London, England: Routledge.

Bequette, J. W., & Bequette, M. B. (2012). A place for art and design education in the STEM conversation. *Art Education*, *65*(2), 40.

Berk, S. (2016). *Design as a core competency.* Retrieved from www.sarabethberk.com/publications

Brown, T. (2008a). Design thinking. *Harvard Business Review*, *86*(6), 84–92.

Brown, T. (2008b). Design thinking: Executive summary. *Harvard Business Review*. Retrieved from https://hbr.org/2008/06/design-thinking

Brown, T., & Wyatt, J. (2010). Design thinking for social innovation. *Stanford Social Innovation Review*. Retrieved from http://ssir.org/articles/entry/design_thinking_for_social_innovation

Bureau of Labor Statistics. (2015). Occupational outlook handbook, 2016–17 edition, *web developers, on the internet.* U.S. Department of Labor. Retrieved from www.bls.gov/ooh/computer-and-information-technology/web-developers.htm

Churchman, C. W. (1967). Guest editorial: Wicked problems. *Management Science*, *4*(14), B141-142.

Cross, N. (1982). Designerly ways of knowing. *Design Studies*, *3*(4), 221–227.

Duvall, A. (2014). Design vs art: The difference and why it matters. *Hongkiat*. Retrieved from www.hongkiat.com/blog/design-vs-art

Gallo, C. (2011). How the Four Seasons helped Apple store rewrite the rules. *Forbes Magazine*. Retrieved from www.forbes.com/sites/carminegallo/2011/05/20/how-the-four-seasons-helped-apple-store-rewrite-the-rules

Gude, O. (2013). The new school art styles. *Art Education*, *6*, 6.

Harp, G. (2012). Reimagining the future of higher education: From STEM to SEAD. *Institute for the Future*. Retrieved from www.iftf.org/future-now/article-detail/reimagining-the-future-of-higher-education-from-stem-to-sead/#sthash.03Y7pvZx.2VasewZL.dpuf

Heilig, J. V., Cole, H., & Aguilar, A. (2010). From Dewey to No Child Left ehind: The evolution and devolution of public arts education. *Arts Education Policy Review*, *111*(4), 136–145.

Inhulsen, D., & Reeve, D. B. (2014). By members for members: How the National Art Education Association is using creative leadership to mobilize a professional community and advocate for art education. *Visual Inquiry*, *3*(3), 449–465.

Jones, A. M. (2008). *The innovation acid test: Growth through design and differentiation.* Axminster, England: Triarchy Press.

Kessler, S. (2012). How snow white helped Airbnb's mobile mission. *Fast Company*. Retrieved from www.fastcompany.com/3002813/how-snow-white-helped-airbnbs-mobile-mission

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice*, *41*(4).

KREATIVE. (2015). Thi king about design is hard. *KREATIVE*. Retrieved from www.kreative.com/blog/thinking-about-design-is-hard-ralph-caplan

Kwek, S.H. (2011). *Innovation in the classroom: Design thinking for 21st century learning.* (Master's thesis). Retrieved from www.stanford.edu/group/redlab/cgi-bin/publications_resources.php

Lawson, B. (2006). *How designers think: The design process demystified*. London, England: Routledge.

Maeda, J. (2016). Is business school the new design school? *TechCrunch*. Retrieved from https://techcrunch.com/2016/06/21/is-business-school-the-new-design-school

Maeda, J. [johnmaeda]. (2015, April 14). Design used to be the seasoning you'd sprinkle on for taste; now it's the fl ur you need at the start of the recipe [Tweet]. Retrieved from https://twitter.com/johnmaeda/status/588115995954442240

McFarland, M. (2015). John Maeda says design is winning in Silicon Valley. *Th Washington Post*. Retrieved from www.washingtonpost.com/news/innovations/wp/2015/03/15/john-maeda-says-design-is-winning-in-silicon-valley

Rolling, J. H., Jr. (2016). Reinventing the STEAM engine for art + design education. *Art Education*, *69*(4), 4–7.

Senge, P. (1995). On schools as learning organizations: A conversation with Peter Senge. *Educational Leadership*, *52*(7), 20-23.

Yeezy, K. (2014). Ten co-founders of tech companies who began as designers. *Hongkiat*. Retrieved from www.hongkiat.com/blog/tech-founders-began-as-designers

Zhao, Y. (2012). *World class learners: Educating creative and entrepreneurial students*. Thousand Oaks, CA: Corwin Press.

Endnote

[1] Stanford University Institute of Design. (2016). *D.school design thinking process.* Retrieved from http://dschool.stanford.edu/dgift

THE ART OF WORDS: *Ekphrasis in Action!*

Julia L. Hovanec

A student intently generates a list of words based on Frida Kahlo's *Self-Portrait with Thorn Necklace and Hummingbird*.

Imagine the reaction of a classroom full of 3rd-grade students when shown Frida Kahlo's *Self-Portrait with Thorn Necklace and Hummingbird* (1940). Aside from the initial gasps and giggles, some of the disparate phrases students would use to describe the artist and her surroundings range from "scary woman" to "colorful jungle." When shared with the class, these verbal descriptions can enhance each student's perspective of Kahlo's work. Imagine then the value of creating poetry based on this or any other great work of art. The processes involved in creating artwork and poetry are both similar and often reciprocal. Ekphrasis celebrates and cultivates this relationship, particularly encouraging the use of written and verbal descriptive works to enhance the art education experience for students.

While ekphrasis can be explained etymologically as a vivid description of an image, the term has come to be synonymous with poetry about a work of art. First introduced in Ancient Greece as a rhetorical exercise (Welsh, 2007), modern ekphrastic works can simply describe a work of art or expressively bring it to life, inviting the reader to look at the piece in a new and different way. The transformative experience of creating any ekphrastic work has the potential to be powerful, purposeful, relevant, and meaningful, both for the creator and the audience.

As effective as ekphrasis is, when introducing its possible implications to art education students, I found many were unaware of this method of engaging with a work of art. My students had a natural understanding of the relationship between the word and the image, but finding tangible ways to use this relationship to enhance classroom learning proved to be a bit more difficult. I developed a presentation to specifically detail the various ways ekphrasis could be incorporated in the art classroom. Presented as a summer institute session at Kutztown University and a workshop for the Pennsylvania Art Education Association, the instructional strategies, labeled *Ekphrastic Experiences*, have been well received by art educators, art education students, and education students.

Background

Ekphrasia's role in the art world and the realm of poetry is evident over a long and prolific h story. James Francis outlines the context of the intricate details depicted in the "Shield of Achilles" from Homer's *Iliad*, the fi st recorded example of ekphrasis in Western culture (2009). By describing each contrasting, layered section of the circular shield, Homer offers detailed insight that has resulted in countless artistic interpretations. Since that time, poets ranging from John Milton to William Carlos Williams have used artistic works as inspiration. Today, teachers introduce visual images in reading and writing classrooms to appeal to a diverse range of learners and encourage higher-order, analytical thinking (Moorman, 2006). For teachers who are actually tasked with integrating reading and writing, this integration will provide additional opportunities to foster creativity and develop a deeper understanding and appreciation of art. Teachers who are not required to teach verbal literacy in the art room will fi d that the inclusion of ekphrasis increases motivation, peaking student interest and curiosity. Finding unique, relevant, and content-driven ways to integrate writing in the art room can be a challenge, but it is a challenge that will ultimately allow the art teacher to reach and teach more students without detracting from the visual arts curriculum and, in fact, enhancing it.

After researching historical and contemporary ekphrasis, I explored and developed instructional strategies that have the potential to transform the art room into a literary and creative think tank where art is not only created but also viewed, analyzed, and interpreted. In order to create an ekphrastic poem the writer/viewer, regardless of age or experience, has to engage in critical inquiry and deconstruct a work of art. Similar thinking skills are required to interpret and personalize the written word in order to create a visual representation. The strategies developed used both perspectives to maximize effectiveness in the art classroom. I initially introduced these strategies to twenty art educators to get a critical sense of its impact and received an overwhelmingly positive response. I read ekphrastic poetry aloud while showcasing the inspiring work of art. I also challenged teachers to look at some famous artists' work from different perspectives—focusing, for example, on the background of Leonardo da Vinci's *Mona Lisa* rather than the famous face. Each teacher expressed anticipation over the possibilities of not only teaching a poetically analytical reaction to art, but also infusing an artistic response to poetry in the art classroom.

An art detective uses a magnifying glass to closely examine a work of art.

Five specific reas of ekphrastic experiences serve to introduce this concept in a way that can appeal to a range of skill levels and interests. Each experience requires students to assume the role of a detective—looking closely at an artistic image or poem in order to glean enough feeling and understanding to effectively respond. Aesthetics and criticism techniques are paramount for all five ekphrastic experiences, adaptable to any grade level.

Ekphrastic Experiences

Ekphrastic Writing

While art teachers may not be required to or otherwise fi d themselves specifi ally teaching writing skills, the preparation and act of writing about art is certainly worth the endeavor as students delve into a work to fi d a deeper, personalized meaning (Grierson & Orme, 2015). The primary objective for writing in the art classroom is to trigger an inquiry into a work that goes beyond the image itself, engaging with the feelings that the image conveys. The writing can be poetic or another interdisciplinary collaboration but should, more importantly, be an elaborate description, analysis, interpretation, or judgment that confronts a work of art or even speaks to it (Greenburg, 2001). It can be serious or funny, abstract, or concrete. The writing need only leave a mark on the work of art as the work of art influences and leaves its mark on the writing.

When developing an ekphrastic activity for the art classroom, the fi st and most important step is selecting an appropriate work of art. To create an environment of enthusiasm and success, the work should readily lend itself to ekphrastic writing and be appropriate for the classroom's interest and skill level. A variation of this activity that has inspired some profoundly refl ctive results clusters three works together—a portrait representing character, a landscape representing setting, and an abstract work offering clues to a central plot or confli t (Cornett, 2014). If possible, avoid giving the title of the work or works to allow the reaction to be personal and impartial.

Before beginning the ekphrastic writing assignment, students should thoroughly investigate the work, posing key questions to gain that deeper understanding. Students can become *art detectives* or virtual art museum visitors, making this step interactive and engaging. While questions will vary depending on the chosen work, it is essential that students extract ideas about subject, mood, or setting as well as the unique feelings each student associates with the work. Allow time for students to stop and jot down words and phrases that come to mind throughout the process. Once there is a suffici t amount on paper, have students circle, star, or highlight those words and phrases that are beginning to resonate.

Th *art detective* exercise provides an interdisciplinary opportunity, with the mechanics of writing an ekphrastic work taught in a language arts classroom. If writing occurs in the art classroom, free verse allows students to focus more on the work

A student carefully chooses resonating words and phrases.

Armed with artistic supplies, students begin to immediately create their own works of art that are inspired by the words they hear.

If the shared poem happens to be an example of ekphrasis, the work of art that the poem is written about should not be revealed until after students' work is complete. Envision it on an easel in the front of the art room draped in black cloth with a question mark

of art than the rules of writing poetry. Haiku and acrostic poetry have also worked well. An activity that allows for an artistic ekphrastic response is to simply have students name the painting then use illuminated letters to convey thoughts and feelings associated with the work.

A student visually responds to William Carlos Williams's poem, "The Great Figure."

Ekphrasis in Reverse

I also recommend teachers reverse the concept of ekphrasis, having students create a work of art that is inspired from poetry. Reverse ekphrastic lessons have produced remarkably insightful and creative responses from students of all ages. Existing lesson plans covering a range of media and techniques can be easily adapted to incorporate poetic inspiration. Not only does it give students an opportunity to produce a work of art, it offers an opportunity to explore and appreciate poetry from a fresh perspective.

Choosing a poem that allows for analysis and inspires an artistic response need not be an intimidating venture for art educators. As the objective is to create a work of art, short, descriptive poems work best. The poetry of William Carlos Williams, an accomplished poet, physician, and amateur artist, is often a successful starting point. Williams's poems are rich with imagery that can appeal to a range of ages and skill levels. His 1921 poem "The Great Figure," describing the number on the front of a fi e truck, inspired Charles Demuth's *I Saw the Figure 5 in Gold*. Other poets whose works create ekphrastic inspiration include Ezra Pound, Pat Mora, Walt Whitman, Jacqueline Woodson, Maya Angelou, and Robert Frost.

To allow each word of a poem to inspire a visual response, the poem should be read aloud, slowly and with expression. With eyes closed, students visualize the poem, thereby bringing it to life in their imaginations. If time allows, read the poem again, giving the students the opportunity to relish each and every word. Some students may benefit from reading the poem aloud also.

A visual response to Robert Frost's poem, "Stay Gold."

An example of a work of art inspired by the poem, "Words, Free as Confetti" by Pat Mora.

attached. Once everyone completes the work there can a dramatic reveal. The students could even compare and contrast what they created to the actual work as well as the work of their classmates.

A specific ex mple I have used during the summer institute sessions at Kutztown University highlights the poem "Words Free as Confetti" by Pat Mora. When read aloud, this poem tosses multisensory, metaphorical, and poignant words around the room for students to pluck as inspiration affords. An added bonus is having both English and Spanish words in the poem. The resultant works incorporated collage and the student's own confetti-like words.

Another variation that works particularly well for elementary school students would be to read a picture book aloud rather than a poem. Cover the front of the book and keep the pictures hidden, allowing the words to inspire original responses. Even well-known, beloved books can be used and have often inspired some of the most interesting responses from students. While I have used *Harold and the Purple Crayon* by Crockett Johnson and *If You Give a Mouse a Cookie* by Laura Numeroff, I have also used lesser-known books such as *Painting the Wind* by Patricia and Emily MacLachlan.

Interdisciplinary Ekphrasis

An interdisciplinary approach to Ekphrasis uses art to reinforce lessons learned across the school curriculum and need not be limited to poetry. Students can use the reverse ekphrasis technique to create works of art based on concepts learned in other subjects with a variety of media. Th s works particularly well if a written synopsis, whether poetic or not, can be read aloud for students. Teachers have used works of art to reinforce summer reading assignments, history lessons, and even Einstein's Theory of Relativity.

The best way to celebrate ekphrasis as an interdisciplinary tool is to develop an *ekphrastic swap*. Students create poetry in the Language Arts classroom and unrelated works of art in the art classroom. The poems and works of art are then switched and the students create poems in response to the student artwork and art in response to the student poetry. Th s can either be facilitated in one building, or across buildings or even districts, thereby promoting collaboration. Taking it a step further by creating a book or display sharing the artistic and poetic endeavors of the students brings the concept full circle. Another variation of this technique is to have students in elementary school create works of art. The works of

A student writes an ekphrastic response to her own work of art.

art are then packed up and sent to either a middle school or high school English class and the students in that class create Ekphrastic poetry based on the art.

Digital Ekphrasis

Keeping the poetic spirit alive and opening our poetic hearts as well as the poetic hearts of our students in an age of social media and texting shorthand can prove to be challenging. The overall immediacy of digital entertainment would seem in stark contrast to the intricate beauty of a poem, however they can and do coexist peacefully and powerfully. For this strategy, the technology enhances poetry and poetry enhances the technology.

While any digital image can be used to create ekphrastic poetry, a method that has proven to engage a range of students celebrates the selfi . Each student takes a selfie ith intention. They then take a close look at the image and are asked to think about an expressive word to describe what they see. When the learners really look into their own eyes, it is amazing what words fl w out of them. The students write an ekphrastic poem in response to the selfie sing those words. Th s type of ekphrastic poetry has so many possibilities in the art room and gives the art teacher a chance to get to know each student in a different way. In the beginning of the year, this encounter could be used as an introductory lesson. It also proves to be an optimal vehicle through which to discuss identity—both private and public. The image reveals what others see as the poem shares what is on the inside.

An example of a selfie used o inspire a poetic response about identity.

Performance ekphrasis

Exploring further beyond the painting and the poem, performance ekphrasis introduces learners to the bond between the visual and performing arts (Davidson, 2010). Works of art can be inspired by songs. Additionally, a poem can be written in response to a dance or theater piece. Spoken word poetry introduces a contemporary genre to students while creating an opportunity to produce culturally relevant works of art.

Spoken word poetry is usually associated with hip-hop culture and has strong bonds to storytelling, modern poetry, and theater (Cornett, 2014). The response to spoken word poetry is meant to be immediate and the intent is for the poet to quickly develop a rapport with the audience while expressing an emotion or insight, often related to contemporary issues and social justice. Spoken word poetry is a powerful, high-energy form of expression that elicits a strong, emotional reaction from the audience. Students can create works of art inspired by a poetic performance or use the spoken word technique to respond to a work of art. Since spoken word poetry is intended to be performed in front of an audience, teachers can include the performance as part of the lesson. After students create an ekphrastic poem inspired by a contemporary work of art, with a spoken word poetic performance in mind, they memorize their work. While there is debate as to the importance of memorization (Holt, 2009), I am a proponent of this brain-boosting activity. When performed, the work of art that inspired the ekphrastic poem becomes part of the presentation.

Conclusion

Ekphrasis celebrates the strong connection between the visual arts and the written word and provides opportunities to create connections to other subject areas. Students of all ages and skill levels can increase appreciation for critiquing and creating both poetry and art through a variety of ekphrastic explorations and experiences. In the art classroom, ekphrasis takes on the role of introducing interdisciplinary tactics while offering ample opportunity for aesthetics and art criticism. Ekphrasis offers art teachers a novel way to teach for deep understanding through inquiry-based teaching. Students analyze, evaluate, and create while using judgment to solve problems. Students use logical, even illogical reasoning throughout the process, employing higher-order thinking skills that are motivated through a personal connection. It is not about seeking out the right answer; instead it is about developing a lifelong curiosity and thirst for knowledge. Learners are invited to look at art and life in new and different ways and from various perspectives. Th s

A student engages in a visual response to a poem.

THIS BOLD INTERSECTION OF ART AND POETRY APPEALS TO THE HEART, HEAD, AND HANDS OF STUDENTS.

bold intersection of art and poetry appeals to the heart, head, and hands of students. It creates conversations about art as students are engaged in dialog about their poetic and artistic creations.

In the children's picture book entitled, *Heart to Heart: New Poems Inspired by Twentieth-Century American Art*, Jan Greenberg puts forth the idea that art has the power to inspire language. She further explains that what is written about the work of art by the poet can transform it. Creating art from poetry can have that same potential to extend the written word into imaginative inspired works of heART. The Ekphrastic Experiences shared here allow students to capitalize on the power and beauty of both the image and the text. When art collides with poetry in the classroom, the experiences that result have the potential to be purposeful and meaningful. If this collision is done explicitly and with passion, the result can become magical and transformational. ■

Julia L. Hovanec is Assistant Professor of Art Education at Kutztown University, Pennsylvania. E-mail: hovanec@kutztown.edu

References

Cornett, C. (2014). *Creating meaning through literature and the arts: Arts integration for classroom teachers.* New York, NY: Pearson.

Davidson, D. (2010). Ekphrastic academia: Images, sounds, and motions in academic discourse. *Phati'tude Literary Magazine, 2*(3), 54-84.

Francis, J. A. (2009). Metal maidens, Achilles' shield, and Pandora: The beginnings of ekphrasis. *American Journal of Philology*, *130*(1), 1-23.

Greenburg, J. (2001). *Heart to heart: New poems inspired by twentieth-century American art.* New York, NY: Harry N. Abrams.

Grierson, S., & Orme, S. (2015). Speak Out! How ekphrasia inspires writing on the edge. *English Journal: High School Edition, 104*(6), 47-50.

Holt, J. (2009, April 2). Got poetry? *The New York Times*, p. BR23.

Moorman, H. (2006). Backing into ekphrasis: Reading and writing poetry about visual art. *English Journal*, *96*(1), 46-53.

Welsh, R. (2007). *Ekphrasis.* Retrieved from http://csmt.uchicago.edu

An ADVENTURE in Full Art Integration

Maggie Leysath and **Chad Bronowski**

I stood in the chemistry lab, masked and goggled, attempting to measure chemicals precisely. The chemistry teacher laughed at my obvious frustration learning this new skill. These precise chemical measurements would eventually produce four batches of powdered base glaze (a foundation mixture for glazes) for the following day of glaze mixing and stoichiometry. Yes, I said stoichiometry. Oh, and I do know what it means, even if I need another year of art integration projects in chemistry to learn how to use it properly.

Stoichiometry is a method by which the atomic weight of chemicals is used for increasing a test glaze to significantly larger amounts. The chemistry students who participated in this arts integration study can certainly teach me about stoichiometry because they have already successfully mastered the process, a mandatory learning objective in chemistry. Significant numbers, moles, and stoichiometry were the chemistry learning objectives introduced through full arts integration in our small, East Texas high school as a part of a study designed by the authors for their advanced degrees.

The chemistry teacher and I were both convinced that collaboration between the arts and core subject areas would be advantageous to student success in both subject areas because we had collaborated successfully in the past with different levels of integration. An adventure in full arts integration, one in which the curriculum addresses both art learning objectives and those of the core subject equally, was the natural next step. Inexperience with glaze formulation notwithstanding, we embarked on a semester-long journey into full arts integration in order to provide innovative instruction and lead the way for teachers in all subject areas to do the same.

As an art teacher in the educational leadership doctoral program at Lamar University, I was concerned about how I could be an educational leader. Leadership within the art education field perhaps, but leadership in education as a whole? Not likely. However, educational reform needs what the arts have to offer and art educators are just the people to pave the way. We excel in creating learning environments that support differentiation and hands-on learning. This project allowed the chemistry teacher and me to explore leadership in curriculum and instruction design through arts integration by exploring the ways in which arts integration influenced the chemistry classroom. In order to provide leadership in campus improvement for administrators and core area teachers, we decided to narrow our exploration of the effects of arts integration to the chemistry students and classroom. However, the learning activities in the chemistry classes each included art learning objectives the assessment of which occurred in the final product. Those products included a ceramic bowl thrown by the students and glazed with a glaze developed by the students' chemistry class. Further research concerning the effects of core subject area learning objectives introduced in arts instruction is an obvious next step in research we are excited to investigate in the near future.

Educational reform needs what the arts have to offer and art educators are just the people to pave the way.

Arts Integration as Educational Leadership

I discovered that the rich history of art education dovetailed with educational history and mirrored more current educational trends such as standardization that have recently served to narrow modern curriculum. I continued to discover the many innovative ways artists of all art forms have influenced the educational landscape through teaching-artists, arts integration efforts, and advocacy. Research such as that conducted by Partnerships for Arts Integration Research (PAIR) indicated full integration improves achievement (Burnaford, 2010). The final report found that students considered low performing increased their performance consistently each school year they engaged in arts integrated learning (Scripp, 2012). Scripp reported from the same study that the gap between high achieving students and low achieving students was lessoned by 22%. In fact, 85% of the reading scores for the treatment school exceeded standard as compared to 59% for the district. These results indicated a need for further research concerning the importance of the arts in education rather than a reduction of time and resources for arts programs.

In a report that involved interviews of arts educators in a public school and data concerning funding and instructional time for both arts programs and core subject area, Spohn (2008) used both qualitative and quantitative data to answer questions about the effects of No Child Left Behind (NCLB) on arts education programs and the perceptions of arts teachers. Effects such as decreased instructional time in arts programs due to remediation opportunities for tested subject areas were helpful in these areas but detrimental to arts programs. Too often advantages provided by arts education to K-12 learners have been overshadowed by legislation such as NCLB, which has significantly reduced instructional time and resources in the arts in favor of literacy and numeracy (Spohn, 2008).

A Brief Arts Education History

Although teaching art in public schools on a regular basis was gaining acceptance by 1929 (Corwin, 2001), according to the art education historian, Arthur Efland (1990), the establishment of Normal Art Schools (teaching colleges) in the late 1800s was a radical idea. Up until that time, the idea that art teachers needed training that differed from that of an artist had not been considered. Following an economic downturn just a few years later, subjects such as drawing were eliminated in order to improve efficiency and reduce instructional costs. As the new century progressed, ideas about the nature of education politicized, greatly affecting educational institutions.

The similarities between the school efficiency movement in the early decades of the 20th century and many of the recent changes in education such as greater standardization and the narrowing of curricular scope make clear the educational philosophy of schools as business. According to Callahan (1962), a movement to bring a more businesslike organization to education and the everyday operations of schools was firmly in place by the first two decades of the 1900s. Unfavorable comparisons between business enterprises and schools suggested that schools adopt industrial and business practices. These comparisons brought about a narrowing of curriculum that excluded studies in humanities. Arts programs managed to survive curtailment by integrating into other studies such as social studies and history (Corwin, 2001). Relating business efficiency to social Darwinism, thus lending science to efficiency arguments, the businessman's standard of efficiency grew to be the standard for judging educational practices.

The most successful arts integration curricula were those in schools where the intrinsic value of an arts education that is independent of other subject areas was respected (Aprill, 2010).

Current Factors

Arts educators are all too familiar with policies that resemble such educational doctrines that narrow curriculum. Recent arts education trends reducing funding and instructional hours in humanities such as social studies, sciences, and the arts in favor of reading and math instruction (Aprill, 2010; Geist & Hohn, 2009; Spohn, 2008; Zhao, 2014) have encouraged educators to implement quick fix arts integrated programs designed to improve math and reading scores. These efforts often fail in reaching the students in most need of the differentiation well designed arts integration offers. Students have fewer opportunities to express learning when the focus is narrowed to numeracy and literacy. Davis (2008) warned arts advocates against defending the arts in education as a way to teach other subjects rather than an essential subject independent of its service to other subjects. However, integration of curriculum creates the opportunity for deeper instruction, learning that is more meaningful and has a greater social understanding, and a more interesting and complex view of the world (Burnaford, Aprill, & Weiss, 2009).

Art Integration as Leadership

I discovered that the idea of arts educators as educational leaders and guardians of an educational reform that embraces the imagination, creativity, and divergence in instruction is what art educators have been articulating for decades. When I asked the question, "How can I, as an art teacher, be a leader in education on my campus, and in my district, as well as contribute to research in the field of education?" I decided to explore the idea of arts integrated curriculum and instruction. At first, I was resistant because I felt that it was just another attempt to justify the arts' place in education. I discovered, however, that numerous instances of arts integration had a positive impact on the learning and success of students from all lifestyles. Additionally, the most successful arts integration curricula were those in schools where the intrinsic value of an arts education that is independent of other subject areas was respected (Aprill, 2010).

Differences in Arts Integration

The construct of integration in terms of resources, structures, pedagogies, and contents can have vastly different meanings for different people; yet the way the term is used is not always explicit in its multiplicity of meanings (Bresler, 1995). Expanding the forms of representation beyond the numerical and verbal realms enriches the perception of the world immensely (Bresler, 1995). Mishook and Kornhaber (2006) reported multiple meanings for the term arts integration when interviewing principal and arts coordinator participants. Two categories of arts integration attempts were identifi d: coequal, in which arts and academic subjects were taught equally and subservient, in which the arts were used to support academic subject content.

Bresler (1995) explained that subservient arts integration allowed teachers to include modes of expression other than verbal or numerical without development of aesthetic awareness, specific rtistic skills, or critical reviewing. The less common arts integration practice was termed coequal and required arts discipline-specific kills and knowledge. Bresler observed aesthetic qualities and higher-order cognitive skills in the coequal approach.

Our Idea

The authors met one afternoon in July 2014 to discuss the possibility of the coequal or full integration of art, namely ceramics and chemistry. We felt the two were compatible; however, we were concerned about aspects of the chemistry curriculum that had strict time restraints and curricular requirements. We began with the requirements for chemistry learning objectives that were of concern to the chemistry teacher and then developed a plan. Each grading period would include a fully arts integrated learning activity in which the chemistry learning objective would be combined with ceramics learning objectives in order to bring about an understanding of the chemistry and ceramics concepts.

Figure 1. Chemistry students learn to throw on the pottery wheel.

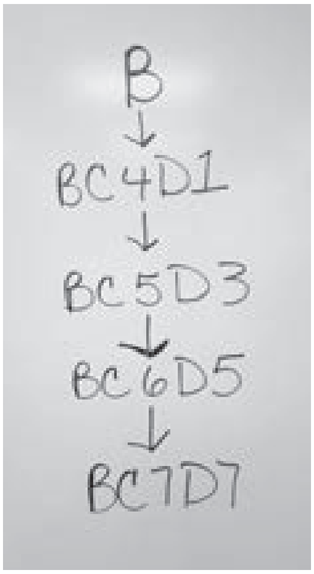
The Plan

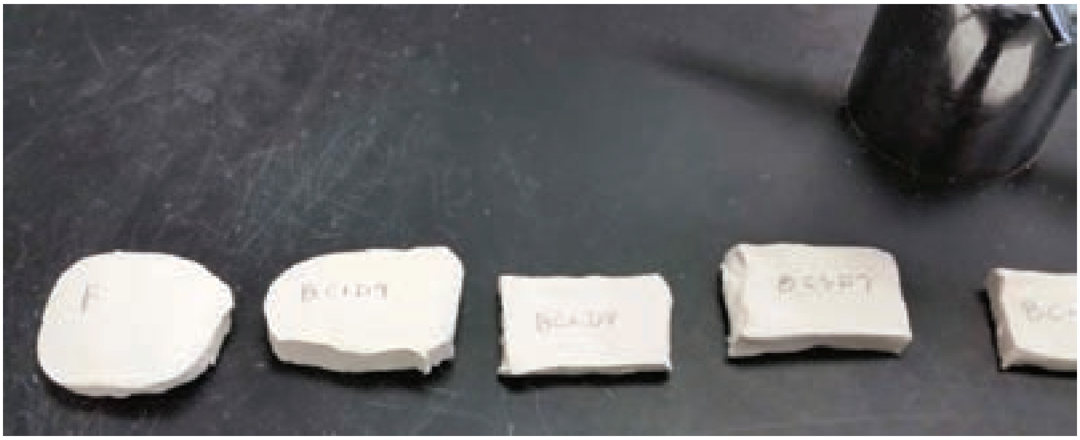
Signifi ant figu es, the mole concept, and stoichiometry were the three chemistry concepts chosen for the project. Ceramic learning objectives included the properties of clay, how to throw a bowl on the potter's wheel and the aesthetics and functions of glazes. Students participated in one art integrated learning activity each of the three grading periods in a semester. Each learning activity combined one ceramic and one chemistry learning objective.

The fi st learning activity involved the properties of clay and signifi ant numbers. Students made a slab of clay using a ruler to place a 10.00 cm line, with 1.00 cm markings on it and then weighed it. The objective was to discover shrinkage rates as well as percentages of water absorption. The tiles were fi ed to bisque, which is pottery that has been fi ed once, leaving it hard and porous (Davies & Polak, 2004). The students re-measured the line and then measured the mass by placing the tiles in a container of water overnight and recording the masses the next day to determine water absorption percentages. Next, the tiles were placed into the kiln and fi ed to vitrifi ation, a measure of bonding of ceramic particles (for strength) and consolidation or reduction in porosity (Lay, Rockwell, & Westreich, 2009). Students placed their tiles on an electronic balance to measure the mass. They measured the line, recorded their values, and placed the tiles back into the water bath overnight so the masses could be measured again to determine vitrifi ation.

The purpose of this activity was to explore the properties of clay as well as develop measuring and reasoning skills. Additionally, chemistry students attended an art class in which they learned to throw on a pottery wheel, thus producing a bowl that they could then glaze with the glaze they formulated in the chemistry learning activity. Th owing on a wheel takes time and practice to create functional and aesthetically pleasing bowls. The art teacher introduced the chemistry students to ceramic techniques and most students were successful in creating a functional bowl. Because of limited instructional time, some students were unable to throw a bowl that was aesthetically pleasing or useful. Advanced ceramic students provided bowls for students who were absent on the days in the art class or whose bowls were not functional (Figure 1).

The second chemistry learning activity helped students to develop a deeper understanding of the mole concept and the





Figures 2 and 3. The code (left) written on the test tiles (above).

Figure 4. Students mix the test glazes.

process involved in glaze development. The mole is a central unit of measurement in chemistry. Students used the atomic mass (molar mass) of elements. On five test tiles with the same design, students used a dry base glaze that the chemistry teacher and art teacher mixed and a selection of colorants: rutile, copper carbonate, iron (III) oxide (red iron oxide), manganese dioxide, cobalt carbonate, and zinc oxide.

The chemistry teacher and I developed a coding system so that students could record which amounts of colorants they added to the base (Figures 2 and 3).

Students chose two of the available colorants and came up with four ratios of colorants, ensuring that they started with the smaller ratio and added more colorants to the mixture. Once students developed their ratios, they glazed the first tile with just the base glaze. Then they mixed in the first colorant ratio in order to glaze the second tile. Students repeated this process until all tiles were glazed with the different ratios. The

Figure 5. Calculating moles.

Figure 6. The test tiles from which students chose the class glaze.

Art learning objectives in our study offered students ownership of the processes they were using in chemistry.

students then calculated the number of moles of the colorant they added into their base glaze at each step (Figures 4, 5, and 6).

During the culminating project, students mixed a large, 10-pound batch of glaze using stoichiometry to increase measurements. Stoichiometry calculates the amounts of substances in each mixture and is a necessary skill for increasing a test glaze to significantly larger amounts. This process for calculation takes into account the atomic masses and ratios of components in order to get the relative amounts needed to make a pre-determined amount of what is being measured. Students carefully considered function and aesthetics in the selection of the test tile to be used to increase for the glazing of their bowls.

Students calculated the amount of colorant needed to increase the initial ratio to the larger amount and then measured and added the colorants to the large base glaze mixture. They used the final product to glaze the bowls thrown earlier in the semester (Figure 7).

The Results

The arts are a powerful way for students to express themselves as learners and recognize themselves as engaged in meaningful learning because the arts give sensory expression to cognition, making learning visible (Burnaford et al., 2009). Integrating art to a greater extent in extracurricular and curricula activities, not superficially or merely instrumental in purpose, is preferable to circumscribing the arts to arts education (Zhao, 2014). Art learning objectives in our study offered students ownership of the processes they were using in chemistry. Integrating art into chemistry also allowed the chemistry teacher to differentiate instruction and offer hands-on experience using concepts in concrete ways.

In order for us to determine if the full integration of art into core subject area instruction was successful, we developed research questions to discover participant perceptions. The perceptions of an administrator, the chemistry teacher, and a focus group of five chemistry students were collected through a series of interview questions. Those questions were:

1. What was the experience with the full integration of art in core subject instruction?
2. In what ways does the full integration of arts instruction influence the core subject classroom regarding academics?
3. In what ways does the full integration of arts instruction influence the core subject classroom regarding engagement?
4. What barriers were encountered and overcome in the full integration of arts into the core subject classroom?

Additionally, documents such as the chemistry teacher's observation evaluation conducted by the administrator during one of the learning activities and benchmark assessments given by the chemistry teacher helped to articulate their perceptions for the integration of art into chemistry instruction. In order to narrow our study, we did not formally investigate the impact of chemistry in these areas of ceramics instruction; however, it is a valid area of investigation we plan to investigate in the future.

Academics

All of the participants shared the perception that the learning activities provided motivation and student responsibility for learning and improved academic achievement. Of particular interest was the perception that the arts integrated activities promoted transfer of skills and making connections. During the focus group interview, one of the students related the story of how the art integrated activities had facilitated a better understanding of the algebra concepts she was learning in her algebra class. She told us about how algebra had always been difficult for her and that the use of equations in chemistry and algebra had always been confusing because they used letters instead of numbers. Once she used letters to represent chemicals in equations, she was able to apply that process of representation in algebraic equations. She emphasized, "Putting chemistry and art together actually made it a lot more fun for me. I also started doing a lot better in my algebra class after that." (Personal communication, January 26, 2015)

Figure 7. The bowls from each of the four chemistry classes.

The chemistry teacher reported that scores on Curriculum-Based Assessments (CBA), given at the end of each grading period, were improved from previous years. Formative assessments, such as (1) the time necessary to use concepts for further learning; (2) student use of concepts to complete assignments; and (3) student questioning, further indicated an increase in student understanding of the chemistry concepts taught using the art integrated learning activities.

In order to have a better understanding of the impact the arts integrated activities had on the students' ability to apply specific knowledge to test questions, the chemistry teacher examined questions that were specifi ally targeted to address concepts covered in the art-integrated activities. The chemistry teacher said, "Overall, when I looked at the CBA questions individually, there were five questions just covering moles and 70% of them [students] got those correct, much higher [than] normal. On the Stoichiometry CBA 64% of students passed and 23% received a 90 or above." The chemistry teacher perceived these scores as much higher than in previous years.

Engagement

Engagement in any classroom is a determinant in the level of learning students experience. Developing the study, the chemistry teacher expressed concern in this area because students generally lack the mathematic skills necessary to engage in learning activities involving chemical equations. He related past experiences of students "shutting down" due to the level of difficulty the chemistry learning objectives presented. However, his perceptions as well as those of the evaluating administrator, a former science teacher, and focus group students agreed that the full integration of art into the chemistry learning activities increased student engagement. Hands-on activities increased the relevancy of the lessons for students and all agreed the activities were fun. The campus administrator observed several instances of increased student engagement during his formal observation of one learning activity. He said, "It gave them ownership. Specific wnership. They were making a product and it wasn't someone else's product. It wasn't the teacher's product. They were going to have complete ownership of the results." (Personal communication, January 26, 2015)

What excited us the most, however, were the responses from the chemistry students, especially students who described themselves as "art kids," and were enrolled in art classes. The discussion about students' engagement turned to students labeled as "dozers" by the focus group. In case you were unaware, as I was, a "dozer" is a student who does not put forth effort in class. As one focus group member explained, "Well, like, in every class you would have a few slackers that just don't do anything and just kind of sit there. They just kind of doze off." Even self-proclaimed dozers agreed that the arts integrated activities were more interesting and helped them engage in classroom learning, therefore better understanding the chemistry concepts. As one student admitted, "I can be considered a dozer, but I think with the art projects, since I'm involved in art, and it's actually something I enjoy doing. It helped me with the stoichiometry because it just helped me understand."

Barriers

During the course of executing the full integration of art in chemistry instruction, we encountered numerous barriers. Of major concern to the student focus group was the barrier of classroom management. Even though neither teachers nor the administrator felt classroom management was a barrier, students spoke at length about the importance of classroom management when integrating art and chemistry. All agreed that the successful integration of art into chemistry classes would be impossible if the chemistry teacher did not have the proper classroom management skills. One student advised, "You've got to have a little bit of control when they're in there and have some directions from the paperwork. If you just let them go at it, it's going to fall apart."

The administrator noted that in order for teachers to be open to art integration, training would be necessary. The administrator's perception was that because the chemistry teacher had participated in local ceramics classes for several years, he had an advantage that other teachers would not likely have. The chemistry teacher and I noted that planning and timing of the learning activities presented numerous barriers. Additionally, the district in which this study was conducted has a mandatory curriculum in place that includes strict time frames for learning objectives. Flexibility was crucial to the successful integration of art into core area instruction.

The implications for district-wide curricular and instructional leadership led us to narrow our scope to that of the arts' influence in core area instruction. Hands-on and differentiated instruction proved to have positive effects on learning according to the perceptions of the participants. Further research that explores the advantages cross-curricular instruction has in arts instruction and the classroom environment was clearly indicated in the results of this study.

Conclusions

As we neared Christmas break, the excitement about "the bowls" electrifi d the air. Students asked, "Are our bowls done?" "Do we get our bowls before Christmas?" Star basketball players, administrators, and academic achievers alike stopped me in the hallway daily to fi d out the status of their bowls. I happily assured them I would let everyone know when the bowls were fi ally complete. The entire school seemed to be buzzing with anticipation. It was evident that interest in arts integration was on the rise. For the remainder of the year teachers accessed resources and contacted me about projects they were interested in trying and administrators discussed the making of pottery and the formulation of glazes with chemistry students. Teachers in other areas of instruction, not just core teachers, wanted to join the art integration adventure despite prior concerns about integrating art

Students developed intricate means to present and represent what they learned working from what they want to know and what they already know.

into their instruction. Our leadership in bringing art integration into core classroom instruction was a successful first step to future integration projects.

Through the commitment of teachers and administrators to flexibility and innovation, chemistry students experienced increased academic success and genuine enjoyment of the learning process in their chemistry classes. The participants' reported perceptions supported the claim of Burnaford and colleagues (2009) that the integration of curriculum creates the opportunity for deeper instruction, a more meaningful learning environment, and a more interesting, complex view of the world. Students developed intricate means to present and represent what they learned working from what they want to know and what they already know. They learned through making creative decisions, multiple learning modalities, adding direction to the lesson, and helping sculpt its format and form (Kelner, 2010).

In this study, participants perceived the arts integrated activities as having a positive effect on academic success and student engagement. The academic success and increased student engagement experienced in this project served as a catalyst for further integrated projects and greater interest in arts integration within our district. Not only did our study increase interest in the advantages of a strong arts program, it also demonstrated the educational advantages of full arts integration. Most importantly these activities were also reported to be fun, thus encouraging students to enjoy the process of learning. As one student said, "I was pretty excited; I like being in art, and chemistry is not one of my favorite classes; so, that just made chemistry more exciting for me." As educational leaders, we must strive to ensure that we are meeting the needs of all students. This study demonstrated that arts integration meets the needs of students by providing engaging, concrete, and hands-on activities. ■

Maggie Leysath teaches art and is ÿne arts Department Chair at Onalaska ISD, Texas, and is Adjunct Professor of art at Lone Star College. E-mail: drmaggieann@gmail.com

Chad Bronowski teaches science at A&M Consolidated High School, College Station, Texas. E-mail: chadmbronowski@gmail.com

References

Aprill, A. (2010). Direct instruction vs. arts integration: A false dichotomy. *Teaching Artist Journal, 8*(1), 6-15. doi:10-1080/15411790903393004

Bresler, L. (1995). The subservient, co-equal, affective, and social integration styles and their implications for the arts. *Arts Education Policy Review, 96*(5), 31-43. Retrieved from www.taylorandfrancisgroup.com

Burnaford, G. (2010). *Partnerships in arts integration research (PAIR) comprehensive report.* (PAIR Report Part 1). Retrieved from www.pairresults.org/downloads/PAIR1.pdf

Burnaford, G., Aprill, A., & Weiss, C. (Eds.). (2009). *Renaissance in the classroom*. New York, NY: Routledge.

Callahan, R. (1962). *Education and the cult of e° ciency: A study of the social forces that have shaped the administration of public schools.* Chicago, IL: The University of Chicago Press.

Corwin, S. (Ed.). (2001). *Exploring the legends: Guideposts to the future.* Reston, VA: National Art Education Association.

Davis, J. (2008). *Why our schools need the arts*. New York, NY: Teachers College Press.

Davies, J., & Polak, J. (2004). Getting started: Materials and methods. In *A glaze of color: Creating color and design on ceramics* (pp. 9-19). New York, NY: Watson-Guptill Publications.

Efland, A. (1990). *A history of art education: Intellectual and social currents in teaching the visual arts.* New York, NY: Teachers College Press.

Geist, E., & Hohn, J. (2009). Encouraging creativity in the face of administrative convenience: How our schools discourage divergent thinking. *Education, 130*(1), 141-150. Retrieved from www.projectinnovation.biz/index.html

Kelner, L. B. (2010). Miracle moments: Tales of arts integration. *Teaching Artist Journal, 8*(4), 229-323. doi:10.1080/15411796.2010.509199

Lay, T., Rockwell, M., & Westreich, P. (2009). Production and characteristics of glass-ceramics derived from manganese crust tailings. *Journal of Materials Science, 44*(13), 3508-3513. doi:10.1007/s10853-009-3471-2

Mishook, J. J., & Kornhaber, M. L. (2006). Art integration in an era of accountability. *Arts Education Policy Review, 107*(4), 3-11. Retrieved from www.taylorandfrancisgroup.com

Scripp, L. (2012). *Partnerships in arts integration research (PAIR) comprehensive report (PAIR Report Part 3A).* Retrieved from Partners in Arts Integration Research (PAIR) website www.pairresults.org/downloads/PAIR3.pdf

Spohn, C. (2008). Teacher perspectives on No Child Left Behind and arts education: A case study. *Arts Education Policy Review, 109*(4), 3-11. Retrieved from www.taylorandfrancisgroup.com

Zhao, G. (2014). Art as alterity in education. *Educational ¸ eory, 64*(3), 245-259. doi:10.1111/edth.12060

Inspire Fellow Art Educators

Write for *SchoolArts* magazine!

Dear Art Educator:

One of the best ways you can advocate for art education is by sharing your ideas and experiences with other art educators. What better way to do so than by having your work published in America's longest-running art education magazine? As a *SchoolArts* author, your fellow teachers, administrators, parents, students, and school community will take notice. **Published articles are a valuable addition to your portfolio, as well as employment and grant applications.**

Wondering what to write about? *SchoolArts* publishes a wide variety of articles that are of interest to art educators, including: studio lessons for all levels, K–12; advocacy efforts; methods for managing the artroom; innovative responses to everyday challenges faced by art teachers; differentiated instruction; and more. **To get started, just think about your successes in the artroom and start writing!**

—Nancy Walkup, Editor

Author benefits:

- **Free one-year print and digital subscription to *SchoolArts***
- **Up to 6 free copies of the issue in which your article was published**
- **Honorarium of up to $100 per article**
- **2 years of access to Davis Digital,** which includes a fine-art image subscription with more than 30,000 images, your choice of one eBook, an ePortfolio, and the Curriculum Builder.

For writer's guidelines, go to SchoolArtsMagazine.com/WritersGuidelines.

Subscribe to *SchoolArts magazine*!

Get a one-year print and digital subscription (10 issues) for only $24.95!
Go to **SchoolArtsMagazine.com/Subscribe** for details.

SchoolArts.com • ContactUs@SchoolArtsMagazine.com • 800-533-2847

TRANSFORMATION:

Constructivism, Design Thinking, and Elementary STEAM

Kelly Gross and **Steve Gross**

Figure 1. Sound rainbow (above) and coding in Scratch (below) by a kindergarten student.

Quacking ducks, singing Christmas trees, sound-producing rainbows (Figure 1), and scary graveyards; these are just a few of the interactive sculptures created by students in our elementary science, technology, engineering, art, and math or STEAM Club. If you walked into our K-5 classroom, you would see a group of students building with cardboard, a second group of students at the computer creating programs using Scratch, a programming language created by the Massachusetts Institute of Technology (MIT) media lab, and a third group of students testing out their projects.

The creation of work is student-led, with students moving between areas as necessary, and teachers acting as a resource for students. At the testing station where students are using their bodies to complete circuits, students can be heard saying things such as “I wonder what would happen if we all hold hands?” Students work with each other in a combination of inquiry-based activities and project development to construct knowledge in areas related to STEAM.

STEAM club is an optional before-school class that occurs on a bi-monthly basis at an elementary school in a suburb of Chicago. The class started in January 2015 and currently includes 20 students in kindergarten through 5th grade. Within our classroom, we create time and space for discovering, planning, doing, refini g, and presenting (Duncum, 2002; Vande Zande, Warnock, Nikoomanesh, & Van Dexter, 2014). Each unit contains several days of inquiry in which students are not creating projects, but rather discovering mathematic, scientific, nd/or engineering principles. Students then engage in application of these principles through project-based learning that incorporates design thinking as the focus of curriculum and pedagogy. The projects push the boundaries of the traditional fi lds of STEM by interlacing issues of aesthetics, design, and visual production.

In this article, we begin by examining constructivism, design thinking, and STEAM, as they relate to the approach we use within our own classroom. We describe in detail a recent project completed with our students and how students’ projects benefited as a result of design thinking and constructivist approaches. A concluding section discusses the benefits of incorporating STEAM as part of K-12 education.

Framing STEAM Education

STEAM education has the potential to fulfill the promise of progressive educators such as Dewey (1934) and Freire (2000), who foresaw education as moving toward a student-centered model, in which students are engaged and central to knowledge production. For our STEAM class, we have chosen to structure our classroom around a Visual Culture Art Education (VCAE), constructivist learning approach. In VCAE approaches, the emphasis is on critical understanding and empowerment, rather than artistic expression (Duncum, 2002). In constructivist approaches, individuals construct knowledge, unlike behaviorism and cognitivism where rules and knowledge is acquired. Most constructivist theorists agree that we construct knowledge through a sequential development and scaffolding of each person’s cognitive abilities as s/he attempts to make sense of experiences (Fosnot, 2005). Th s scaffolding moves through increasingly complex ways of thinking from recognition to recall, analysis, refl ction, application, creation, understanding, and evaluation. Greene (2005) argues that constructivist thought in art education can lead us to “look for keys to unknown doors” (ch. 7, para. 41).

Behavioral and cognitive theories of learning cannot adequately explain how students learn in environments such as Montessori and Reggio Emilia schools. An integral part of the Montessori educational approach is the consideration of social environment. Classrooms often include a range of ages, with younger students watching older students, internalizing, and then constructing their own knowledge through a combination of mimicry and exploration. Social–cultural theory, also known as social constructivism, describes learning as more holistic and relative; emphasizing the strengths and knowledge students bring to the classroom, while enabling students to make meaning of the social and cultural worlds they inhabit (Efland, Freedman, & Stuhr, 1996; Greene, 2005; Trent, Artiles, & Englert, 1998). Vygotsky’s (1978) theory of sociocultural development recognizes that social interactions are critical and knowledge is constructed between two or more people. Furthermore, Vygotsky argues that what students are capable of learning, their Zone of Proximal Development (ZPD), expands “in collaboration with more capable peers” (p. 89). A social constructivist would argue that children create understanding through observation, social interactions and expectations, and their creation of knowledge through the experience of play. Th s is a subtle difference, but nonetheless the personal creation of rules and knowledge, based on social and environmental conditions, helps account for differences in human behavior in similar situations. Teachers in constructivist classrooms structure situations so that learners become actively involved in content though the manipulation of materials and social interaction. According to Eisner (2002), “it falls to those of us in education to try and design the situations in which children’s efforts become increasingly more sophisticated, sensitive, imaginative, and skilled” (p. xiv). By incorporating these philosophies, our STEAM Club implements a project-based approach that allows opportunities for students to construct knowledge through the design process.

Teachers in constructivist classrooms structure situations so that learners become actively involved in content though the manipulation of materials and social interaction.

The Design Process as a Constructivist Approach

Duncum (2002) argued that artmaking is often a process of open experimentation; while “image making in VCAE would adopt more of a design procedure such as discovery, planning, doing, and assessing” (p. 7). The more common model of the design process relies on a cyclical fl w of six steps: (1) defini g the problem, (2) investigation and research, (3) generate ideas, (4) make the prototype, (5) present, and (6) refi e (Vande Zande et al., 2014). Our classroom space utilizes a hybrid between these two models that moves from discovery to planning, doing, refini g, and presenting. Art classrooms that rely on students "playing" with materials and discussing fi dings to create understandings, rather than teacher led discussions and demonstrations, can act as a starting place for design thinking. But the second key component of the design process is that students are able to learn from and with each other. Students gather information from sources and take into consideration their failures along with feedback from presentations to further refi e the product. It is the reciprocity between student and materials, along with fellow students and teachers in the class, which helps students to construct understandings. In a design-based classroom students engage in deep inquiry producing less "products" and often using more materials as a result of experimentation and failure. However, the constraints of time, materials, and school expectations can hinder a teacher's ability to fully implement a design-based approach. Due to these issues, teachers should take into consideration ways to incorporate opportunities for learning in multiple subject areas. Vande Zande (2011) argued that the optimal approach for teaching design in K-12 education is to employ an interdisciplinary-based project.

One of our continued concerns, as educators, about the way that most K-12 education is structured in the United States is the reliance on subject specific urriculums. Although art teachers often incorporate skills from other subject areas, the "silo system" of education fails to simulate professional careers in which these skills are interwoven and reliant on one another. Hayes-Jacob (1989) points out that in the real world, subjects do not exist in isolation, but rather we encounter problems and situations in which we must "gather data from all our resources and generate solutions" (p. 1). An engineer will need spatial, drawing, and drafting skills. An artist needs the ability to write and communicate effectively about their work. A STEAM curriculum presents the opportunity for project-based curriculum that is not defi ed by one subject area. Furthermore, cross-disciplinary projects can help students, teachers, and parents relate the value of artistic experiences to other content areas (Rolling, 2015).

Interactive Sculpture Project

In the fi st semester of the STEAM club, we introduced students to basic principles of engineering, art, and design through the following units. The fi st unit, a toothpick bridge challenge, introduced students to the design process and learning through failure and revision by experimenting and building strong structural bridges out of toothpicks. The second unit, squishy circuits (Figure 2), explored and helped students develop understandings of electricity, circuitry, and conductive properties, through the manipulation of conductive dough, batteries, and light-emitting diode (LED) lights.

Students were also introduced to computer programming using Hour of Code, and storytelling, in a stop-motion Claymation project. Students were highly engaged in the projects and the fi st semester provided opportunities for us, as teachers, to see how a large age range of students can work successfully together. At the conclusion of the fi st semester, we decided to reduce the number of projects in the coming year to create further opportunities for students to have time to engage in the design process.

Figure 2. Squishy circuit sculpture of "The Cat in the Hat."

At the 2015 National Art Education's Convention in New Orleans, we were inspired by the Plug-In Studio's pop-up art + tech makerspace and several projects that were presented. We decided to build upon our previous lessons with circuitry and coding to create interactive sound sculptures using the Makey Makey[1] tool. Because many of our students had previously created musical instruments as part of a school project, we thought the instruments would resemble traditional musical items. We imagined that students would create guitars or drums, and import scale notes into Scratch that would be programmed to play. Our vision was that students would create cardboard musical instruments with brads as metal contact points. Then, the students would use the Makey Makey board to connect the sculptures to the computer to create interactive musical instruments.

Our interdisciplinary approach can best be described as a "complementary unit," in which two or more subject areas are brought together in a formal unit to investigate a theme or issue (Hayes-Jacob, 1989, p. 16). For this unit, the theme of transformation integrated concepts of circuitry (from science), technology, art, and visual culture using a design-based process. We wanted students to think about transformation in two ways. First, how can we use technology to transform every day materials such as cardboard? Second, how can we help students transform their understandings of what a musical instrument is? The transformation unit lasted six class periods, during which students completed some of the work on their own at home. Although we had previously discussed circuitry, over two-thirds of the students were new to the STEAM club by the time this project started and had little experience working with circuits or programming, so the beginning portion of the unit was focused on investigation of circuitry and the Makey Makey device. The learning objectives for the project included re-introducing and reinforcing the concepts of circuitry, developing an understanding of how technology and coding can be used to enhance and transform objects, and creating sculptures that combined visual and auditory aesthetics to create interactive experiences.

Discovering

Interdisciplinary approaches to STEAM should use both discipline-fi ld-based and interdisciplinary experiences for students (Hayes-Jacob, 1989). Th s unit was structured to provide students with both these opportunities. The fi st two class meetings were spent discovering understandings of concepts and principles that are domain specific. On he fi st day, we wanted to help students explore and develop understandings related to technology and circuitry. At one center, students experiments with batteries, wires, LED lights, and conductive dough to create complete circuits (Figure 3). Students had to draw on their paper what a complete circuit looked like. Once students, understood the basic properties, they expanded on this by exploring ideas of parallel and series circuits. Students experimented to fi d out how many lights one battery could light up, and how long of a circuit could be created. A second center introduced students to the Makey Makey board.

Figure 3. Students discovering principles of circuitry.

At this center, the teacher demonstrated how to complete a circuit using the Makey Makey board by using metal spoons to become alternative piano keys. Students then experimented, acting as part of the circuit with metal tape on their wrist connecting them to the ground wire. Once students touched the spoon, it completed the circuit and the computer played a note. Students became very excited by the idea of becoming part of the circuit and began experimenting to create long chains of students, through which the current passed to complete the circuit. Students were repeatedly asked to "think-pair-share" with partners as a way to contribute to their own construction of understandings. At the end of the day, students were given an opportunity to view a YouTube video on applications of Makey Makey and left o ponder the possibilities of

Figure 4. Plan for Christmas tree.

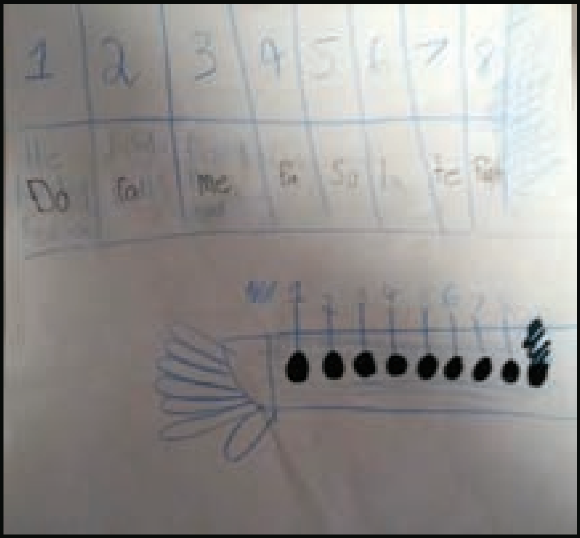


Figure 5. Plan for arm piano.

what they could transform (Rosenbaum, 2013). The second day of the unit was focused on students starting to develop their concepts for instruments (which were quickly looking less like instruments) and exploration of domain specific   nowledge in the arts related to sculpture (Figures 4 and 5). We discussed and explored issues such as how to transform a 2-D object into 3-D, ways to hide wires needed for circuity, material choice, and size.

Planning and Doing

The structure of fi st allowing students to develop domain specific   nowledge allowed students to more fluidly apply these concepts to their fi al projects. The second portion of the unit involved the construction of sculptures and coding of sounds. Students were broken up into groups based on personal choice, with common themes working together (Table 1).

Table 1. Student groupings by themes.

Theme	Scenes	Objects	Christmas	Musical Instruments
Student 1	Duck on a pond	Robot	Christmas tree (fl t)	Arm piano
Student 2	Playground	Rainbow	Christmas artifacts	Drums
Student 3	Graveyard	Skull	The Grinch that stole Christmas	Guitar
Student 4		Snake	Christmas tree round	

Two class sessions were devoted to the building of sculptures with cardboard and designing Scratch Programs for the sound component of the sculptures. During these sessions, students worked individually within their grouping to build their sculptures out of cardboard, paint, and decorate. As students were working in groups they had the opportunity to learn from each other and use each other as resources, both in fi ding solutions to creating the sculptures and developing coding.

Refining and Presenting

The last two sessions of the unit were devoted to testing, refi ement, and presentation. As students started to have both components of the project completed, we asked them to plug their sculptures into the Makey Makey boards. Th s was an opportunity for students to recognize if they needed to refi e their projects. As a result of these testing sessions, students had to change materials so that they would be more/less conductive, add more structure to hide the wires, create structure so the sculpture could stand-up, and change the coding within the Scratch Program. As we did throughout the unit, at the end of each day we asked several students to share with the class how they had refi ed their projects and refl ct on what they wanted to do moving forward. The fi al session was a presentation of student work to parents, faculty, and fellow students at the school.

Moving Beyond Musical Instruments

In examining the student work from this project we noticed three clear trends emerge regarding learning and a constructivist design approach for STEAM. First, we found that students were clearly learning through the experience of material manipulation as describe by Dewey (1934) and Greene (2005). Second, we found that a large age range of students produced diverse and original work while also providing opportunities for peers to reinforce learning through peer–peer tutoring. Finally, we found that the students were able to use the design process and open-ended constructivist pedagogy to create fi al products that evolved far beyond initial plans.

Providing opportunities for students to learn though experience and material manipulation was an essential component for students to create knowledge. As teachers, we learned with our students as they tested various aspects of their sculptures. One student constructed a guitar using pipe cleaners as the strings and tested the project leading to refi ement:

Student: It's not working

Teacher: What's not working?

Student: The sound, when I touch it the computer is not making sound.

Teacher: Why do you think that might be happening?

Student: It's not making a circuit?

Teacher: Right it's not making a circuit. What do you think is wrong?

Student: Maybe the fur?

Teacher: What about the fur?

Student: I think the fur is stopping the pipe cleaner from being conductive.

Teacher: How?

Student: The metal isn't touching (pointing to the clamp on the pipe cleaner).

Teacher: That's what I think too, why don't you try a different material and see if it works? (Personal communication, December 4, 2015)

We had planned for the students to use pipe cleaners as conductive materials, so it was as much a surprise to us, as the student, that they were not conductive. The student then had to go back and replace the pipe cleaners with metal wire on his guitar. When students modifi d their sculptures from their initial drawings (Figure 4) to refl ct the need to hide the Makey Makey wires and create a 3-D objects, they often had to experiment with structure. After students discovered their projects would not stand up on their own, many students revised their initial sculpture plan to include cross lap joints (Figure 10). The conversations

The conversations that happen between students—and the learning that occurs by watching other class members—has proven to be just as valuable as the instruction by teachers.

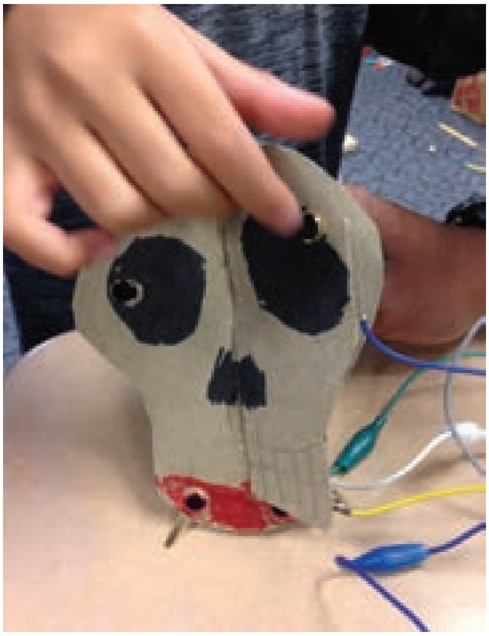


Figure 6. Older brother's skull.

Figure 7. Younger brother's snake.

that happen between students—and the learning that occurs by watching other class members—has proven to be just as valuable as the instruction by teachers.

In the end what students were able to achieve far exceeded our expectations, due to the social–cultural aspects of the classrooms that supported students to move beyond their expected ZPD. Second- through 5th-grade students were provided with opportunities to reinforce knowledge by re-teaching and helping younger students with their project development. While it can be challenging to work with students as young as kindergarten in these projects, we found those same students created objects that are more original in structure and content than their older classmates. These objects can be less representational or represent a deviation in content from the norms of the class. With a pair of siblings, we saw a 2nd-grade student create a realistic sculpture of a skull, and his younger brother, in kindergarten, create a sculpture he later identifi d as a snake (Figures 6 and 7). However, the siblings worked together to record sound files and the older brother created a four sound program, while the younger sibling incorporated one of the sounds. By working together the two students learned and accomplished far more than if they had worked independently.

The key to students expanding beyond the envisioned project was the scaffolding of initial discipline-fi ld-based experiences combined with the social–cultural small group dynamics (Eisner, 2002; Greene, 2005; Hayes-Jacob, 1989). In this case, the discipline-based knowledge from our initial exploration of circuitry, Makey Makey, and sculpture combined with the theme of transformation, to help students not only transform materials, but also our ideas of what instruments and sculpture can be. While several students pursued the avenue of a more traditional musical instrument, most students varied from this in both form and sound choice. Out of 15 students who completed the project, only three projects resembled instruments in form and four students used scale notes for sound. Instead, we had students who decided to embrace cultural holidays (which are often common to the elementary experience) through sculptures related to Halloween and Christmas. Students also built animals, robots, rainbows, and abstract forms. The breadth of student sculptures varied greatly within the small class of 15 students. While we had planned for students to use note scales for the programs, the students were quick to think of possibilities beyond the given. Duncum (2002) argued that what was once a novelty to a previous generation becomes natural to the next. Students who have grown up with a computer their entire lives, are completely comfortable with creating objects that interact with and are enhanced by technology. Because the Scratch programming was Internet based on Chromebooks, students felt comfortable switching from coding to searching for songs, downloading, and importing files into their programs. Before we knew it students were singing songs, making spooky sounds, and creating vocalized sound effects. Th s opened the door to students moving from what we had initially imagined would be musical instruments to much more complex and individualized interactive sculptures. Due to the integrated nature of computer systems and discipline-based knowledge related to technology, students were comfortable fluidly incorporating elements that transformed their sculptures.

One of the 3rd-grade students had a particular interest in ducks. For this project she had initially drawn a duck as her sculpture idea. After the second day of discovery, she realized she needed to make the duck stand up and added the cross-lap joint that looks like wings. Additionally, she realized that she would need some way to hide the wires, and so she decided to add the surface of the pond, so that the wires would run underneath. At the same time, she was working in a group with a fellow student who was making a "spooky gravestone," which evolved into a cemetery scene, with

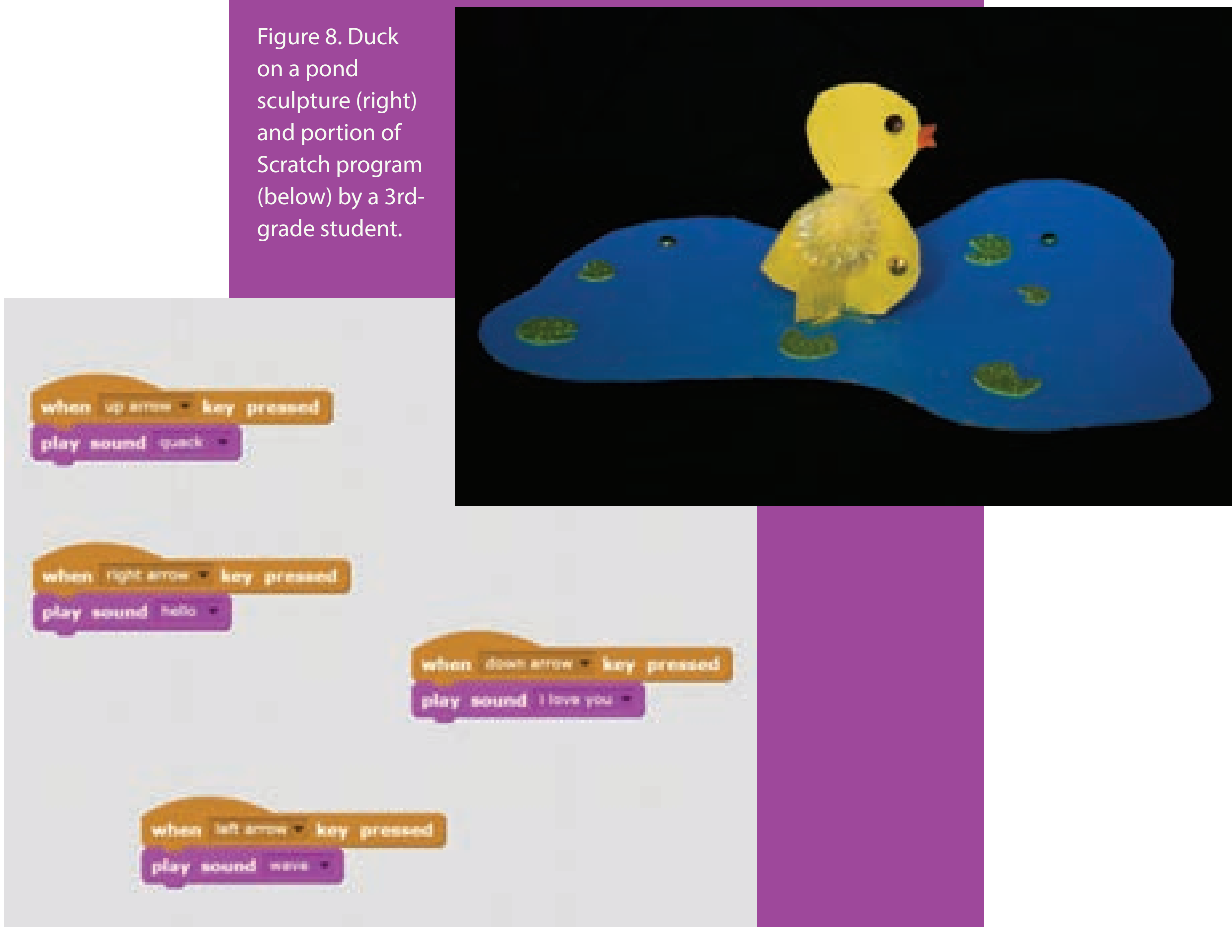


Figure 8. Duck on a pond sculpture (right) and portion of Scratch program (below) by a 3rd-grade student.

STEAM education opens the door to integrate design thinking as part of the K-12 educational experience.

ground, multiple headstones, a ghost, grass, and fence. When it came time to program, these were the fi st students who started asking about recording sounds rather than importing songs. The fi al duck project (Figure 8) incorporated four contact points. When you touched each contact point a different vocalized sound clip played, including: a quacking noise, a voice saying "hello," a voice saying "I love you," and a water sound.

The third area in which students surprised us was their ability to individualize shared concepts. Initially, we saw that many students planned for similar concepts, often clustered in groups that they were working with. We were concerned that the social nature of the class, was leading students to copy from each other without internalizing and individualizing. For instance, we had five 3rd-grade girls who all planned to make a singing Christmas tree. However, by providing a large amount of choice in materials and sounds, opportunities were created for the Christmas trees to be developed into very different interactive sculpture experiences. While some of the variation in forms were due to material constrains and students problem solving based upon cardboard pieces that were available, all of the students had unique visions on how to translate a 2-D drawing into a 3-D form and what sounds to use (Figures 9 and 10). Vande Zande (2014) points out that as part of the design process students discover through testing and revision that there are many possibilities for success.

Conclusions

Constructivists "reject that notion that meaning can be passed on to learners via symbols and transmission"; rather this approach to learning creates opportunities for concrete and meaningful experiences (Fosnot, 2005, preface, para. 2). In this unit, students were able to create projects that went far beyond the initial scope of what we had imagined due to the scaffolded and sociocultural learning environment (Vygotsky, 1978). Students learned from and with their classmates, but also differentiated projects to meet individual vision. While the students might have gained similar knowledge about computer programming and circuitry through a classic scientific nd technology unit, it would not have engaged students to consider issues of aesthetics, the design process, and the

Figure 9 (above). Christmas theme.

Figure 10 (left). Christmas tree. See Figure 4 for planning sketch.

notion of using technology as a tool to transform their ideas into reality. The complementary interdisciplinary approach worked, because the theme of transformation was enhanced by using discipline-based knowledge from the fi lds of art, science, and technology (Hayes-Jacob, 1989). By using an approach based in design, we found that STEAM education, at the elementary level, provided opportunities for students to develop understandings of complex concepts through engaging projects that break down barriers between disciplines.

While art education has seen dramatic shifts in erms of content and focus in the last 20 years, STEAM education offers further opportunities for the fi ld. Educators have struggled to actualize the vision of progressive educators who aimed to centralize education around students, their knowledge, and their experiences. STEAM education opens the door to integrate design thinking as part of the K-12 educational experience. STEAM education, which is based on constructivist and design philosophy, puts students at the center of learning. A constructivist design–based approach to STEAM, values the arts and design as an essential part of the educational experience, while preparing students for the 21st-century workplace that requires creativity and the skills to turn ideas into reality. ■

Kelly Gross is a Lecturer of Art Education at the School of the Art Institute of Chicago, Faculty Co-Chair of Art and Design Education at Vermont College of Fine Arts, and co-founder of The Rubber Band Project, Wheaton, Illinois. E-mail: kgross3@saic.edu

Steve Gross is co-founder of The Rubber Band Project, Wheaton, Illinois. E-mail: steve@rubberbandproject.org

References

Dewey, J. (1934). *Art as experience*. Westport, CT: Praeger.

Duncum, P. (2002). Back to the future: Redefini g art education. *Art Education, 55*(3), 6-11. doi:10.1080/00043125.2002.11651489

Efland, A., Freedman, K., & Stuhr, P. (1996). *Postmodern art education: An approach to curriculum*. Reston, VA: National Art Education Association.

Eisner, E. (2002). *The arts and the creation of the mind*. New Haven, CT: Yale University Press.

Fosnot, C. (Ed.). (2005). *Constructivism: Theory, perspective and practice, second edition* (Kindle ed.). Retrieved from Amazon.com

Freire, P. (2000). *Pedagogy of the oppressed*. New York, NY: Continuum.

Greene, M. (2005). A constructivist perspective on teaching and learning in the arts. In C. Fosnot (Ed.), *Constructivism: Theory, perspective and practice, second edition* (Kindle ed.). Retrieved from Amazon.com

Hayes Jacobs, H. (1989). *Interdisciplinary curriculum: Design and implementation*. Alexandria, VA: Association for Supervision and Curriculum Development.

Rolling, J. H., Jr. (2015). STEAM education: Special issue call for papers. *NAEA News*, *57*(5), 21.

Rosenbaum, E. (2013). *Makey makey music examples*. Retrieved from www.youtube.com/watch?v=wkPt9MYqDW0

Trent, S., Artiles, A., & Englert, C. (1998). From defic t thinking to social constructivism: A review of theory, research, and practice in special education. *Review of Research in Education*, *23*, 277-307.

Vande Zande, R. (2011). Design education supports social responsibility and the economy. *Arts Education Policy Review*, *112*(1), 26-34. doi:10.1080/10632913.2011.518123

Vande Zande, R., Warnock, L., Nikoomanesh, B., & Van Dexter, K. (2014). The design process in the art classroom: Building problem solving skills for life and careers. *Art Education*, *67*(6), 20-27.

Vygotsky, L. S. (trans. 1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press. (Original works published 1930-1934)

Endnote

[1] www.makeymakey.com

From Interdisciplinary to Transdisciplinary: An Arts-Integrated Approach to STEAM Education

Christine Liao

What should science, technology, engineering, art, and math (STEAM) education look like?

In the context of educational policy, the STEAM conversation has intensified and spread across the United States and some other counties (Eger, 2015; Yakman & Lee, 2012). Therefore, proposing answers to this question is a timely endeavor. I suggest an arts-integrated approach to STEAM education and discuss the potential of this approach for opening up a transdisciplinary space—a space "at once *between* the disciplines, *across* the different disciplines, and *beyond* all discipline" (Nicolescu, 1997, para. 4) and, therefore, capable of fostering an "innovated" society. However, for art educators to enter the STEM education dialogue and play a role in shifting the emphasis to STEAM, we must first establish what STEM education is and how it is practiced.

Why STEM and STEAM?

The rhetoric of STEM education starts with the belief that future economic growth and innovation in the United States relies on STEM fields, yet the number of students pursuing studies in these areas is decreasing (U.S. Department of Education, n.d.). The promise that STEM holds for the future is based on the idea that STEM fields drive critical innovation and that innovation, in line with early- to mid-20th-century notions, is explicitly tied to economics (Godin, 2008). Similarly, the idea that innovation is connected to creativity is a product of mid-20th-century research on organizational productivity (Godin, 2008). This link between creativity and productivity supported the connection between creativity and innovation-based economics, and creativity—although explicitly not art-based creativity—gradually became associated with innovation.

One of the strongest arguments for STEAM derives from the view that creativity is the most important ability in the 21st century (Trilling & Fadel, 2009). Accordingly, the arts offer an important way to cultivate creativity. Among the proponents of this view is former president of the Rhode Island School of Design and champion of STEAM, John Maeda, who has argued that art and design education fosters creativity and innovation (2012, 2013).

Art educators have also advocated for STEAM. One view emphasizes STEAM's potential for advancing design education (Bequette & Bequette, 2012; Watson, 2015). Aligned with Maeda's (2013) viewpoint, this position highlights the potential of teaching design thinking skills and of encouraging students to become innovators. This position situates design education as essential to STEAM education. Another argument for STEAM aligns with the perspective of arts integration[1] described next.

How Can Art Educators Participate in the STEM/STEAM Education Dialogue?

Integrated Approach to STEM and STEAM

Some educators argue that increasing the number of school hours dedicated to STEM subjects will not foster students' interest and ability in STEM fields. Therefore, they call for an integrated approach to STEM education as most applicable to the real world (Honey, Pearson, & Schweingruber, 2014). Numerous methods have been used to achieve an integrated approach of this nature,

An integrated approach to STEM education emphasizes that at least two STEM subjects be used in concert to construct applications, especially those with real-world implications.

including project-based learning (Capraro, Capraro, & Morgan, 2013), problem-based learning (Lou, Shih, Diez, & Tseng, 2011), and integrative STEM education (Sanders, 2008). An integrated approach to STEM education emphasizes that at least two STEM subjects be used in concert to construct applications, especially those with real-world implications.

Arts-integration proponents have taken note of the continuing focus on STEM education. They see both integrated STEM education and arts integration as ways to support integrated learning (Riley, 2012; Sousa & Pilecki, 2013). Therefore, adding the arts to STEM and advocating for STEAM is the next step in pursuing an agenda designed to campaign for and elevate the importance of arts subjects. The goal of supporting STEAM from this viewpoint is integrated learning; however, it should be understood that arts-integration practices are diverse.

Integrated learning is also pushed by some art educators (Chappell, 2005) who see interdisciplinary collaboration as a best practice for arts-integrated education. In Bequette and Bequette's (2012) view, art and design educators should communicate with their peers in STEM fi lds to determine how to integrate art with STEM to create a STEAM curriculum. However, they caution that art should be emphasized as a discipline. Similarly, Wynn and Harris (2012) encourage art teachers and STEM teachers to learn from each other. Their view on STEAM education is expressed through creating a class environment where students learn through creative problem solving. Th s viewpoint also corresponds with problem-based integrated STEM education. Another view takes the communication between art and STEM educators to a transdisciplinary space (Guyotte, Sochacka, Costantino, Walther, & Kellam, 2014) where the focus is applications to social practices. Indeed, art educators have long promoted interdisciplinary art education and arts integration (Stokrocki, 2005). Integrated STEAM education, in this regard, is interdisciplinary education focused on transformative learning experiences whereby STEAM subjects are presented together.

The increasing importance of STEAM education is evident in that the National Art Education Association (NAEA) recently published a position statement on STEAM, defini g it as "the infusion of art and design principles, concepts, and techniques into STEM instruction and learning" (2014, para. 1). Th s defin tion is closely associated with the arts-integration approach (i.e., an approach generally understood as referring to the use of the arts in teaching other subjects; Goldberg, 2011). Silverstein and Layne (2010) defi e arts integration as "an approach to teaching in which students construct and demonstrate understanding through an arts form. Students engage in a creative process which connects an art form and another subject area and meets evolving objectives in both" (para. 1). Th s defin tion recognizes the importance of creative production and promotes hands-on learning through artmaking.

Advocates of arts integration connect STEM and art with integrated teaching and learning in mind. However, there are drawbacks to STEAM from this viewpoint. Although integrated teaching takes multiple forms, discussions of STEAM education in this camp often focus on arts-integration instructional strategies and lesson ideas as constituting STEAM education. As arts integration before the advent of STEAM already included strategies and curricula that integrated the arts with other subjects, including STEM subjects, discussing the same content and ideas (arts integration) under a different term (STEAM) could cause confusion. Arts integration is also often misunderstood as referring to the use of the arts only to enhance teaching and learning. Unfortunately, when arts integration is misunderstood in this way, art is often watered down in classroom practices (LaJevic, 2013). Additionally, although in arts integration, art and other subjects should be equally important (Silverstein & Layne, 2010), art is usually a vehicle for learning STEM—not the other way around. Therefore, maintaining the integrity of art education is a concern for art educators (Roucher & LovanoKerr, 1995; Ulbricht, 1998).

New Perspective on Arts Integration for STEAM

Despite the confusion that could arise as discussed in the previous section, I suggest that art teachers start by positioning STEAM education along the lines of arts integration. I advise that this approach be followed because arts integration has long-established strategies that are benefic al to classroom work. Bringing STEAM directly into the individual teacher's classroom is an easier starting point than executing a larger-scale project in the current general and curricula environments of many schools. By producing tangible results in the classroom, teachers can lay a

Bringing STEAM directly into the individual teacher's classroom is an easier starting point than executing a larger-scale project in the current general and curricula environments of many schools.

foundation for creating their own more sophisticated initiatives. Further, newer perspectives on and practices in arts integration are bringing arts-integration practices to a new level. For example, Marshall (2010, 2014) proposed using contemporary art strategies to integrate art and key ideas in other subjects and to view visual arts integration as a transdisciplinary space. From this perspective, using an art-centered approach to integrate art into STEM does not fall within the established pedagogical conversation, but is instead a new transdisciplinary method capable of bringing fresh ideas to STEAM.

Arts-integration practices are diverse. It is, therefore, difficult to determine the limits of an arts-integrated approach to STEAM education and to pinpoint best practices. Borrowing from Silverstein and Layne's (2010) defin tion of arts integration, I suggest that creation/production is essential for art teachers focusing on STEAM. Creative problem solving through artmaking should be at the center of this approach. Th s view also accords with problem-based learning through which students learn by solving problems presented in a given project. Th s approach encourages students to see connections among their knowledge, skills, and abilities and to draw on these connections in advancing their own education and eventually in contributing to solutions to 21st-century problems.

How Can Art Educators Integrate STEAM Into Pedagogical Practices?

The Arts-Integrated Approach to STEAM Education

I provide an example of an arts-integrated STEAM education project to demonstrate the opportunities this approach offers for STEAM learning, creating transdisciplinary knowledge, and teaching 21st-century skills. Th s example is a learning activity in my undergraduate elementary teacher education class. It is centered on one characteristic of arts-integrated approach to STEAM education—the creation of art that is simultaneously applied work. Students were required to create an application (a physical 3-D storybook that could be used to teach a concept) by acquiring and utilizing STEAM knowledge and skills.

The project integrates language arts (children's literature), science, technology, engineering, art, and math. Over a 3-week period, the students worked in groups to create interactive 3-D storybooks to teach the concept of embracing difference. The students could either modify a children's story of their choice or create an original story. Using an online 3-D modeling program, TinkerCAD, the students created 3-D characters (Figure 1), which they 3-D-printed to illustrate their books. The 3-D storybooks included interactive object components (buttons) for users to touch so that the recorded story and/or sounds associated with it would play. For example, one group created *The Turtle and the Pig*, a story about a turtle who is different from other turtles and is bullied as a consequence. The story ends with the pig and the bullied turtle working together to save the other turtles in a crisis. The bullied turtle uses the ways in which he differs from the others to rescue them. The design relies on a scene at a pond with a night sky dominated by the moon (Figures 2 and 3). When the moon is touched, the recorded story plays, and when other features

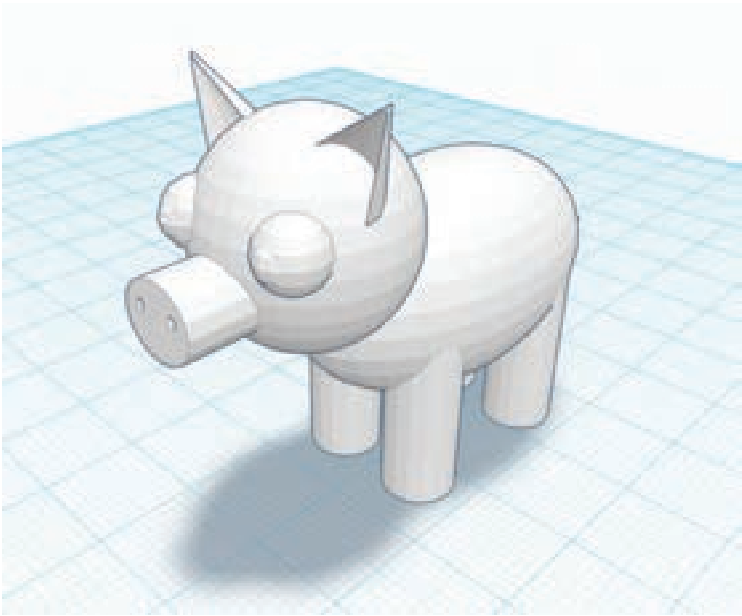


Figure 1. Student-created 3-D model of a pig in the online program TinkerCAD.

such as the pond or rock are touched, a corresponding sound plays. The students created the interactive aspects using Makey Makey (an electric circuit board) and Scratch (an online visual programming tool). They learned about the scientific c ncepts governing electronic circuits and electricity, acquired some coding skills, and gained art and technology skills. They also designed and engineered a 3-D display of a story by drawing on mathematical knowledge (i.e., by designing interactive components/buttons, engineering the wires connecting the buttons to Makey Makey, and calculating the proportion and scale of their models). Moreover, they created stories conveying the concept of embracing difference that they could use in their own teaching.

The students' refl ctions show that the perspectives, knowledge, and skills they acquired in this project transcended what they learned about the respective subject areas covered. One student wrote:

> I find it ha d to describe exactly what I have learned from this project because I feel like it all has to do with the new thought process I was introduced to.… [This project] had my brain working on many levels at once. (Personal communication, December 7, 2015)

The students reported gaining an understanding of how integrating subjects can produce a greater learning experience. Additionally, many students indicated growth in their collaborative skills.

> The creative process is as, if not more, important than the final p oject. Learning to develop these processing skills was crucial to this assignment. As a group, we came up with many different ideas and had to problem-solve in some situations. I also learned a lot of team work skills. Together, we had to combine ideas and distribute job positions to complete the book. (Personal communication, December 4, 2015)

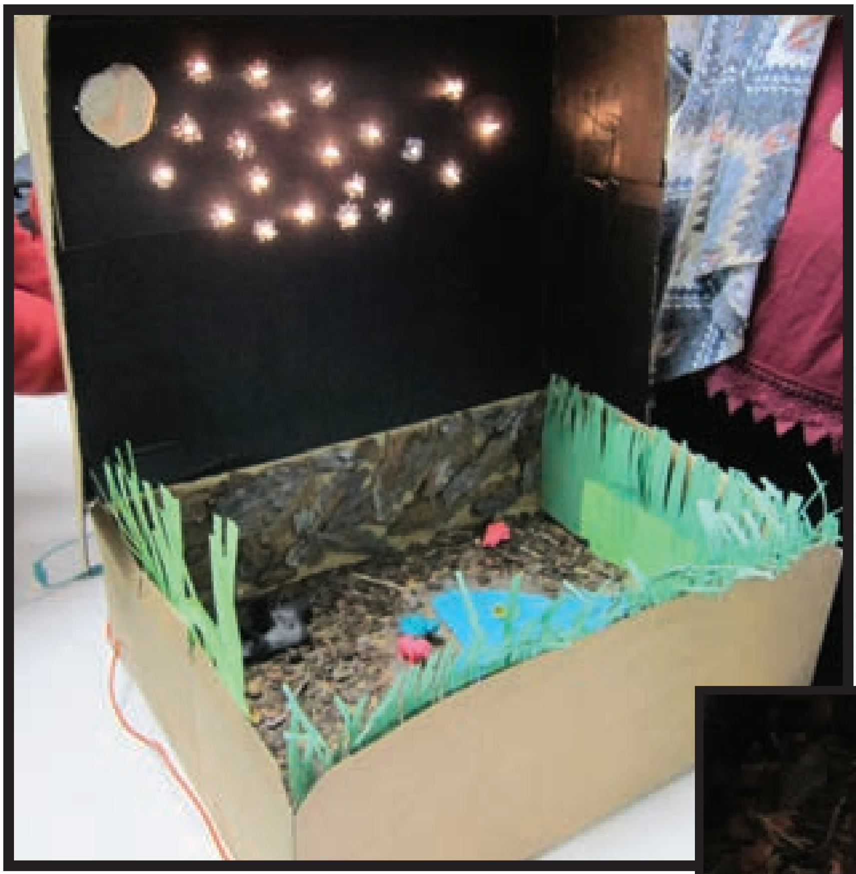
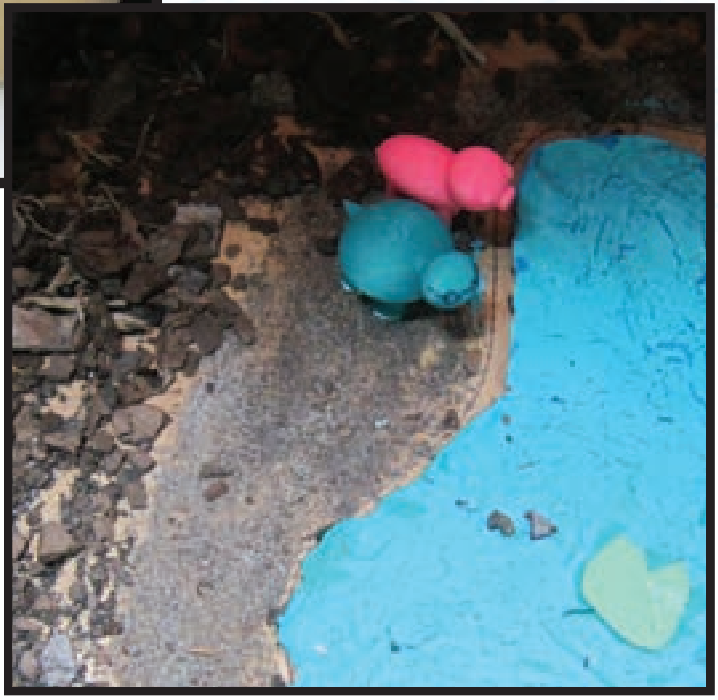


Figure 2. A 3-D storybook for *The Turtle and the Pig*.

Figure 3. Close-up of a turtle and a pig standing next to the pond in the 3-D storybook.



The project illustrates characteristics of the arts-integrated approach to STEAM education. First, it focused on learning through artmaking, which is one of the most important aspects of arts integration. Further, although it relied on artmaking as a method for learning, art did not disappear among the STEM subjects, as the students were also asked to focus on the aesthetics and design of their storybooks and required to learn art skills such as creating a 3-D model. Second, the assignment involved learning and applying knowledge and skills deriving from multiple STEAM subjects. Third, it provided opportunities for the students to collaborate and develop communication skills through teamwork. For all these reasons, the experience transcended subject boundaries such that transdisciplinary spaces opened up, as the students worked across, between, and beyond individual subjects. Although this work was undertaken by undergraduate elementary education students, K-12 art teachers can learn from it as an applied arts-integrated project that they can modify for their own classrooms. For example, K-12 art teachers could have their students create a 3-D storybook integrating art with language arts, technology, and other subjects. The developmental process would be similar in a K-12 classroom except the content would be based on grade level. Another option is a 3-D application, such as a model, as a learning tool to teach a concept.

This example constitutes a starting point for art educators planning to integrate STEAM into their pedagogical practices, because this project can be executed by a teacher either independently or in collaboration with partnering teachers and it requires minimum outside resources. Therefore, assignments of this nature offer a gateway to more sophisticated STEAM education opportunities, such as endeavors on the part of students to solve a real-world problem with STEAM skills acquired in the classroom.

Transdisciplinarity in Arts-Integrated Approaches to STEAM Education

An arts-integrated approach to STEAM education affirms the process of creative production, utilizes the creative process to acquire knowledge, and teaches 21st-century skills, such as communication and collaboration (Framework for 21st Century Learning, 2007). Moreover, STEAM should create a

STEAM should create a transdisciplinary space that cannot be defined in reference to any traditional sense of discrete disciplines… such a space is opened up when students do not categorize what they are learning as science, technology, or art.

transdisciplinary space that cannot be defined in reference to any traditional sense of discrete disciplines. For instance, such a space is opened up when students do not categorize what they are learning as science, technology, or art. Instead, students view their work as created through engaging with all these subjects and beyond these subjects such that they can apply their work to and even solve problems in other settings. In my example, the students' reflections on the blended nature of their learning indicate that a transdisciplinary space was achieved. Further, they view their learning included the development of collaborative and critical thinking ability through applying STEAM skills.

Teachers can create a transdisciplinary space in their own STEAM lessons by designing assignments that engage with multiple disciplines and thereby nourish students' ability in transferring learning in multiple disciplines. Student's engagement, reflection, and ability to explain the implication of the project and apply their knowledge and skills to new areas are ways to determine transdisciplinarity in the lesson. Overall, the experience of learning in a transdisciplinary space enables students to connect their work to real world settings thereby demonstrating that their learning is useful in ways that transcend achievements within the classroom.

Concluding Thoughts

Art educators can begin to implement STEAM education through an arts-integrated approach, such as the focal example described in this article. Ulbricht's (1998) guidelines for interdisciplinary art education "emphasize art's unique perspective and [that it should] not become a handmaiden for other disciplines." Further, Ulbricht specifies that "*new* understandings [should be] developed as a result of connections" and that interdisciplinary art education should be "concerned with important social and personal issues" and "organized around important themes." And, finally, that "art study should be collaborative" (pp. 16–17). These guidelines also hold for STEAM education. But what is new in the context of STEAM education is that a transdisciplinary space should be created in the STEAM experience. Defining the goal of transdisciplinary (research) as "the understanding of the present world, which cannot be accomplished in the framework of disciplinary research" (Nicolescu, 1997, para. 8), Nicolescu argues that transdisciplinarity is necessary for solving complicated problems in the modern global landscape (2002) such that STEAM should provide innovated solutions to contemporary problems.

To achieve the goal of creating a transdisciplinary space through STEAM, innovation can be directed toward the creation of a more just society (Turner, 2015). The transdisciplinarity of STEAM has the potentiality to address contemporary social issues, perhaps even on a global scale (e.g., Ahn, 2015; Guyotte et al., 2014). An arts-integrated approach to STEAM education is political in nature: while it might ensure future prosperity, it also offers educational opportunities, thereby equipping students with transdisciplinary experiences that contribute to a more just and "innovated" society. ■

Christine Liao is Assistant Professor at University of North Carolina, Wilmington. E-mail: cllyliao@gmail.com

References

Ahn, C. (2015). EcoScience + art initiative: Designing a new paradigm for college education, scholarship, and service. *STEAM Journal*, *2*(1). doi:10.5642/steam.20150201.11

Bequette, J. W., & Bequette, M. B. (2012). A place for art and design education in the STEM conversation. *Art Education*, *65*(2), 40-47.

Capraro, R. M., Capraro, M. M., & Morgan, J. R. (Eds.). (2013). *STEM project-based learning: An integrated science, technology, engineering, and mathematics (STEM) approach* (2nd ed.). Rotterdam, The Netherlands: Sense.

Chappell, J. A. (2005). The efficacy of an arts integrated approach to teaching and learning. In M. Stokrocki (Ed.), *Interdisciplinary art education: Building bridges to connect disciplines and cultures* (pp. 31-43). Reston, VA: National Art Education Association.

Eger, J. (2015, November 24). *Th Congressional STEAM Caucus may turn STEM to STEAM in the reauthorization of ESEA*. Retrieved from www.huffingtonpost.com/john-m-eger/stem-may-become-steamoffi_b_8634126 tml

Framework for 21st Century Learning. (2007). Retrieved from www.p21.org/our-work/p21-framework

Godin, B. (2008). *Innovation: Th history of a category* (Project on the Intellectual History of Innovation). Montreal, Canada: The Institut National de la Recherche Scientifi ue. Retrieved from www.csiic.ca/PDF/IntellectualNo1.pdf

Goldberg, M. (2011). *Arts integration: Teaching subject matter through the arts in multicultural settings* (4th ed.). Boston, MA: Pearson.

Guyotte, K. W., Sochacka, N. W., Costantino, T. E., Walther, J., & Kellam, N. N. (2014). STEAM as social practice: Cultivating creativity in transdisciplinary spaces. *Art Education*, *67*(6), 12-19.

Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM integration in K-12 education: Status, prospects, and an agenda for research*. Washington, DC: National Academy Press.

LaJevic, L. (2013). Arts integration: What is really happening in the elementary classroom? *Journal for Learning Through the Arts*, *9*(1), 1-28.

Lou, S.-J., Shih, R.-C., Diez, C. R., & Tseng, K.-H. (2011). The impact of problem-based learning strategies on STEM knowledge integration and attitudes: An exploratory study among female Taiwanese senior high school students. *International Journal of Technology and Design Education*, *21*(2), 195-215. doi:10.1007/s10798-010-9114-8

Maeda, J. (2012, October 2). *STEM to STEAM: Art in K-12 is key to building a strong economy.* Retrieved from www.edutopia.org/blog/stem-to-steam-strengthens-economy-john-maeda

Maeda, J. (2013). STEM + art = STEAM. *The STEAM Journal*, *1*(1). doi:10.5642/steam.201301.34

Marshall, J. (2010). Five ways to integrate: Using strategies from contemporary art. *Art Education*, *63*(3), 13-19.

Marshall, J. (2014). Transdisciplinarity and art integration: Toward a new understanding of art-based learning across the curriculum. *Studies in Art Education*, *55*(2), 104-127.

National Art Education Association. (2014, April). *Position statement on STEAM education.* Author. Retrieved from www.arteducators.org/advocacy/articles/143-position-statement-on-steam-education

Nicolescu, B. (1997, November). *Th transdisciplinary evolution of the university: Condition for sustainable development.* Retrieved from http://ciret-transdisciplinarity.org/bulletin/b12c8.php

Nicolescu, B. (2002). *Manifesto of transdisciplinarity* (K.-C. Voss, Trans.). Albany: State University of New York Press.

Riley, S. (2012). *STEAM point: A guide to integrating science, technology, engineering, the arts, and mathematics through the common core*. Westminster, MD: EducationCloset.

Roucher, N., & LovanoKerr, J. (1995). Can the arts maintain integrity in interdisciplinary learning? *Arts Education Policy Review*, *96*(4), 20-25.

Sanders, M. E. (2008). STEM, STEM education, STEMmania. *Th Technology Teacher*, *68*(4), 20-26.

Silverstein, L. B., & Layne, S. (2010). *What is arts integration?* Retrieved from http://artsedge.kennedy-center.org/educators/how-to/arts-integration/what-is-arts-integration

Sousa, D. A., & Pilecki, T. (2013). *From STEM to STEAM: Using brain-compatible strategies to integrate the arts*. Thousand Oaks, CA: Corwin.

Stokrocki, M. (Ed.). (2005). *Interdisciplinary art education: building bridges to connect disciplines and cultures*. Reston, VA: National Art Education Association.

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. San Francisco, CA: Jossey-Bass.

Turner, C. (2015, November). *Keynote*. Presented at the CONNECT Conference, Wilmington, NC.

Ulbricht, J. (1998). Interdisciplinary art education reconsidered. *Art Education*, *51*(4), 13-17.

U.S. Department of Education. (n.d.). *Science, technology, engineering and math: Education for global leadership.* Retrieved from www.ed.gov/stem

Watson, A. D. (2015). Design thinking for life. *Art Education*, *68*(3), 12-18.

Wynn, T., & Harris, J. (2012). Toward a STEM + arts curriculum: Creating the teacher team. *Art Education*, *65*(5), 42-47.

Yakman, G., & Lee, H. (2012). Exploring the exemplary STEAM education in the U.S. as a practical educational framework for Korea. *Journal of the Korean Association for Science Education*, *32*(6), 1072-1086.

Endnote

[1] The term *arts integration* includes all the arts areas (visual art, music, dance, theater). However, I use it here with an emphasis on visual art.

Sharon Vatsky

Identity: Three Global Perspectives

In 2012, the Solomon R. Guggenheim Museum announced the launch of a new major project, the Guggenheim UBS MAP Global Art Initiative. Hailed as an unprecedented cross-cultural project, its goal was to broaden the geographic representation of the Guggenheim's holdings and create a truly global collection. With funding provided by UBS, the project has focused on three major geographic areas: South and Southeast Asia; Latin America; and the Middle East and North Africa. It has added 126 works from 37 countries to the museum's collection.[1]

Places of Rebirth, 2009. Acrylic on canvas, triptych, 220 × 720 cm. Solomon R. Guggenheim Museum, New York, Guggenheim UBS MAP Purchase Fund © Navin Rawanchaikul and Navin Production Co. Ltd. Photo courtesy Navin Rawanchaikul.

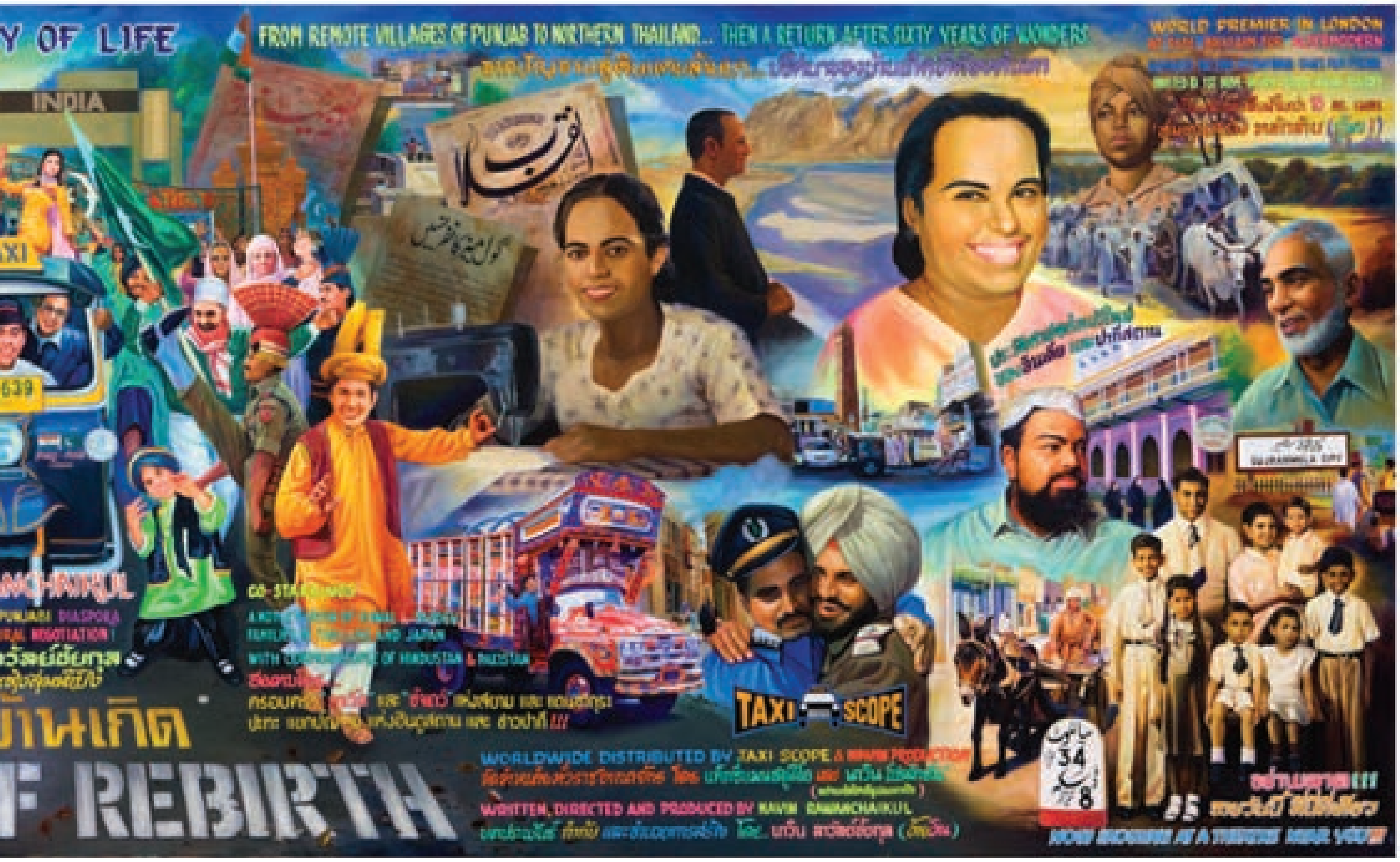
For each phase, a curator with deep knowledge of the area in question joined the Guggenheim staff. During a period of research and development, these curators traveled extensively, visiting artists and their studios across the region of focus. These journeys resulted in three distinct exhibitions, each of which premiered at the Guggenheim in New York before traveling to additional venues in parts of the world with which they were concerned. The exhibitions were as follows:

- No Country: Contemporary Art for South and Southeast Asia, organized by June Yap (February-May 2013)
- Under the Same Sun: Art from Latin America Today, organized by Pablo León de la Barra (June-October 2014; Camnitzer, 2014)
- But a Storm Is Blowing from Paradise: Contemporary Art of the Middle East and North Africa, organized by Sara Raza (April-October 2016)

In spite of the vastness of the territory addressed by the project, certain themes recur throughout, including the mutability of borders and the legacy of colonialism, alongside aspects of national and international confli t, geography, heritage, history, and migration. In addition, the theme of *identity* echoed through each of the exhibitions in various forms. For this Instructional Resource (IR), I have selected three contemporary artists, Navin Rawanchaikul (b. 1971, Chiang Mai, Thailand), Alfredo Jaar, (b. 1956, Santiago, Chile), and Kader Attia (b. 1970, France, raised in Algeria), who hail from different parts of the globe and consider the concept of identity from various perspectives. When these artists' works were on view in the museum's galleries, they sparked conversations, raised issues, and prompted new areas of inquiry for students and teachers alike. I am hopeful that sharing these works in this IR will encourage other educators to bring them into their classrooms, prompting student engagement and personal response.

For each of the three artists, I have included:

- A short essay focusing on the artist and the selected work;
- Sample inquiry-based questions designed to support classroom discussion;
- Suggestions for cross-curricular activities that may include writing, research, and/or artmaking; and
- Additional online resources that may include links to high-resolution images, videos, interviews, and/or articles.



THESE ARTISTS' WORKS… SPARKED CONVERSATIONS, RAISED ISSUES, AND PROMPTED NEW AREAS OF INQUIRY FOR STUDENTS AND TEACHERS ALIKE.

PHASE 1: South and Southeast Asia (Navin Rawanchaikul, *Places of Rebirth*, 2009)

The Artist and This Work

In *Places of Rebirth*, Navin Rawanchaikul considers issues of identity by carefully researching his own family history. Born in 1971 in Chiang Mai, Thailand, Rawanchaikul has made a painting motivated by his journey back to his family's homeland. Although he was born and raised in Thailand, the artist's family emigrated from India in 1947. By train, ship, and foot, his mother and great-grandfather traveled from Gujranwala (the Punjab region that is now Pakistan) and India to Chiang Mai in Thailand to arrive at the place of his family's "rebirth."

Painted in a style typical of Indian Bollywood movie posters, *Places of Rebirth* deals with the artist's background as a son of the Hindu-Punjabi diaspora and his cross-border, cross-cultural heritage. It blends images of his family and relatives with others showing people he encountered in Pakistan, alongside historical images from the 1947 partition of India and Pakistan. These portraits of a community's passing through time and place are bridged through the imaginary journey of a local Thai taxi (*tuk-tuk*) transporting Navin and his Japanese family across the border between India and Pakistan.

According to Rawanchaikul, his project is rooted in retelling stories from the past to his daughter, Mari: "I think about what it is like for her to grow up as half an outsider in Japan.… Thi king about the future of my child also makes me think about how I grew up and who my ancestors are." Rawanchaikul spent his childhood trying to be Thai alone, and fi ds himself repeating his parents' advice to his daughter, who has encountered teasing for her ambiguous identity: "Be yourself and respect your roots." *Places of Rebirth* presents an intimate look into familial relationships, also seeking specifi ally to inform his daughter about her own mixed heritage.

The painting is peppered with upbeat and optimistic messages of brotherhood, friendship, and togetherness that stand in stark contrast to the aftermath of the 1947 partition of South Asia that forced millions to leave their homes. Th s reimagining and blurring of identity refl ct the artist's desire for a community based on a dismantling of borders between nations and individuals.

Discussion

- Th s complex painting is more than 23 feet long. Project the image in your classroom. Examine it carefully with your students and make a collaborative list of all the things you notice.[2]
- The work incorporates images of the artist and his family as well as of people and places culled from news reports, historical records, and the artist's imagination. Challenge your students to fi d examples of each. For example, in the upper left c rner, Rawanchaikul has included a rendering of a 1947 photograph by American documentary photographer Margaret Bourke-White that depicts a young refugee contemplating his future.[3]
- In this work, Rawanchaikul takes an approach reminiscent of a style of Bollywood movie poster. Have students fi d examples of these posters online and list the attributes that *Places of Rebirth* shares with them. Are there also ways that this work *differs* from Bollywood movie advertisements?

Extension Activities

- In *Places of Rebirth*, Rawanchaikul has created an extended family tree culled from family photos, news events, and personally signifi ant places. At the top center are the words *An Odyssey of Life*. Ask students what they would feature in an odyssey (long and eventful journey) of their life. Have students create their own Odyssey of Life collage, incorporating:
  - Family photos both recent and older (be sure not to destroy original photos; photocopy, scan, or re-photograph them for use in your collage)
  - Images of places that are important to you and your family
  - News reports that relate to your family history
  - Writings, including names, slogans, and headlines
  - On a sheet of illustration board, experiment with various possible arrangements of these materials. When you have arrived at a composition that best expresses your family history, secure the images with glue. If possible, make a color photocopy of your collage to knit all the images together. Th s project can also be accomplished digitally by scanning images and using Adobe Photoshop
- As an artist who travels frequently, Rawanchaikul keeps in touch with his daughter Mari through long handwritten letters that chronicle his research and revelations about his family history. In one letter he writes: "Let me tell you again what my mom taught [me]… she said, 'be yourself and proud of your roots.'" Ask students to interview an older family member to fi d out more about their family's history. What did they learn that they did not previously know about their roots?

Resources

Navin Rawanchaikul's Facebook site, www.facebook.com/NavinProduction

Alfredo Jaar, *A Logo for America*, 1987, computer animation, 45 sec. Commissioned by the Public Art Fund for the Spectacolor Sign, Times Square, New York, April 1987. Photo courtesy of Alfredo Jaar and Galerie Lelong, New York. © Alfredo Jaar.

Navin Rawanchaikul, *A Tale of Two Cities*, youtube.com/watch?v=PWR3QW5QtRw&feature=plcp. Th s 10-minute video shows Rawanchaikul and members of his family, offering us glimpses into the way he explores his history and makes his work.

Navin Rawanchaikul's Guggenheim Museum artist's page: www.guggenheim.org/map-artist/navin-rawanchaikul

PHASE 2: Latin America (Alfredo Jaar, *A Logo for America*, 1987)

➤ *The Artist and This Work*

Alfredo Jaar's *A Logo for America* asks us to reconsider what it means to be an American, and to interrogate the identity associated with that term. Jaar was born in Santiago, Chile, in 1956. Since 1982 he has lived and worked in New York. One of his best-known works, *A Logo for America* (1987), used an electronic billboard in New York's Times Square to display the statement *THIS IS NOT AMERICA* emblazoned across an outline map of the United States. Th ough an apparently contradictory juxtaposition of word and image, Jaar's work draws attention to the fact that the word *America* is routinely but erroneously applied to just one part of the two American continents. For some, this is just a convenient nickname, but to many who inhabit this continent

Teachers view and discuss Alfredo Jaar's *A Logo for America*, 1987/2014, in the Guggenheim's galleries. Photo by Filip Wolak, 2014.

with us, it is a signifier hat we have we have unfairly usurped their place on the land mass known as the Americas, and claimed it as ours exclusively. Jaar's work is intended to remind us that the term *America* refers not only to the familiar contour that is identifiable as the United States, but rather to the hemispheric mass comprised by North, South, and Central America, which is more correctly designated by the plural *Las Americas* in Spanish. According to Jaar:

> When I moved to New York in 1982, I was shocked to discover that the daily use of the word America was referring only to the United States and not to the continent. In expressions like

"Welcome to America" or "God bless America" or "When did you arrive in America?," I realized that people were only referring to the United States and, in doing so, were ignoring the rest of the continent, practically erasing it from the map.

As an artist who was born in Chile, I always considered myself as a Chilean firs , a Latin American second, and an American third. In Spanish, the word America refers to the entire continent, and it was part of our education to see ourselves as belonging to America, the continent, as opposed to Europe or Africa, for example.[4]

In August 2014, *A Logo for America* was recreated in Times Square. On this occasion, the displays used the up-to-date technology of light-emitting diode (LED) lights, creating a more spectacular and visually arresting impression than did the original.[5] But had things changed in the intervening quarter-century? Almost 30 years after the work was fi st shown, the representation of an entire continent is still monopolized by the same, single country.

Discussion

- With your students, watch the video of Alfredo Jaar's *A Logo for America* (1987) at youtube.com/watch?v=u-adpTvjNOk. What is their response to this work? Discuss the message that Jaar is trying to convey. Do your students think his concerns are well-founded or trivial?
- In 2014, Jaar's work was reenacted in New York's Times Square using current technology. Watch the video documenting this installation at youtube.com/watch?v=2jJfNdE1xds with your class. Discuss the differences between the 1987 and 2014 versions. Do they think the issue that Jaar addresses has changed over the past 30 years?

Extension Activities

- Ask students, "If you had access to the digital displays in Times Square, what message would you want to convey? Why is this message important to you and vital to share?" Have each student plan the text, graphics, and animation they would want to project.

Resources

Alfredo Jaar's website: alfredojaar.net

Jaar's page on Galerie Lelong's website: galerielelong.com/artists/images/alfredo-jaar

Public Broadcasting System, *Art in the Twenty-First Century*, Season 4 (2007), “Protest,” pbs.org/art21/artists/alfredo-jaar?expand=1

Jaar’s artist’s page on the Guggenheim Museum website: guggenheim.org/map-artist/alfredo-jaar

Jonathan Blitzer, “A Logo for America,” *The New Yorker*, August 27, 2014, newyorker.com/business/currency/logo-america

PHASE 3: Middle East and North Africa (Kader Attia, *Untitled (Ghardaïa)*, 2009)

The Artist and This Work

Kader Attia’s work considers how *cultural identity* can be usurped, sometimes without even being acknowledged. Attia (b. 1970, France) grew up in Algeria and the suburbs of Paris, and takes this experience of living as a part of two different cultures as a starting point for his work. For *Untitled (Ghardaïa)* (2009), Attia modeled the Algerian town of Ghardaïa in couscous, a regional food staple originated by the Berber people of North Africa that is now popular worldwide. Almost a thousand years old, Ghardaïa is located in northern-central Algeria, in the Sahara Desert. Accompanying the artist’s fragile and ephemeral construction are photographs of famous architects Le Corbusier (1887–1965) and Fernand Pouillon (1912–1986), and a copy of a 1982 United Nations Educational, Scientific, nd Cultural Organization (UNESCO) certifi ate that designates the town a World Heritage Site.

Le Corbusier visited Ghardaïa in 1931, just three years after becoming a French citizen, and made sketches of its buildings. The style of those drawings strongly resembles that of the modernist architecture he subsequently advocated in his treatise on urban planning. That a noted French architect should take inspiration from an Algerian town may seem like a historical footnote, but as Attia notes, “architecture has fi st to do with politics, with the

Kader Attia, *Untitled (Ghardaïa)*, 2009. Couscous, two inkjet prints, and fi e photocopy prints, couscous diameter: 500 cm; prints: 180 × 100 cm and 150 × 100 cm, edition 2/3. Solomon R. Guggenheim Museum, New York, Guggenheim UBS MAP Purchase Fund 2015.84.

Teachers compare Kader Attia’s *Untitled (Ghardaïa)*, 2009 with a photograph of the Algerian town of Ghardaïa. Photo by Andrew Kist, 2016.

political order." As Attia is a child of Algerian immigrants and grew up partly in a Parisian suburb, this statement has a particular resonance. The use of couscous as a building material is symbolic, showing the impact of the artist's native culture on that of France, Algeria's former colonizer. The work highlights the cultural impact of the colonized on the colonizer, reversing traditional thinking about the direction of influence.

Discussion

- Ask your students to make a list of questions about this work, and then read the short essay above about Kader Attia. How does learning more about the artist and his intentions change their view of this work?[6]
- Look at photographs of Ghardaïa online. How does seeing images of the place that Attia is referencing influence your response to his work?
- Have students research examples of buildings designed by Le Corbusier and Fernand Pouillon. Do they see evidence that these famous French architects were influenced by their visits to Ghardaïa?
- In transferring ownership of this work, Attia provided the recipe, molds, and instructions for constructing the sculpture using 760 pounds of cooked couscous. Imagine that you were part of the museum staff harged with constructing this installation. What questions would you ask the artist?

Extension Activities

- Couscous has long been a staple of North African cuisine—references to it date back to the 13th century, and it remains known as North Africa's national dish even as its popularity has spread worldwide. In 2011, couscous was voted France's third-favorite dish.[7] Couscous is now available in most supermarkets. Ask students to have a meal that includes couscous or create a communal meal. What are student responses? What foods do students associate with their own identity and heritage?
- Kader Attia has become known for installations that use nontraditional materials. In his 2007 video *Oil and Sugar #2*, Attia pours thick black crude oil over a stack of brilliant white sugar cubes configu ed into a giant block. Your students can view this short video on YouTube. Have them think about how a material can be symbolic and then make a work that uses a nontraditional material or materials to convey meaning in a symbolic way.

Resources

Kader Attia's website: kaderattia.de

Julie Belcove (2016), "Shelf Life," *The New Yorker*, newyorker.com/magazine/2016/05/23/kader-attias-couscous-architecture-in-the-guggenheim

Kader Attia's artist's page on the Guggenheim Museum website: guggenheim.org/map-artist/kader-attia

Conclusion

To suggest a simple narrative connection between these three works would be presumptuous and naïve; they were made in different parts of the world and in response to different motivations. Rather, I present them together in this IR to demonstrate the enormous variety of inventive approaches and perspectives that may be loosely grouped under the theme of identity. For your students, some enduring conclusions may include the following:

- Art can be made from anything; any material has the potential to be transformed by a creative imagination.
- Many contemporary artists work in collaboration; all the artists cited here work with teams that help them to realize their vision.
- Art can resonate across borders and help us to see from other perspectives.
- Personal experience and insight continue to be major sources of artistic inspiration.
- New and interesting works of art are being produced in every part of the globe.

Being part of the Guggenheim UBS MAP Global Art Initiative has enabled me to meet and work with artists, curators, and educators in all three regions and become more familiar with the impressive range of work that is being produced in response to contemporary issues. My hope is that students will be as intrigued with these works as the visitors who have experienced them at the museum. ■

Sharon Vatsky is Director of School and Family Programs at the Solomon R. Guggenheim Museum, New York. E-mail: svatsky@guggenheim.org

References

Belcove, J. (2016, May 23). Shelf life. *The New Yorker*. Retrieved from newyorker.com/magazine/2016/05/23/kader-attias-couscous-architecture-in-the-guggenheim

Blitzer, J. (2014, August 27). A logo for America. *The New Yorker*. Retrieved from newyorker.com/business/currency/logo-america

Camnitzer, L. (2014). *Teacher's Guide: Under the Same Sun: Art from Latin America Today.* New York, NY: Solomon R. Guggenheim Museum. Retrieved from guggenheim.org/wp-content/uploads/2016/03/guggenheim-map-under-the-same-sun-teachers-guide-english-luis-camnitzer.pdf

Solomon R. Guggenheim Museum. (2012). *Guggenheim UBS MAP Global Art Initiative.* Retrieved from guggenheim.org/map

Endnotes

1 See guggenheim.org/map

2 For a high-resolution image, see: http://education.guggenheim.org/new-york/education/school-educator-programs/teacher-resources/arts-curriculum-online?view=item&catid=765&id=195

3 www.gettyimages.com/pictorial/margaret-bourke-white-photographer-of-life--GNqEtRdvUE-NWjE9DJ6r6w#october-1947-boy-sitting-on-rock-ledge-above-refugee-camp-picture-id50865278

4 Alfredo Jaar, in correspondence with Luis Camnitzer, March 11, 2014.

5 See guggenheim.org/guggenheim-foundation/collaborations/map/latinamerica/artist/alfredo-jaar

6 For a high-resolution image see: http://education.guggenheim.org/new-york/education/school-educator-programs/teacher-resources/arts-curriculum-online?view=item&catid=784&id=233

7 https://en.wikipedia.org/wiki/Couscous

2017 NAEA **NATIONAL** CONVENTION

MARCH 2-4, 2017 | NEW YORK, NY

REGISTER NOW!

DETAILS

WHEN
March 2-4, 2017

WHERE
Hilton New York*
1335 Avenue of the Americas

Sheraton New York
811 Seventh Avenue

COST
Members
$165 Now | $195 after 1/27/17**

Non-members
$225 Now | $255 after 1/27/17

REGISTER
Register online at www.arteducators.org/convention, or call 800-299-8321

STAY
Book discounted accommodations at www.arteducators.org

* Headquarters Hotel

**See additional member pricing when registering.

This is your national professional Convention—the largest gathering of visual arts educators in the world!

1,000+ Sessions, workshops, and tours: including **Jeff Koons** General Session!

GET THE BEST DEALS!

Register for the Convention, and book accommodations before 1/27/17 to receive maximum savings!

www.arteducators.org/convention


RESOURCES
NATIONAL VISUAL ARTS STANDARDS
PreK-2
GRADES 3-5
GRADES 6-8
GRADE LEVEL SPECIFIC
Standards posters!
The HEART of Art Education
Holistic Approaches
Curriculum Inquiry and Design
Teaching and Learning
EMERGENT
Culturally Sensitive Art Education in a Global World
Art Education for SOCIAL JUSTICE
CONNECTING
Creativity Research and Practice in Art Education
Reaching and Teaching
INCLUDING DIFFERENCE
INQUIRY in Action
Design STANDARDS for School Art Facilities
Open. Turn. Learn. Apply.
Turn Over a New Leaf!
NAEA RESOURCES
2016-2017
ART MATTERS
FOR MORE, see NAEA Resources (mailed with September Art Education) or download it at www.arteducators.org/catalog
STUDIES in ART Education
SUBSCRIBE!
Studies in Art Education
ART MATTERS!
Advocacy wear, buttons, stickers
NAEA RESOURCES
www.arteducators.org/store

VCU ART EDUCATION
GRADUATE STUDIES

VCU | VCUarts

VCU ART EDUCATION GRADUATE STUDIES

RESEARCH SPECIALITIES

- Aesthetics
- Arts & Healthcare
- Assessment
- Critical Theory
- Culturally Sustainable Pedagogy
- Curriculum
- Dialogic Looking
- Feminist Pedagogy
- Gaming
- Museum Education
- Program Evaluation
- Service-Learning
- Socially-Engaged Art Practices
- Technology
- Urban Education

FACULTY

- Dr. Melanie Buffington
- Dr. David Burton
- Dr. Pamela Lawton
- Dr. Ryan Patton
- Dr. Pamela Taylor
- Dr. Sara Wilson McKay
- Dr. Courtnie Wolfgang

APPLICATION DEADLINE
PhD: DECEMBER 15
MAE: JANUARY 15

MASTER OF ART EDUCATION + TEACHING LICENSE

MASTER OF ART EDUCATION FOR LICENSED TEACHERS

PhD IN EDUCATION: **ART EDUCATION** CONCENTRATION

ARTS.VCU.EDU/ARTEDUCATION • ARTEGRAD@VCU.EDU