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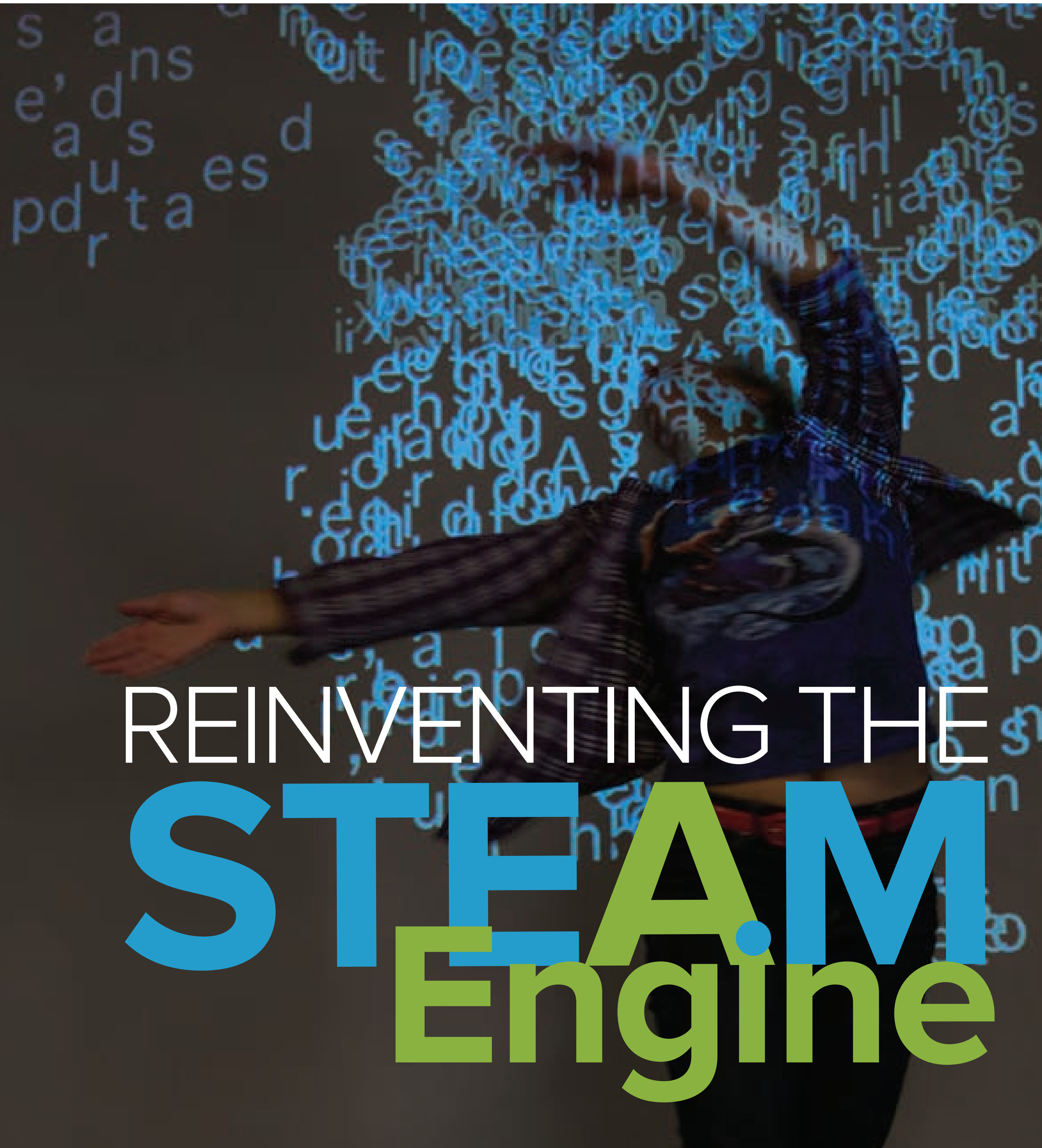

REINVENTING THE STEAM Engine

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Cover: Detail from *elicit*, an interactive installation by Nathaniel Stern (2001-2013). Photo by Wyatt Tinder. Page 36 from "Nathaniel Stern: Performing Images into Existence."

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Reinventing the STEAM Engine for Art + Design Education

If we work every day as K–12 art + design teachers, arts coordinators, museum professionals, or university teacher educators, why should science, technology, engineering, art, and math (STEAM) matter? STEAM matters because we are more than just instructors of art and art education. While most of our students year in and year out will not become professional artists, we are nevertheless arguably the primary teachers of creativity our students will ever have throughout their education. Fundamentally, our job is to instigate and foster arts practice and design thinking as a means for individual learning, social responsibility, and creative problem solving—mediating ideas and materials toward meaningful and enduring solutions. The art studio is one of the very few spaces in school or society where widely divergent outcomes are encouraged and never-before-imagined design solutions are valued. As an acronym for educational imagination, **STEAM** promises the enhancement of divergent outcomes emerging from the art + design studio by immersing students in a diversity of knowledge bases across contributing domains of **S**cience, **T**echnology, **E**ngineering, **A**rts, and **M**ath. Moreover, one of the best things about STEAM education is that you do not have to figure out how to invent the STEAM engine for innovation alone. Diverse collaborations and resources equip STEAM classrooms for locomotion.

A Diversity of Knowledge

Renowned as a artist and designer, it is illuminating to recognize that the creativity of Leonardo da Vinci emerged from exposure to a diversity of knowledge bases and resources, not out of thin air (Rolling, 2013). Leonardo's individual genius was the natural extension of the collective genius of both Renaissance culture and his working relationship with other local STEAM thinkers and doers. Apprenticed at the age of 14 to the prominent artist and sculptor Andrea del Verrocchio, who worked for the court of the powerful Florentine statesman and arts patron Lorenzo de' Medici, Leonardo was the product of a swarm of activity that was known as one of the finest workshops in all of Florence, Italy, producing several other artists who grew to fame. According to a Wikipedia entry, Leonardo's young mind was "exposed to both theoretical training and a vast range of technical skills including drafting, chemistry, metallurgy, metal working, plaster casting, leather working, mechanics and carpentry as well as the artistic skills of drawing, painting, sculpting and modeling" at Verrocchio's very well-funded workshop ("Leonardo da Vinci," n.d., para. 10). In other words, Leonardo's genius was the product of a STEAM education, not just an art education!

It was his facility with a diversity of knowledge that prepared Leonardo to become a practicing architect, musician, anatomist, inventor, engineer, sculptor, mathematician, and painter. By the age of 20, Leonardo was qualified as a master in the Guild of Saint Luke, a guild of artists and doctors of medicine highlighting an era when there was no false division or hierarchy yet established between the intellectual value or practice of the arts and sciences. Leonardo flourished in an era when invention across a diversity of STEAM knowledge bases was celebrated. For example, before his death in 1519, Leonardo produced a portfolio of hundreds of brilliantly realized anatomical drawings of dissected corpses, dogs, frogs, horses, bears, monkeys, and bats, completed from around 1490 to the early 1500s. Leonardo's incisive studies of the workings of the human heart from the years 1511–1513 are said to astound cardiac surgeons even to this day.

It is easy to assume that the paradigm of "science" as we understand it today was the same held by all those who contributed to what we identify as the "Scientific Revolution" in Western Europe. This assumption is incorrect. Rather, from the 14th to approximately the mid-19th centuries, the prevailing concept of inquiry was "something called 'natural philosophy'," which aimed to describe and explain the entire system of the world" (Henry, 2002, p. 4). This study of the workings of nature and the physical universe was exemplified in the development of areas of inquiry such as chemistry, astronomy, physics, anatomy, botany, zoology, geology, and mineralogy. In other words, STEAM-generated learning and discovery is nothing new.

STEAM Today

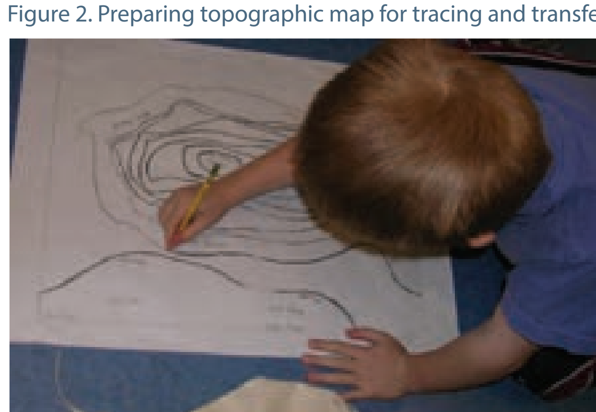
In this, the first of two special issues of *Art Education* scheduled for the calendar year of 2016, the articles that have been assembled are devoted to helping our readers reinvent the STEAM engine for art + design education. In the upcoming November 2016 issue, a new cohort of authors will present articles on the theme of STEAM locomotion, modeling classrooms and spaces for learning that are already powered by STEAM energy. Exemplified by early artist-researchers like Leonardo Da Vinci, methods of practice and technical skills applied in Renaissance visual arts, sculpture, and architecture served as "an instrument of knowledge" (Claude Lévi-Strauss, cited in Berger, 1972, p. 86). Creative and scientific activities were attached together in human cultural development. Today, STEAM has reemerged in the national conversation as the premise for building contemporary studio-laboratories in educational settings along with broader curricula for arts + design learning. In my final *NAEA News* column as the director of the Higher Education Division a few years ago, I chose to highlight a national news item, one that was easy to miss but that continues to have direct policy implications for both the practice of arts + design education and preparing the next generation of arts educators. This brief news item was originally posted in February 2013 on the website of the *Americans for the Arts Action Fund* and is presented here in its entirety:

> The Congressional STEAM Caucus was approved on January 28, 2013, with the Chairs and Co-Chairs being Representative Suzanne Bonamici, and Representative Aaron Schock. Representative Bonamici represents the First Congressional District of Oregon. She is on the Committee on Education and the Workforce and the Committee on Science, Space, and Technology… Representative Schock represents the Eighteenth Congressional District of Illinois. He serves on the House Ways and Means Committee and serves on three Ways and Means subcommittees: Trade, Oversight, and Social Security. Representative Schock also serves on the committee on House Administration and as the Chairman of the Franking Commission.
>
> A bipartisan team of members of Congress launched the Congressional STEAM Caucus. The STEAM caucus "aims to change the vocabulary of education to recognize the benefits of both the arts and sciences and how these intersections will benefit our country's future generations." Caucus members will work to increase awareness of the importance of STEAM education and explore new strategies to advocate for STEAM programs. STEAM is an acronym for Science, Technology, Engineering, Arts and Math. While the act of launching this new caucus is radical, the idea that science and art are complimentary is not so radical. Albert Einstein wrote, "After a certain high level of technical skill is achieved, science and art tend to coalesce in esthetics, plasticity, and form. The greatest scientists are always artists as well."
>
> Robert Lynch, Americans for the Arts Action Fund President & CEO saluted this newly formed caucus. We work to advance the cause of arts education at the federal, state, and local levels through our professional and advocacy programs. These were Robert Lynch's remarks on the STEAM Caucus,
>
> > *"Thanks to the leadership of Representatives Suzanne Bonamici (D-OR) and Aaron Schock (R-IL), the message of how the arts can help launch creativity and innovation among our nation's students will have a proper place in the halls of Congress. Having worked with both of them on these issues, we were excited to assist in establishing this new congressional policy e¯ ort in education."*
>
> While the Congressional Arts Caucus began its formation in the late 1970's through the early 1980's and is a bipartisan organization for Members of Congress who support the arts through federal initiatives, the introduction of the STEAM Caucus will cast a larger net of awareness for improving arts education. The Congressional Arts Caucus as well as the STEAM Caucus will simultaneously serve the arts community by illustrating that art can be a part of their policy solutions. (The Congressional STEAM Caucus, 2013, February 7)

So what does the news of a bipartisan Congressional STEAM Caucus mean to the National Art Education Association in our

Figure 1. Completing the topographic map drawing and map key.

Figure 2. Preparing topographic map for tracing and transfer.



Figures 3–5. Painting the imagined three-dimensional world.

organizational commitment toward shaping human potential? What does it mean to the working elementary, middle, or high school art teacher and those of us who partner with them? First of all, it is the signal of a sea change in the area of public education. It is almost uniformly acknowledged that recent high-profile legislative solutions like *No Child Left ehind* and *Race to the Top* have not come close to adequately addressing the shortcomings of public schooling in our nation. By all measures of achievement, American learners are lagging behind much of the developed world. Not only are our schools and neighborhoods filled with too many children left ehind—our present-day preoccupation with high-stakes standardized testing has too often left s racing to the sidelines.

Second, new STEAM initiatives reveal a growing recognition that a focus on STEM subjects in education alone will not meet the needs of our students or our nation. Science, technology, engineering, and math education require the arts at the center of learning as well. Th s has always been the engine of the highest order of creative thinking. Like Leonardo da Vinci, apparently Einstein also understood the value of a diversity of knowledge.

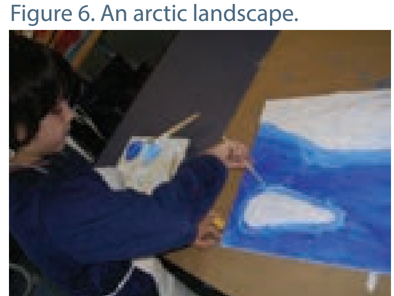
Thi d, it is noteworthy that a rethinking of the arts + design in education by other collaborating subject areas also requires a similar rethinking by our own arts education practitioners. The arts and related creative practices are uniquely adaptable (Rolling, 2011). Alternately—and often simultaneously—the arts have historically been practiced as (1) a system for producing well-crafted *forms* of aesthetic depth and beauty with a focus on thinking through observation and experimentation while achieving a mastery over materials and techniques; (2) a system for communicating cultural and personal *information* with a focus on thinking expressively through symbolic languages; and (3) a system for critical-activist *transformation* with a focus on critically (re)thinking and interrogating images, ideas, and prevailing contexts.

When art + design education is framed as a system of production and reproduction, practitioners with an affi ty for techniques and practices that generate beautiful forms, structures, and singular solutions will likely fi d curricular kinship with industrial and interactive designers—with architects, poets, filmmakers, and scientists. When art + design education is framed as a system of communication and translation, practitioners with an affi ty for more interpretive practices that navigate the signs and symbols humans make in order to convey valued signifie s will likely fi d curricular kinship with writers of all kinds, mathematicians, musicians, dancers, and a multicultural array of ethnic, religious, and social communities. When art + design education is framed as a system of critical refl ction, practitioners with an affi ty for more critical practices that question situated or embodied contexts will likely fi d curricular kinship with feminists, iconoclasts, revolutionaries, cultural theorists, mass media dissenters, political activists, and environmentalists. A pluralistic, adaptable, STEAM-driven model for education draws on any and all of these creative paradigms without partiality in answer to Julia Marshall's (2006) challenge for a more substantive integration of art disciplinary content with the humanities and other subject areas such as the sciences, technology, engineering, math, social studies, and entrepreneurship.

Hands-On Land Forms: Building a STEAM Engine in an Elementary School

Right after the completion of my doctoral studies in education, I was hired to teach art and help design an integrated fi e arts curriculum in early 2003 as part of the faculty of a brand new elementary school in New York City espousing a fully integrated curricular format. My desire to collaborate with our school's brilliant and resourceful science teacher, Lisbeth, to build a small STEAM engine for learning was due in no small part to the fact that the science room was situated right next door to the art studio.

Figure 6. An arctic landscape.



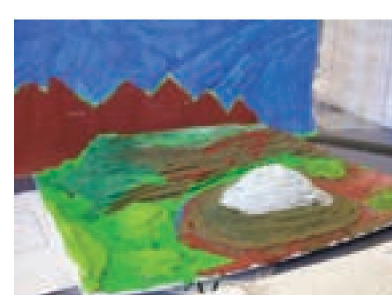


Figure 7. Model with landscape painting.

Figure 8. An earthly landscape.

Figure 9. An alien landscape.

"Hands-On Land Forms" was conceived as a Fall 2004 Integrated Project Week (IPW) offering for 3rd- and 4th-grade students. An IPW was intended to involve small groups of students from different classes and grade levels in a focused and extended collaborative learning exercise that would allow each student to deepen their understanding of a particular topic, theme, or concept already encountered in the curriculum, and in which they had indicated an abiding interest. These project outcomes were then exhibited and/or performed in a culminating school-wide showcase to which all families were invited.

Our Hands-On Land Forms project prompted students to invent hand-drawn imaginary maps of landforms on the earth's surface they had recently learned about in science class (e.g., bay; peninsula; mesa, volcano; desert, canyon). Th s STEAM engine for learning immediately engaged students, rapidly gathering momentum as they translated the contour lines of their topographic maps into three-dimensional terrains utilizing Foamcore and corrugated cardboard, safety blades, Elmer's glue, papier mâché, architectural scale rulers, and other supplies as needed. Drawing on my own background as an architecture student and a freelance architectural model maker, I was able to facilitate the construction of anything a student wished to build. We traveled with students through the stations of inventing a topographic terrain map, drawn to scale (Figure 1); tracing each elevation layer onto Foamcore and cutting it out (Figure 2); stacking and gluing the layers together in order of descending elevation and smoothing out the transitions with papier mâché (Figure 3); painting the imagined three-dimensional world (Figures 4, 5, 6); and creating a painting of the imagined landscape as if we were standing in it (Figure 7). In the process, students created models of landscapes that varied from the earthly to the alien (Figures 8, 9).

STEAM Engineering

Th s July 2016 issue of *Art Education* features an assembly of authors with a variety of strategies for building STEAM engines for learning in contemporary art + design education. **Andrew D. Watson** shares some big picture insights stemming from his work with both the Innovation Collaborative—a coalition of national institutions representing a much-needed synergy between the arts, sciences, humanities, and higher education—and the White Paper Writing Group for the National Congressional STEAM Caucus. **Michael Gettings** explores the diversity of knowledge to be found in abundance at the intersection of Project Based Learning, scientific i quiry methods, and developing Studio Habits of Mind. **David Rufo** shares an invited refl ction examining his and his teaching partner's efforts to launch a STEAM fair in an elementary school general education classroom.

The diversity of knowledge powered by STEAM often requires a diversity of means for interfacing with and mediating that knowledge. Given the innate *multimodality* of human perception, in this issue **Ehsan Akbari** investigates sound as a fundamental feature of how we experience visual media and the everyday world. **Jescia J. H. Hopper** highlights the meaningful integration of technology, often a necessary platform for building effici t STEAM engines, in her use of tutorial videos as a method of presenting information during an 8th-grade self-portrait unit. In their co-authored contribution, **Christine Liao**, **Jennifer L. Motter**, and **Ryan M. Patton** advance hands-on digital art projects as an avenue for sparking girls' interest as creators of technology and a corrective for the gender and minority imbalance in STEM fi lds. Finally, in this month's Instructional Resource, **Christine Woywod** presents the interactive artworks of Nathaniel Stern who often blends art and technology to generate participatory installations through which audience members may bodily experience art, performing images into existence.

By modeling *adaptable* STEAM-centered educational frameworks and projects for the nation, the diverse membership of the National Art Education Association may also seize a unique opportunity to situate arts + design practices both as an engine for innovation in public schooling reform and at the center of initiatives toward more effective integration across disciplines in general education. ■

—James Haywood Rolling Jr., Editor

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Revving Up the STEAM Engine

Andrew D. Watson

Now, the real work starts. For over half a decade we have talked about moving from science, technology, engineering, and math (STEM) to science, technology, engineering, arts, and math (STEAM). While we must continue to advocate for STEAM education, the passing of the Every Student Succeeds Act (ESSA) in December 2015 has moved us into the implementation stage. ESSA is intended to empower state and local decision makers to build differentiated community-based systems for school improvement in ways that "cookie-cutter federal solutions like No Child Left Behind" never supported (White House Report, 2015, December 10, n.p.). In the reauthorization and amendment of the Elementary and Secondary Education Act of 1965 (ESEA) achieved under ESSA, "Arts and music education are specified as eligible uses for new, state-administered 'Student Support and Academic Enrichment Grants' including support for the arts in STEM education" (ESEA Reauthorization is Finalized as Every Student Succeeds Act [ESSA], n.p.). Now that the federal government recognizes the role that the arts can play to elevate STEM education, it is time to ask ourselves some important questions.

What Should STEAM Look Like?

STEAM is not Arts Integration. While the two cross-disciplinary teaching methodologies share some important traits, they also differ on how the arts relate to other disciplines of learning. In a typical Arts Integration model, instruction is always presented through the arts. In a STEAM educational model, all of the disciplines are co-equal. That means if you were to enter a STEAM classroom on any given day you may observe a lesson that heavily relies on the arts or includes no arts component whatsoever. You might come in on a day where students are working on tessellations with a heavy connection to visual arts and mathematics, or you could witness a lesson where students are responding to an egg drop challenge with an engineering focus, and science and mathematics as its primary components. The point is not to try and cram *every* discipline into *every* project, but rather to regularly and authentically make connections between the disciplines whenever it makes sense to cross borders.

In the art room, a STEAM project should always start with art and integrate additional disciplines to support and expand the learning in art. Likewise, in a science room the teacher will start with science. Utilizing art supplies in a project exploration is not integrating art. Likewise, mentioning that pigments are created through chemical processes is not integrating science. True STEAM requires the incorporation of discipline content and standards outside of one subject. While there are individual teachers that have a deep knowledge of multiple STEAM disciplines, it is unrealistic to expect individual teachers to have such a breadth and depth of knowledge. A more attainable model is to form a collaborative STEAM Team.

“STEAM is not Arts Integration. . . . In a STEAM educational model, all of the disciplines are co-equal.”

How Can We Engage and Collaborate With Our STEM Colleagues?

The art teacher is not the school's STEAM teacher. It is questionable whether there should even be a STEAM teacher. STEAM is not a subject; it is a curricular approach that is applicable in every classroom. Instead, art + design teachers should serve the role of chief creativity officer or your STEAM Team. When working with a collaborative team it helps to start with a central theme or problem as a guide for inquiry. As a team you can then construct the learning experience for your students. Creative use of scheduling and space usage constraints can lead your students through different avenues of exploration that tie in multiple disciplines and resources. Depending on the context of your school and how your STEAM Team is structured, you may work on parts of these projects in different classrooms, or you may be able to schedule a regular time for selected students or grade levels to work on and complete specific rojects.

What Are the Best Practices for Teaching in a STEAM Approach?

Does STEAM have best practices? It takes time to demonstrate the consistent success of any method for learning and instruction and we are still in the wild west of STEAM. Teachers across the country and the world are currently pioneering and experimenting with innovative projects and lessons. We are beginning to see trends; anecdotally, we see successes when STEAM is blended with inquiry methods such as Project-Based Learning and metacognitive constructs such as Design Thi king. However, to understand if these successes are repeatable in a variety of contexts will take time and research.

Figure 1. For more information on the Innovation Collaborative, go to www.innovationcollaborative.org.

The Innovation Collaborative, an outcome of the National Science Foundation–funded SEAD (Science, Engineering, Arts, and Design) Network, is currently taking up this issue (Figure 1). Members of the Innovation Collaborative coalition—including the National Art Education Association, the National Science Teachers Association, the National Association for Gifted Children, Americans for the Arts, and the Association of Science-Technology Centers—have put out a call to their memberships to participate in a project that may help to develop these best practices. The Effective Practices Project will collect lesson, unit, and project plans from K–12 educators that integrate the arts with STEM and the humanities. Dr. Hope E. Wilson, a professor at the University of North Florida, will lead a research study using these plans. Other contributors, including leaders in the art education, science education, humanities education, creativity, and neuroscience fi lds, will review the plans for quality and make them available for teachers, administrators, and other interested stakeholders. It is our hope to continue this project for years to come testing the practices in classrooms, making the fi dings widely available, and expanding to out-of-school learning in order to provide a rich resource for teachers and source of data for researchers and policy makers.

Conclusion

Yes, we have a lot of work ahead of us, but we have already accomplished so much. STEAM builds upon our knowledge of Arts Integration, Design Thi king, Play-Based Learning, Project-Based Learning, and various other forms of cross-disciplinary learning of the past. We have won the support of industry, legislators, and educators in other fi lds. I believe that STEAM has the ability to transform our public educational model. With STEAM engines for learning, we can unify the best aspects of workforce development for an innovation-based economy with a more holistic form of learning and instruction that nurtures our students as empathetic and refl ctive humans. ■

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Putting It All Together:

STEAM, PBL, Scientific ethod, and the Studio Habits of Mind

Michael Gettings

As an arts administrator for a large school district in Central Virginia, I have been working with and keeping an eye on developments in the growing science, technology, engineering, art, and math (STEAM) initiatives. I have seen these develop and morph into a robust set of ideas that are being developed into curriculum. This curriculum is "de-siloizing" content in an effort to bring authentic learning and deep student engagement. Our students will be the direct beneficia y of STEAM programs delivered with a solid underpinning of what STEAM is and how it relates to other initiatives and lines of inquiry.

STEAM can be described as intentionally integrating the concepts and practices articulated with 21st-century skills in curriculum, instruction, assessment, and enrichment, while purposefully integrating science, technology, engineering, arts (including but not limited to the visual and performing arts), and mathematics. STEAM education offers contextual learning; utilizing subject overlap for greater understanding. STEAM has also been described as "Science and Technology, interpreted through Engineering and the Arts, all based in the elements of Mathematics" (Yakman, 2015).

Many artists have long regarded science, mathematics, technologies, and engineering as part of the artistic creative processes. Look no further for proof of this than daVinci's studies in anatomy, engineering, and artistic renderings, or the work of contemporary artists such as Kimsooja. Teachers and students are also exploring the artistic uses of 3-D printers and other contemporary media for expressive purposes.

In science, the activity model for scientific i quiry contains activities and steps in which students engage throughout the scientific rocess. These activities are: observing, defini g a problem, forming the question, investigating the known, articulating the expectation, carrying out the study, examining the results, refl cting on the fi dings, and communicating with others (Harwood, 2003). These activities or steps allow for close considered observation and refl ction. Key components of the process are revision as needed shown by the evidence gathered, and then communicating the fi dings.

Project Based Learning (PBL) is another model of inquiry that is being used in many schools. The Buck Institute for Education has defi ed it as, "a set of learning experiences and tasks that guide student in inquiry toward answering a central question, solving a problem, or meeting a challenge" (Larmer, Ross, & Mergendoller, 2009, p. 5). Similar to the scientific i quiry model, PBL's progression or wheel is:

1. The teacher-coach sets the stage for students with real-life samples of the projects they will be doing.
2. Students take on the role of project designers, possibly establishing a forum for display or competition.
3. Students discuss and accumulate the background information needed for their designs.
4. The teacher-coach and students negotiate the criteria for evaluating the projects.
5. Students accumulate the materials necessary for the project.
6. Students create their projects.
7. Students prepare to present their projects.
8. Students present their projects.
9. Students refl ct on the process and evaluate the projects based on the criteria established in Step 4 (Stix & Hrbek, 2006).

These two models are centered around driving questions, research, critical thinking, revision, and communication of ideas.

In, *Studio Thinking 2, The Real Benefits of Art Education* (Hetland, Winner, Veenema, & Sheridan, 2013) the authors propose a series of steps or dispositions called the Studio Habits of Mind (SHoM). Using research, Hetland and her group identifi d how teachers plan and teach art classes, as well as what is taught in visual arts classes. The how are labeled Studio Structures. The Studio Structures include Demonstration-lecture, Students-at-work, critique, and exhibition.

The "hidden curriculum" or what is taught, are the SHoM. The SHoM contain what their research considers eight dispositions. These dispositions include skills and the inclination to use them. There is much more to this book and I highly recommend reading it, but for the focus of this article we will focus on the eight SHoM:

- Develop Craft Learning to use tools, materials, artistic conventions; and learning to care for tools, materials, and space.
- Engage and Persist: Learning to embrace problems of relevance within the art world and/or of personal importance, to develop focus conducive to working and persevering at tasks.

- Envision: Learning to picture mentally what cannot be directly observed and imagine possible next steps in making a piece.
- Express: Learning to create works that convey an idea, a feeling, or a personal meaning.
- Observe: Learning to attend to visual contexts more closely than ordinary "looking" requires, and thereby to see things that otherwise might not be seen.
- Refl ct: Learning to think and talk with others about an aspect of one's work or working process, and learning to judge one's own work and working process and the work of others.
- Stretch & Explore: Learning to reach beyond one's capacities, to explore playfully without a preconceived plan, and to embrace the opportunity to learn from mistakes.
- Understand Arts Community: Learning to interact as an artist with other artists (i.e., in classrooms, in local arts organizations, and across the art fi ld) and within the broader society.

Adding the studio experience of showing art aligns with the "communicating with others" strands in science and PBL.

It is obvious that the scientific odel of inquiry, the PBL wheel, and the SHoM are all related. Each describes a method of inquiry. The activities, series, or habits allow students to slow down, engage in detail, and use critical thinking skills to add depth to their understanding. These habits or dispositions are intentionally taught and used.

Currently, most STEAM education in K–12 is delivered as special challenges; usually with an engineering approach. In STEAM, the A(rt) enables students to look at design or engineering problems through the additional lens of artistic or aesthetic experience. Th ough this lens the student applies creative problem solving, design, and aesthetics.

However, there is a danger of superfic ally including art in what are essentially STEM projects. Without intention or by using artistic materials in a shallow way, you can get what I call POS, or Paint on Stuff. With POS, the design and application of art material is given low thought; a surface approach. An example of POS would be to simply add a color to an engineering project without prior thought and calling it an artistic contribution. While there may be a practical application of using color in a design or engineering challenge (for instance, adding color to heighten visibility on an underwater robotics project), color or paint for the sake of adding it without thought defeats the purpose of intentionality or thoughtful approaches to design.

I call the thoughtful and intentional approach to applying artistic media, meaning, and design "artistic design aesthetics." Th s artistic design aesthetic process yields something that is not only functional but intentionally thought of as having a pleasurable affect for the creator and the consumer or viewer.

Using the studio habits, scientific ethod, the PBL model, and artistic design aesthetics, I propose a set of actions and goals for artistic production for use in the development of STEAM projects. These actions and goals may be used for individual students or in collaborative groups. STEAM projects should:

- Engage in real world problems that blend the STEAM disciplines.
- Allow the student to envision multiple possible solutions, outcomes, or problems related to the challenge.
- Use artistic thinking skills to stretch beyond the student's initial vision and explore possibilities before, during, and after the work is done.
- Use intentional application of artistic design aesthetics to all challenges.
- Solve problems of design challenges with originality, flex bility, fluency, and imagination.
- Select and use art media, subject matter, and symbols for expression and communication.
- Use materials, methods, information, and technology in a seamless and creative manner within the design processes.
- Observe and refl ct during the entire process. Be open to suggestion and actively listen to all input before expressing opinions or solutions. Based on input, be able to envision different solutions.
- Use a high level of craft uring all phases of the project or challenge.
- Develop understanding and appreciation of the roles, opportunities, and careers in the arts and related areas.
- Develop an awareness of royalty and copyright requirements and apply them.
- Be able to articulate, show, and/or demonstrate the use of artistic design aesthetics and how it affected the end product.

Whether STEAM projects, challenges, or units are written for single students or collaborative groups, the follow through and fid lity of using authentic approaches must be used. STEAM is not STEM. STEAM uses a wider variety of habits of mind and adds artistic design aesthetics. Done intentionally, STEAM can be a game changer for our students. ■

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STEAM-ing Up *the Science Fair*

David Rufo

A student gathers data to ascertain the effects of rock climbing on the automaticity of basic math facts (2012).

My teaching partner Greg and I sat at a long mahogany table in the center of a paneled conference room adjacent to the office of the headmaster. The room was once the grand dining room of a home built in the early part of the 19th century. What began as a farm eventually became the campus of our private day school in upstate New York. It was late August and an imprint of moisture collected on the high gloss surface whenever I placed my folded hands on the table. A few days before, the recently hired head of lower school informed us that the newly appointed headmaster had requested a meeting to discuss the upcoming school year. The heavy Italianate doors that separated the conference room from the headmaster's office opened and the headmaster arrived followed by the head of lower school.

Backstory

During the previous school year Greg and I were invited by the school's two 5th-grade teachers to join them in developing a combined 4th- and 5th-grade program. It was decided that they would teach language arts and social studies while we taught an integrated (science, math, technology, engineering, the arts, and math [STEAM]) curriculum. In past years, Greg and I noticed that our students thrived when allowed to engage in creative modes of learning. They loved painting, sculpting, building, designing, dancing, performing, and making movies. We hoped to further enhance our arts-based, child-centered, democratic classroom practices by incorporating a STEAM approach with a focus on the arts. In a democratic classroom, the curriculum is based on student interest where children have a voice in what they learn and how they go about their learning (Hmelo-Silver, Chinn, O'Donnell, & Chan, 2013; Shor, 1992).

Our school had a reputation as a progressively minded institution. The school's website proudly proclaimed that the students became passionate learners who thought critically, took risks, and accepted challenges. Yet, as do many private institutions, our school also took pride in decades-old traditions. One such tradition was the annual science fair. Each year students from 5th to 8th grade were required to take part in this event, and from January until March science classes were dedicated to science fair preparations. Students were given lengthy handbooks that contained procedures, guidelines, rules, regulations, assignments, and due dates. Some students seemed to enjoy the science fair and each year a few won local, regional, statewide, and national competitions. However, the majority of the students dreaded taking part in the science fair. For these children, and their families, it meant 3 months of added stress to already rigorous academic demands.

As part of our arts-based STEAM initiative, we wanted to make participation in the science fair optional for our 5th-grade students. During the previous school year and over the summer break I lobbied heavily to have science fair become a choice rather than a requirement. However, it was becoming increasingly evident that our school was gradually adopting a more conservative orientation and we worried that the new administrative team was looking to establish less progressive and more traditional teaching practices among its faculty.

The Directive

As he entered, the headmaster extended his hand in warm welcome and the head of lower school bid us good morning. The headmaster took his seat at the head of the table, and the head of lower school sat opposite the headmaster. After exchanging a few pleasantries, the conversation turned to the topic of the science fair. When asked for my input I shared my critiques of the highly ritualistic science fair process. I believed many of the current practices such as drafting lengthy detailed reports containing abstracts, citations, and bibliographies were developmentally inappropriate for 10- and 11-year-old children. I felt the traditional science fair presentation model requiring students to read notes from a stack of index cards while standing alongside the ubiquitous trifold board was antiquated and tedious. They both listened for a few minutes and then countered my arguments saying that parents might interpret my idea as abandoning one of the school's venerated traditions. What began as an invitation for a discussion soon became a directive. The headmaster abruptly stopped the conversation and simply said that we had to take part in the science fair, adding, "I need to know now if you're not going to be able to do this." Left with no other options, we acquiesced to his demand. As if sensing our disappointment, they added that as long as we brought our students through the science fair experience, we could do it our own way.

Picking Up STEAM: Our Own Way

After the meeting, Greg and I walked across the campus to reflect on methods in which our students could take part in the science fair without having to sacrifice their creative agency. We decided that, although we would guide the students through the scientific process, we would also allow them to deviate from certain traditional science fair practices and instead, let their creativity drive the learning.

In the past, each student had to choose from a teacher-generated list of topics and conduct their own science fair experiment. This made the teacher's job easier and guaranteed a quantifiable outcome within a predetermined time frame. Alternatively, we helped our students design experiments around whatever topic they chose and also allowed them to work in groups. There were even instances of fluid groupings where some children moved from group to group, acting as consultants as their peers conducted experiments and designed presentations. We also scaled back the report requirements and provided templates for those students who found orthodox scientific writing to be an arduous task.

We did our best to rid the experience of any vestige of competition, choosing instead to create a mood of celebration. First, all the work was done in the classroom instead of partitioned out as homework assignments. This minimized parental influence and ensured that parents did not do any of the work for the children. Second, we did away with clipboard toting judges who evaluated the students' work using metrics ranging from Excellent to Needs Improvement. Third, we did not award the students with any type of special recognition such as trophies or certificates of completion.

The most conspicuous deviation from our school's traditional science fair practice was that we did not require our students to make a standardized trifold board display. Instead, we supported whatever creative vision they felt suited their needs and interests. The students who did choose to incorporate a display board as part of their presentation could design, mark, and manipulate it in any way they deemed best.

The research literature shows that children are drawn to creative modes of learning (Anning, 2002; Dissanayake, 2002; Kim, 2008; Rufo, 2012; Wilson, 1974). Creativity is integral to the learning process and fundamental to the way children make sense of the world around them (Haanstra, 2010; Marshall, 2006; Matthews, 2003). In our classroom, STEAM provided a convenient vehicle for creative learning investigations to thrive. However, when given agency and self-governance in their learning, children often transgress the visual codes and conventions found in schools (Bresler, 1999; LaJevic, 2013; Thompson, 1999). We knew from our past experiences that offering our students creative agency would lead to unexpected results that might disrupt and subvert our school's traditions and conventions (Rufo, 2014).

Full STEAM Ahead

From September to December, our classroom was a flurry of activity. We held weekly STEAM celebrations to help the students become familiar with the scientific process and build confidence as presenters. On Mondays we introduced and guided the children through a science experiment. On Tuesdays and Wednesdays, the children developed their own science experiment that evolved

A student works on his report while others practice their presentation on our classroom stage and Greg confers with a group about their experiment (2012).

Electrical conductors experiment poster with stick puppet characters (2012).

from the Monday experiment, which they could do alone or in a group. Students who felt they needed additional help with science concepts had the opportunity to meet with a teacher or receive support via peer tutoring. On Thursdays, the students developed presentations that celebrated their learning during the fi st part of the week. Fridays were dedicated to tying up any loose ends, and in the fi al hour we watched student presentations on our classroom stage. The children produced a broad spectrum of presentations that included skits, PowerPoint presentations, student-directed movies, musical productions, vocal and dance performances, comedy routines, scientific r mathematical demonstrations, and brief orations.

In January, our time was dedicated to preparing for the STEAM Fair. We originally wanted to call it a STEAM Celebration, but the chair of the science department was becoming increasingly distressed over our changes and modifi ations so we decided to keep the word Fair in the title so as not to digress too far.

We started the process in January to give our students ample time in case halfway through they decided to abandon an experiment and explore a different topic, or if they wanted to develop an elaborate presentation. Over the following weeks and months our classroom became a bricolage of sights and sounds. Students swarmed about the space, weaving in and out of tables, projects, experiments, and presentation materials. The children worked on every available surface and their materials covered the tables, fl ors, counters, and shelves.

By mid-March the classroom bore similarities to a cohort of National Aeronautics and Space Administration (NASA) researchers preparing for the launch of a new space shuttle. Most students had already conducted their experiments, analyzed their data, written up their reports, and were gleefully putting together their presentations. However, when our students were allowed agency in their creative learning, they generated ideas and produced artifacts that did not conform to adult expectations or resemble the orderly visual aesthetic of school functions. It was difficult for the administration to accept anything that diverged from familiar conventions and practices. The head of lower school shared her trepidation, "I am concerned… and I don't feel like I understand how the event is going to work" (personal communication, March 6, 2013).

Part of the dilemma was that neither Greg nor I knew how it would work. Since we allowed our students to have ownership of the process, we could not predict what would transpire or what it would look like. We only could speculate and offer support as the children continued to form and mold their ideas. The full vision of the STEAM Fair would be made manifest only after it happened. One thing was clear, the STEAM Fair would not resemble a traditional science fair with "rows upon rows of students stand[ing] before tri fold boards reciting their purpose, hypothesis, results, and conclusion repeatedly as visitors pass by" (Rufo, 2013, p. 4).

STEAM ~~Fair~~ Celebration

Tensions grew as Greg and I continued to defend our practices and vocalize our critiques of the traditional science fair process. It became evident that the administration would not allow us to do another STEAM Fair, and it was rumored that we were going to be put in separate classrooms and no longer allowed to team teach the following year. Realizing that this might be our last opportunity, Greg and I decided it would be best to follow our original vision and once again call it a STEAM Celebration.

In late March, a group of students approached Greg and me asking if our STEAM Celebration could be held in our classroom rather than the dining hall or gym. As was our practice, we convened a class meeting to discuss the issue, which was then decided by a vote. The majority of the children argued for having their presentations in our classroom. Their comments reveal they felt secure within our child-centered space where they were empowered to make decisions and take ownership of their learning:

- "I like this room. It feels more comfortable. It's a place you know better and that you spend more time in."
- "[Th s room] is where everything happened. It would be fun and because we were so creative in here it would be easier to give the presentations."
- "My experiment has to do with climbing so I think it would be better for me to present here in front of our climbing wall."
- "Th s is our only chance to do it in this room because next year we're going to have to do science fair in the gym or the dining hall."
- "Everyone is doing something super creative. So, since we are doing something creative for our project, why can't we present it in a creative space?"

I e-mailed the head of lower school the children's request to have our STEAM Celebration in the classroom. She decided on the more formal feel of the dining hall and scheduled our presentation date for April 17, nullifying the vote of our students.

Since we allowed our students to have ownership of the process, we could not predict what would transpire or what it would look like.

Allowing our students choice in their learning resulted in a variety of experiments and displays. Some experiments were relatively conventional with students measuring the acidity of water samples from local lakes or figuring out which material would hold the most static charge. Other experiments involved novel ideas and concepts. One girl wanted to find out if there was a correlation between snack foods and dreams. She provided her study participants with 2 week's worth of bedtime snacks, a journal, and a pencil. Each night the participants ate one of the snacks and then in the morning recorded their dreams (or nightmares) in the journal.

Some of the children put whimsical twists on otherwise traditional experiments. One student modified a familiar botany experiment by investigating the effects of different types of cereals on plant growth. At first glance her experiment looked like every other plant growing project, but upon closer inspection, one could detect bits of Cocoa Krispies, Life, and Bite-Size Shredded Wheat mixed into the potting soil.

As the presentation date approached our classroom became a staging area for further artistic innovation. Making interactive displays suddenly became a popular trend. Students who started with a plain trifold board display became inspired by the creative production of their peers and began enhancing and expanding their designs. One boy built a large cardboard enclosure with a doggy door–type entrance. He took apart his report and glued the pages to the inside walls. Holes were cut into the top to let in light so that visitors who were willing to crawl inside his cardboard tower could read his report and view the charts. The outside was decorated with clay figures and the words, "Warning Awesome Experiment" to attract potential visitors. Not wanting to be outdone, a girl whose experiment examined tongue sensitivity to sweet and sour tastes turned her simple trifold board display into a full-blown juice bar. Another girl who studied the relationship between rock climbing and mathematics constructed an information booth. On a pair of small cardboard doors she painted a sign that read: "Knock to Hear Presentation." She planned to sit on a stool inside the booth so that visitors had to first knock before she revealed her analysis and findings.

Juice bar (2013).

Presentation booth with sign (2013).

Cardboard tower (2013).

Rocket launch sequence (2013).

Children cannot grow if their learning is constrained by old habits. Innovation cannot come about if it is hampered by tradition.

On the evening of the STEAM Celebration, our students excitedly gathered in the dining hall to organize their presentations. The children set up their displays and cardboard constructions, which resembled kiosks, tunnels, and abstract sculptures. Many children had multimedia displays that incorporated iPads, graphic novels, sculptures, posters, and even dance routines to present their fi dings.

STEAM On

Change in education is difficult. For administrators, it involves having to explain to concerned parents why the change was made. For teachers, it means having to move out of their comfort zone and beyond customary practices and procedures to which they have become acclimated. But for students, it is a necessity. Children cannot grow if their learning is constrained by old habits. Innovation cannot come about if it is hampered by tradition. I understood why Greg and I encountered so much resistance and opposition from the administration and some of the faculty. But more importantly, I knew why the children and parents were enthralled by our STEAM Celebration. For the parents, the reason was clear; they saw their children as happy, confide t, learners. For the children, they had agency in their learning. The children were allowed to make personal choices, vote on group decisions, and perhaps most importantly, to put creativity at the center of their learning.

Th s was made evident by the fact that our students continued their STEAM investigations long after the celebration ended. In June, during the fi al days of school when most classrooms were cleaning up and putting things away, a group of boys decided to do an experiment using rockets. As the class watched, they counted down from 10 and when they reached the number one, pushed a bright red button on the launch controller. For a split second the rocket stood motionless. Then suddenly, a plume of smoke appeared surrounding the rocket briefly, before it shot up into the sky. The children hooted with delight. ■

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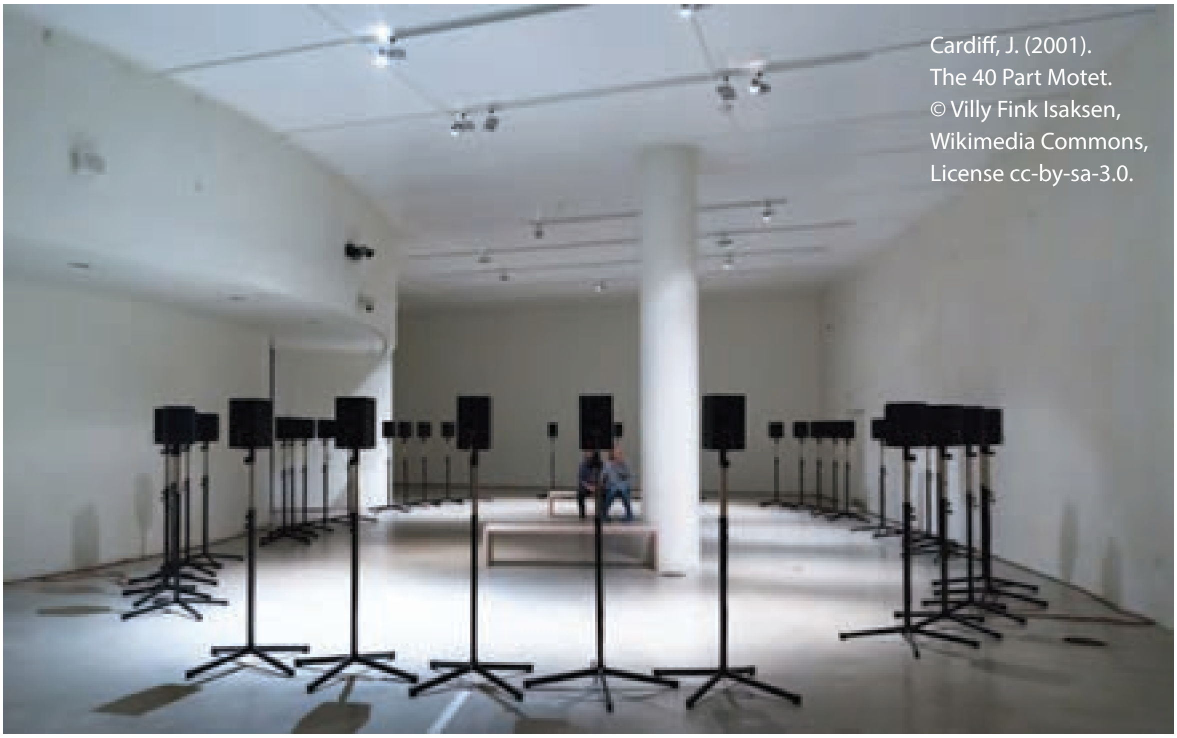
Soundscape Compositions



Cardiff, J. (2001).
The 40 Part Motet.
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for Art Classrooms

Ehsan Akbari

In recent years, the inclusion of popular visual culture in art curricula has emerged as a focal point of investigation and discussion in art education. Its proponents sought to expand the content of study to include contemporary cultural forms such as television, magazines, and the Internet (Chalmers, 2005; Eflan , 2004; Tavin & Anderson, 2003).

While the integration of popular visual culture may have led to an increased relevance of art education in today's media-saturated environment, an important aspect has often been neglected: visual culture is not exclusively visual (Duncum, 2012). Paul Duncum (2004) pointed out that these media incorporate images, texts, and sounds in order to convey messages, and advanced the term *multimodality* to study this phenomenon. However, this integration of the senses is not unique to media and visual culture; it is also a basic fact of life. All perception is anchored inside a body that is always hearing, touching, tasting, smelling, feeling, interpreting, and understanding (Bal, 2003). In this view, seeing always involves other modalities and senses. Sound is a fundamental feature of how we experience visual media and the everyday world; and as such, can be explored creatively in art education. In this article, I will provide suggestions for teaching sound in art classrooms by describing what I call the process of *soundscape composition*, which involves deep listening, going on walks to collect recordings, editing these recordings, and presenting them as audio files, videos, or installations. I will begin by surveying a number of artistic practices that incorporate sound, then draw on my artistic practice and educational research to suggest methods for incorporating soundscape compositions in art classrooms.

In both Cage's composition and Eno's borderless music, everyday sounds are the key consideration.

Sound Art

There are numerous examples of artists exploring sensory multiplicity and utilizing nonvisual sensations, including artists who incorporate sound in meaningful ways. Some early instances of sound art include Futurists Luigi Russolo's *intonarumori,* or noise machines, and Filippo Marinetti's *Zang Tumb Tumb,* which is a sound and visual poem that combines Marinetti's onomatopoetic representation of destruction with visual concrete poems that use typography to convey rhythm, cadence, tones, and textures. Numerous Dadaists, including Hugo Ball, also composed sound poems that combined phonetic fragments of speech, which removed linguistic meaning and rationality from the human voice. In the 1960s, composer and painter Dick Higgins (2001) coined the term *intermedia* to describe the work of a group of artists known as the Fluxus. The works of these artists did not conform to one medium, but existed as an *intermedium* of sound and poetry, or performance and painting, for example. These avant-garde artists were interested in an interdisciplinary art that blurred not only the boundaries of media and senses, but also art and life (Kirby, 1969). A central figu e in this movement was John Cage, whose radical ideas about music, philosophy, and art continues to inspire artists today. One of Cage's most influential works is his infamous composition *4′33″*:

> At its first pe formance, virtuoso pianist David Tudor sat at the piano, opened the keyboard lid, and sat silently for thirty seconds. He then closed the lid. He reopened it, and then sat silently again for a full two minutes and twenty-three seconds. He then closed and reopened the lid one more time, sitting silently this time for one minute and forty seconds. He then closed the lid and walked off stag . That was all. (Pritchett, 2009, p. 167)

With this act, the ambience of the concert hall became the musical composition, and the boundaries of music had opened up to include the sounds of people's feet shuffl g on the fl or, coughing, sneezing, whispering, the buzz of traffic utside, and the hum of fans and radiators inside. Th s act had far reaching implications not only for contemporary musicians but also visual artists.

Another notable example of a pioneering musician is music producer and visual artist Brain Eno. One of Eno's greatest contributions is *ambient music*, which he has said to have conceived while traveling through the Cologne Bonn Airport in Germany looking around and listening to the space. Eno imagined a kind of borderless music that would blend into the atmosphere of an airport, filling the space. His approach to ambient music used sounds in such a way that "everything you could hear could be music, even things that weren't on the record" (Thie en, 2011). In both Cage's composition and Eno's borderless music, everyday sounds are the key consideration.

For many contemporary sound artists, the sculptural and spatial qualities of sound are salient conceptual concerns (Licht, 2007; Ullrich, 2011). Janet Cardiff (ardiff & ures Miller, 2015), whose installations use sound in conjunction with light, images, and kinetic sculptures to create immersive environments, is one notable example. One of Cardiff's better-known works is *The Forty Part Motet*, which has been installed at the Metropolitan Museum of Art, The Museum of Modern Art (MoMA), The National Museum of Canada, and Art Gallery of Ontario. In this work, the voices of individual members of a choir are recorded separately and played back through a series of speakers arranged in a circle so that the spectator can walk around and experience the voices of individual choir singers. *The Forty Part Motet* emphasizes the interconnection between sound and space, as well as our embodied and subjective relationship to sound.

Susan Philipsz—the fi st sound artist to win the prestigious Turner Prize—also understands the centrality of space in sculpting a sonic experience. In *Lowlands*, Philipsz recorded her voice singing a 16th-century Scottish ballad, and played it back under three different bridges in Glasgow (Cameron, 2010). In this piece, Philipsz' untrained singing voice travels from the speaker and bounces off w ter, metal, and stone, which shape how listeners experience the song. In Bill Fontana's (2014) sound sculptures, attention is given to the musicality of architectural structures such as London Millennium Bridge and MAXXI (Italian: Museo nazionale delle arti) in Rome. In John Wynne's work there are similar concerns for how a specific l cation shapes sound. For *Installation for 300 speakers, Pianola and vacuum cleaner*, Wynne (2009) played sound from 300 speakers that were mostly rescued from a recycling-plant, stressing the materiality of the sound-making devices we depend on for listening.

These divergent examples from contemporary art, experimental music, and avant-garde poetry encompass a range of interdisciplinary and multisensory practices that fall under the umbrella term of sound art. The interdisciplinary nature of these practices suggests that sound art exists in a stimulating liminal space between the various disciplines of music, visual arts, literature, and performance.

Soundscape Studies

Salient examples of sound art can contextualize sound within art classrooms. However, for developing specific ducational interventions, the fi ld of Soundscape Studies provides pertinent strategies. Founded by Murray Schafer, Soundscape Studies explores sonic environments and the omnipresent array of sounds that defi e daily life. In the 1970s, Schafer established a research group called the World Soundscape Project, which documented and analyzed the sonic environments of various locations, such as five small villages in Europe (Davis, Truax, Schafer, Aesthetic Research Centre of Canada, & World Soundscape Project, 1977). By listening, recording, and notating the ambient sounds of these communities and comparing this data to historical records, they were able create a portrait of the rhythm of life, and demonstrate changes in the living patterns of the inhabitants due to modernization. One of the key methods used by these researchers was the *soundwalk*. Soundwalks are excursions "whose main purpose is listening to the environment" (Westerkamp, 2007, p. 1). McCartney (2010) traces this practice of listening while walking to diverse practices such as Henry David Thoreau's philosophy of walking, haiku poet Matsuo Basho's excursions that inspired his poetry, the Situationist concept of the dérive or drifter, and the literary figu e of the flâneur as a detached observer. These various approaches to walking have in common an awareness of how spaces influence the attentive walker. Soundwalking has been extensively used by McCartney (2015) to record the sonic environments of urban centers, city parks, riverbanks, and railway tracks. Sometimes, these soundwalks begin with careful listening to the body, the breath, the clothing, and footsteps of the walker before expanding outward to the surrounding world. At other times, the walkers move through space and allow their ear to pull them toward sound objects. Th s act of mindful walking and listening has inspired and informed both my artistic and educational practices.

Recording devices in use in author's artistic practice. The ears and the microphone are two distinct instruments for listening. Photo by author.

Artistic Practice

While sound art and soundscapes have become the focus of my practice in recent years, my artistic background and training is in visual media. One thing I have learned in particular from making videos is the importance of sound in setting mood and conveying meaning. To further expand on this, I began creating images and recording sounds separately, using a range of digital audio equipment. I distinctly remember the fi st time I listened to the familiar environment of my backyard with an audio digital recorder. The familiar environment of my backyard had been transformed into an aural ocean imbued with sonic energy when listened to digitally. Th s experience brought to my attention a world full of sound, and helped me realize the potential for technology to amplify my awareness of my surroundings. I had a similar experience years ago, when a friend visited me in my tiny apartment in the suburbs of Tokyo. He had just returned from a retreat in a Zen monastery and was eager to share his experiences with me. He sat me down and told me to breathe slowly and deeply and count my breaths. I obliged, and after sitting quietly in that position for five minutes, I began to hear children laughing and screaming, birds chirping, and locomotives moving outside my room. At that moment, my conscious awareness was enlarged to encompass my surroundings.

These two experiences underscore the importance of deep listening for our awareness and engagement with our environment. They also demonstrate that both technological devices and the ear are instruments that can be implemented to facilitate deep listening. Westerkamp (2002) proposed the tactic of imagining the ear as a microphone and the microphone as the ear, which causes a shift in he perception and reception of a given environment. Th s strategy has been fruitful for the soundscape compositions that I have been creating, which combine recordings of everyday sounds and mix the monotonous and repetitive with the poetic and beautiful.[1] In the process of creating these works, I have identifi d four distinct steps that are integral and interrelated parts of the process: listening, recording, editing, and presenting. I developed educational interventions for each of these stages, and used design-based research methodology to test them in various educational contexts.

Educational Research

Design-based research is "a systematic but flex ble methodology aimed to improve educational practices through iterative analysis, design, development, and implementation… in real-world settings" (Wang & Hannafin, 2005, . 6). Currently, this methodology is being implemented by researchers in a variety of educational fi lds, including Art Education. For instance, Mary Erickson (2005) has conducted a study on integration of a Web-based learning environment for secondary art teachers, and Juan Carlos Castro (2012) investigated the impact of social media on learning, and student–teacher relationships. These studies indicate that design-based research can be implemented to develop effective and practical teaching strategies, and to gain theoretical insights on teaching and learning in general.

One thing I have learned in particular from making videos is the importance of sound in setting mood and conveying meaning.

Going for a walk to listen to environmental sounds. This image was taken during an educational workshop on listening. Photo by author.

For my research (Akbari, 2014), I developed and conducted educational workshops for secondary students in two main contexts, a high school and a teacher's association. The fi st phase of the research took place at a high school in Montreal, during which after-school workshops were held with up to eight students and their teacher. Interviews were conducted at the beginning and end of this process to evaluate what students learned from the workshops. For the second phase of the research, I worked with a group of art, drama, and music teachers working in private elementary and secondary schools. During this phase, I conducted an in-depth focus group discussion about the pedagogical potential of soundscape composition. The data generated from this research has enabled me to develop, test, and refi e strategies for teaching soundscape compositions in the classroom. In the subsequent sections, I outline my fi dings for each step of soundscape composition.

▸ *Listening*

Listening begins with silence. An exercise I have tried with different groups is to ask them to identify sounds in the room. At fi st, they were able to identify all predominant sounds. I then asked them to listen carefully for a minute, after which more detailed and subtle qualities of sound were identifi d. For example, in one workshop the general description of "ventilation system" turned into "a high hissing sound and low thump" after a few seconds of active listening. As such, sitting silently and actively listening to the room you are in is a good starting point. Th s activity can then be taken outside to bring attention to surrounding sounds. I have personally found that after spending time creating soundscape compositions, deep listening has become a part of my daily life.

▸ *Recording*

One effective way to approach the recording phase is to go on a soundwalk with the aim of capturing the sounds of an environment, either with the ears and memory, or with an audio recording device such as an iPad. I have been advised to always start exploring a space with the ears before relying on technological mediation (A. McCartney, personal communication, November 19, 2014). In my experience, listening attentively to a space without technological mediation is a powerful means of bringing attention to that environment, which enables the recordist to make more thoughtful and meaningful choices.

Furthermore, Murray Schafer (1977) provides applicable vocabulary for guiding the recording process with the terms *signal*, *keynotes*, and *soundmarks*. Just as an image has a background, against which figu es in the foreground are discernable, keynotes are "the anchor or fundamental tone" of a place (p. 9), while signals are "foreground sounds that are heard consciously" (p. 10). Keynotes can include the sound of a nearby sea, or traffic i cities, while bells, horns, sirens, and people's voices are common signals. Soundmark "refers to a community sound which is unique and important to the community" (p. 10), such as the church bells in Montreal or the calls to pray in Istanbul. During the teachers' workshop, these terms were introduced, and the term soundmark in particular was met with great enthusiasm. When asked about the soundmarks of their schools, one teacher pointed out that the loud noises of students filling up the hallway between periods function as a clock that establishes everyone's life. Th s teacher also suggested the idea of a *sonic portrait* of their school, for which they will go on soundwalks with iPads to record soundmarks in their school. In this kind of project, searching for soundmarks can give students a clear directive, and also allows them to notice and interpret the space of the schools in which they spend most of their days.

▸ *Editing*

Once sounds are collected, they can be mixed, edited, and transformed. There are a number of pertinent creative and aesthetic considerations in editing a soundscape composition. In order to elucidate this for students in visual arts classrooms, I fi d it useful to look at examples of M.C. Escher's images and relate them to sound. For instance, in *Night and Day,* Escher transforms an ordinary scene of geese flying over a village into a visual illusion. Th s image uses contrast, symmetry, and repetition to bring the viewers' attention to the act of seeing. I presented this image at the high school, and asked students to think about how Escher composes his images, and how these elements could be used when composing a soundscape. Students pointed out that symmetry and repetition in the image is analogous to tempo and beat in music.

Another important element for editing requires a basic understanding of how the human ear experiences different frequencies of sound. Human ears are mostly tuned to notice the voices of other humans, which are in the mid to high frequency range. Low-pitched sounds, on the other hand, tend to sit in the background and go largely unnoticed, while high-pitched sounds are

Students creating soundscape compositions with iPads. This image was taken during an educational workshop on soundscapes in the Montreal art classroom. Photo by author.

directional and jump to the foreground. For this reason, most keynote sounds that constitute the background of a soundscape tend to be low-pitched, while signals, or sounds that aim to grab the listeners' attention, tend to be high-pitched. We can make an analogy to how the eyes see the colors in a painting. In Vincent Van Gogh's *The Harvest*, for instance, we can see how cool colors appear to recede into the background, while warm colors appear to move toward the viewer. For Van Gogh, the relationship of warm and cool colors was key to painting his landscapes. In composing soundscapes, thinking about the arrangement of high, mid, and low frequency sound is crucial for conveying a sense of depth and richness.

► ***Presenting***

The presentation of a soundscape provides endless creative possibilities for the art classroom, as sound can be presented on its own on social media sites such as *Soundcloud*, or integrated with various visual media. Video is a particularly suitable medium for combining sound, images, and text to invoke artistic expression. In my artistic practice, video art has given me the platform to amalgamate the distinct acts of writing poems, taking pictures, and making soundscapes. Creating videos that separate and combine different elements can be an effective means of raising students' awareness of the multimodal nature of digital media, as it provides an opportunity to refl ct on how meaning is conveyed and altered with the combination of sound, text, and image. A classroom project can begin with a soundscape to which images are added, or a video clip for which a soundscape is composed. In one workshop, a music teacher discussed a project he does with students where he gives them all the same video clip and asks them to compose music for it. Artific ally recreating sound in this manner can also be an effective strategy for teaching multimodal literacy, by drawing

Van Gogh, V. (1888). *The Harvest* [Oil painting]. This image illustrates how a landscape painting is composed by combining warm and cool colors, which is analogous to high and low sounds in a soundscape composition.

attention to the little-known practice of sound design, which is essential to film and television production.

Another approach to presenting soundscape compositions is installation. The artistic practices discussed above highlight the profound relationship that exists between sound and space. In Cardiff's *Th Forty Party Motet*, for example, the sculptural arrangement of the speakers defi es the space, and the movement of the spectator through space is the key compositional element. Th s approach to presenting the soundscape was favored by one of the visual arts teachers, who suggested asking students to gather in the classroom after fin shing their soundwalks to play their soundscapes simultaneously. Thi king about sonic composition as the layering of sounds in space creates a bridge between soundscapes and other art forms that are experienced by moving through space, such as sculpture and installation. In the art classroom, this relationship between sound and space could be explored in installations that start as soundscape compositions and cumulate into projects that incorporate paintings, photographs, dance, movement, and performance.

Conclusion

Conducting workshops with high school students and teachers has allowed me to draw some conclusions about the salience of teaching the process of soundscape compositions in classrooms. One consistent fi ding is that when we listen deeply to our surroundings, we notice sounds more discerningly. Th s practice can be applied in educational contexts to raise awareness of the sounds of the school by identifying *soundmarks* that defi e students' and teachers' relationships to their environment. Furthermore, the act of using technology to bring awareness to everyday sounds has important implications for youth in a world that is saturated with digital and mobile technologies. During the workshop with the high school art teachers, one teacher pointed out, "we are often so caught up with the world in our handheld devices" that we forget to interact with the person who is in front of us, and "using the technology that is within our grasp is a wonderful" way of exploring "what it means to be at our school" (Akbari, 2014, p. 82). As such, listening, recording, editing, and presenting soundscape compositions can also bring awareness to our habitual, technologically mediated interactions with our surroundings. Moreover, focusing on sound shifts ur understanding of these technologies as purely visual. As visual people, art educators can sometimes forget the crucial role that other senses, including sound, can play in visual arts. Exploring these other senses can lead to an enriching educational experience, and provide fertile ground for creative exploration. ■

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1 https://soundcloud.com/ehsan-akbari-1-1

2 Van Gogh, V. (1888). *Th harvest* [oil painting]. Retrieved from http://commons.wikimedia.org/wiki/File:Vincent_Van_Gogh_0019.jpg

Digitizing the easel: *Student Perspectives* on Tutorial Videos in the Art Classroom

Jescia J. H. Hopper

In my classroom, a typical live demonstration often resulted in a crowd of fidge y, wiggling, middle school students standing on tiptoes and squeezing between others to see the easel. I struggled with finding ways to keep students engaged and focused when presenting new material. There were always a number of students who could not see the demonstration. The pacing never seemed quite right: too slow for the fast workers, too quick for the detail-oriented. Those who missed class on the day of the demonstration had difficu y catching up. My presentations would vary from class to class, elaborating here, forgetting there. Some students would get lost toward the back of the group, where they would covertly play on their phones or hold whispered conversations. Students would forget the information, and I would end up explaining the same thing multiple times during the course of each unit, losing valuable class time. These problems opened up a unique opportunity for exploring a different avenue of presentation. My solution to the crowded easel was to digitize the demonstration, creating tutorial videos covering skills such as portraiture, perspective drawing, ceramic processes, and papier-mâché and posting them to YouTube.

When my school issued laptops to each of its students, I pondered ways in which I could create a hybrid classroom, combining aspects of blended and fl pped classroom models. In a blended classroom, students interact with tutorial videos independently during class under the guidance of their teacher (Rosen & Beck-Hill, 2012). Conversely, fl pped classrooms involve inverting the traditional instructional model by watching online lectures or demonstrations at home and then practicing and discussing the information at school (Tucker, 2012). Rosen and Beck-Hill (2012) found that a "technology-rich learning environment can more effectively promote social-constructivist educational goals, such as higher-order thinking skills, learning motivation, and teamwork, in comparison to traditional settings" and "can play a social role in bridging the achievement gap between students" (p. 227). A potential benefit of fl pped classrooms is that teaching students skills outside of class can free up class time for experimentation, collaboration, and exploring big ideas and concept development, in turn promoting the possibility of increased student engagement (Enfi ld, 2013; Roehl, Reddy, & Shannon, 2013; Tucker, 2012). Combining these two classroom models into a hybridized learning environment, I conducted a qualitative research study that examined the ways in which students interacted with and learned from instructional tutorial videos. Th s article focuses on the perspectives of six students from my 8th-grade art class, examining their interactions with and reactions to tutorial use both in and out of the classroom.

The Digital Native

Today's adolescents are enamored with technology. They have grown up with screens in their hands, immersed in visual culture, with easy access to the Internet wherever they go. As Prensky (2010) asserted, "It would be foolish to ignore the medium of video as a powerful learning tool for today's youth. It is, in fact, mostly how they learn on their own..." (p. 129). The near constant use of technology by young people has caused a fundamental shift in he ways they process new information (Fitton, Ahmedani, Harold, & Shifflet, 2013;   rensky, 2010; Sefton-Green, 2011; Taylor & Carpenter, 2007). Contemporary learners, sometimes referred to as "digital natives," exhibit preferences for collaborative learning experiences, personally relevant learner-centered instruction, and video rather than written texts (Prensky, 2010). These students analyze information differently than previous generations, shifting their primary literacies from those of letters and numbers to multimodal and visual literacies (Roehl, Reddy, & Shannon, 2013; Taylor & Carpenter, 2007; Unrath & Mudd, 2011). Educators can create curricula that best meet the learning preferences of today's digital natives by effectively incorporating technology into the classroom. The use of multimodal tutorial videos within a blended or fl pped classroom is a means of meeting most learners where they are, incorporating the digital culture that permeates their daily lives through text, imagery, sound, and interactive elements created by the teacher (Freedman & Stuhr, 2004; Roehl et al., 2013; Taylor & Carpenter, 2007; Unrath & Mudd, 2011).

Screen shot of *How to Draw Facial Proportions,* which was created for the self-portrait unit.

Introducing Tutorials in the Classroom

To investigate the effectiveness of tutorial use within a hybridized classroom, I observed students interacting with tutorial videos during a portraiture unit and conducted a series of recorded interviews about their experiences in the new classroom environment before, during, and after the unit. Students fi st drew a self-portrait from observation to assess their current ability level prior to explicit instruction in portraiture. Following that exercise, the students learned how to draw individual facial features and facial proportions by viewing five 8- to 12-minute tutorial videos that I created and posted on our classroom YouTube channel (Hopper, 2014). The videos consisted of the same information that would be presented in a live demonstration. Students took notes and practiced along with the videos during class and were assigned two tutorials to watch as homework. I encouraged them to seek additional online sources if they felt they needed to expand on the information in the assigned tutorials. After the students completed their work with the videos, they created a second self-portrait from observation, using the information on facial features and proportions to guide them. The students were allowed to reference the videos throughout the remainder of the unit.

Putting Students in Control

Th ough the analysis of my fi ld notes and transcribed student interviews, I found that the ability to *play, pause,* and *rewind and rewatch* videos during practice provided the students with control over their learning process. The students' feedback gave insight into their experiences interacting with the online tutorial videos in class and at home.

▸ *Play*

Watching tutorials independently allowed the students to see, hear, and focus better on the information being presented. Putting on headphones and independently pressing *play* created a one-on-one environment for the students to learn new content. Frank,[1] 13, explained that watching the tutorials on his own "helped because you can't see the sketchbook as well when the teacher's doing it in person. When they draw lightly, you're not going to see it that well when you're in the back." Nikki, 13, described the difference between live demonstrations and tutorial videos. "For the whole class it's different because not all the people are focused, so there could be distractions. When it's yourself, it's just you and the video, and there's no distractions, except for the ones you make yourself." Michael, 14, remarked,

> For me it's easier to watch a video on my own. That way I'm more focused and I'm just paying more attention to that, rather than having the whole class watch. It's harder to pay

Michael sketches and takes notes while watching the *How to Draw an Eye* tutorial.[2]

> attention as a group because someone will do something, and I'll turn to look… and then... I'm not paying attention to the demonstration.

When students fi st began watching the tutorials in class, their engagement was clearly visible—the room was silent except for the scratching of pencils on sketchbooks, the clicking of trackpads, and an occasional whisper to a classmate as they compared drawings or asked questions.

▸ *Pause*

According to a study on learning styles and interactive tutorials by Bollinger and Supanakorn (2011), individually controlling the pace of instruction can be benefic al for student learning. Learning at one's own pace through independently controlled videos proved to be the preferred method of practicing new skills within my classroom. "I think watching the videos on your own are the best because you can watch them at your own pace. So if you don't quite understand something, you can go over it," Frank mentioned. Learning new skills was no longer a frantic race to keep up. Demonstrations in video format allowed students to work along with the teacher during class as well as at home. "I actually like tutorials because you can watch it at home… and you can take as much time as you wanted for the video instead of just the one class period," Nikki explained. Michael agreed:

> When I'm home, I'm free of all school, you know. I guess, like, the worriness [*sic*] of being in school and getting it done on time and stuff.… I just felt chillaxed and not worried about having the bell ring and having to go and do something else. It felt nice to have some time to do it.

Sarah, 14, explained, "I felt like I could take my time with it… I didn't have a time limit." Tutorials were also benefic al when students were absent and missed demonstrations. One student was sick during much of the in-class work with the tutorial videos. Because the videos were posted online, she was able to watch them at home rather than miss important live demonstrations. She said, "I felt like I was pretty much right there [caught up with coursework]."

Demonstrations in video format allowed students to work along with the teacher during class as well as at home.

Frank's "Before & After" self-portraits.

▸ *Rewind and Rewatch*

The repetition of information through individually controlled tutorials benefitted student learning. Participants explained that they preferred to learn and remembered skills best through hands-on learning experiences and repetition. Freddy, 14, described his learning process as such: "I like practicing something. Just because you do it once, it doesn't mean you'll get it right away, so you'll probably have to go over and over and over. That's what I had to do sometimes." Many of the students were able to answer their own questions by rewatching confusing sections. Students who were not comfortable asking questions during live demonstrations could replay sections in order to independently answer questions. Samantha, 14, admitted, "If you're teaching it to the class, I probably wouldn't raise my hand and say, 'wait a second, could you rewind it?'" She continued, "If I didn't like how my drawing looked, I'd be able to watch it again instead of asking you to go over it and then feeling like I'm wasting the whole class's time. So I'd be able to work on it by myself." Frank corroborated, "It's better because you can understand it over and over again instead of asking the teacher three different times if you didn't understand something." The ability to independently answer one's questions allowed students to progress at a pace that best suited their learning needs.

Sometimes students had difficulty remembering information from the videos that they watched at home, but they were not overly concerned about this because, as Nikki related, "You might not remember the details of it, but you could watch it again in the class… you can watch it as many times as you want." The students felt that they had continual access to information, which seemingly negated their need to recall the entirety of the demonstration. Similarly, in a discussion on informal digital learning, Sefton-Green (2011) stated, "We can no longer expect to 'know' everything, even as experts; and learning by rote has become less important than knowing how to fi d things" (p. 249).

Nikki rewinds a section of the *How to Draw an Eye* tutorial.

Differentiation

The impact of tutorial videos on student learning was seen most directly in the increase of differentiated instruction that took place during the unit. One of the benefits of a blended model in which tutorials are watched during class is increased one-on-one time with students, where struggling students can receive individualized attention while others work independently (Enfield, 2013; Roehl et al., 2013; Rosen & Beck-Hill, 2012). Typically, differentiation is seen as an action that takes place between teacher and student. Although I worked with many students individually to enrich or remediate their instruction, I noticed that many were able to independently adapt the tutorials to meet their own learning needs.

Students differentiated their own instruction naturally while they interacted with the tutorials. They changed the speed of the instruction to meet their needs, pausing and rewinding, rewatching, and selecting specific information on which to focus. Once the students had watched the assigned tutorials, they appeared comfortable searching out additional sources on their own to elaborate on concepts in the videos, demonstrating a level of independence that is a main goal in many flipped classrooms (Enfield, 2013; Roehl et al., 2013; Tucker, 2012).

In an age when information is at our fingertips, teaching students to find credible sources on their own is an important factor for developing autonomy. Morain and Swarts (2012) stated that students frequently use YouTube as a means of filling gaps in their learning. Giving students the task of finding quality online videos, separating the useful from "what is merely 'there'" can be a part of the learning process (Prensky, 2010, p. 129). Throughout the unit, many of my students watched additional online tutorials by other artists, seeking multiple solutions to a problem in order to combine or create strategies that worked best for their personal learning needs. Freddy said that when he watched multiple tutorials on the same subject, he would ask himself, "What do they do different or what do they do the same?" Nikki reflected, "They showed me how someone sees it in their own way and how they can be different, and how you could combine the two so that it's right for you," while Samantha "watched a couple of other videos to see how differently they did it compared to how you did it [in the assigned tutorials]." Many of my students would watch additional tutorial videos to expand on their knowledge or fact check information.

Students found that rewatching the videos while working on their second self-portrait was helpful; however, some had difficulty applying the techniques from the videos to their portraits, which occasionally resulted in a formulaic portrait with little likeness to the artist. Although skillful at rendering features, Nikki had some difficulty adapting the instruction from the videos to create a likeness of herself the second time around. She reflected that the video was "not the personal way everyone's face is, so then you kind of have to change it. But sometimes it's kind of hard to change it because you don't really know how things are supposed to differ, or change to make it look like your own face."

In instances such as Nikki's, differentiation was key. Closing the computer was often the first step. I worked with her individually to help her apply the drawing techniques to her own features, using the mirror as a reference. We would point out angles, curves, and relationships between facial landmarks. While others worked independently with videos, I was able to work one-on-one with struggling students to break their reliance on mimicry and focus on application. Much like students copying from a teacher example during class, adolescents may be inclined to mimic exemplars from tutorial videos if explicit guidance is not provided.

Nikki's "Before & After" self-portraits.

A Tool, Not a Solution

Technology is not the end-all solution to our educational dilemmas, despite the positive effects tutorials had on student learning in my classroom. Technology in the classroom is best seen as a tool: one small piece of a larger learner-centered pedagogical practice. It is evident that tutorials cannot replace quality teaching. My students needed explicit instruction on how to watch and interact with tutorials, as well as high expectations for their notes and sketches they created while watching. The necessity for modeling and providing high expectations demonstrates that students still need the guidance of a teacher in the classroom. For example, Frank and Freddy both initially exhibited concerns about fl pped lessons because they wanted to be sure that I would still be available to help them and answer questions during class. Technology, such as tutorial videos, acts as a tool that can extend the reach of the teacher and help students take control of their learning by serving as a resource for fi ding and sharing useful information.

Art educators are in an ideal position to embrace the technology-laden, visual culture of digital natives.

Table 1. Tips for creating quality tutorial videos:

- Practice before filming o work out any kinks.
- Make sure the subject is always in the frame! Block your area off with tape or pencil lines o keep the action in the right place.
- Provide a sturdy base for your camera to avoid wobbles or unwanted noises.
- Light your subject evenly to reduce shadows and increase clarity.
- Avoid unnecessary background noises.
- Use an outline or script to stay focused.
- Inject confiden e and enthusiasm into your voice to engage the viewer.
- Include a variety of modalities: visuals, written annotations, and voice-overs.
- Be concise. Speed up or remove unnecessary elements during editing.

For a more extensive look at assessing online instructional videos, see Morain and Swarts (2012).

Basic studio set up for filming a d awing tutorial using a GoPro camera and studio lights clamped to a simple PVC pipe structure.

Creating Tutorials for the Classroom

Art educators can create and share a wealth of information on art techniques, processes, and concepts through the use of online tutorial videos. By posting videos online, educators have the capability to share their skills not only in the classroom, but also with a global audience. Prensky (2010) explained that YouTube was not created as a one-way communicative device; it was designed for users to post questions and ideas and receive feedback and responses from others. YouTube users of many ages and nationalities frequently send me comments and e-mails seeking constructive criticism or further advice on techniques, tools, and processes. In addition, some students may fi d their teacher's Internet presence exciting, which can lead to further engagement with demonstrations.

Conclusion

By listening to my students talk about their experiences with tutorials, I discovered that the ability to independently control the pace of instruction was benefic al for learning. Students were able to see, hear, and focus better on the demonstration when it was presented in a video format. They felt less rushed when they knew videos were accessible at school and at home. Those who missed class demonstrations could easily get back on track without having to use class time to catch up. Additionally, students who were uncomfortable asking questions in front of the class had time to talk with me individually or answer questions themselves through repetition with the videos. The tutorials provided an initial hook to engage students in learning by incorporating an online platform with which many adolescents are familiar. However, as Nikki's learning suggests, tutorials may lead students to imitation rather than application of skills. It is important for the teacher to strike a balance between generalized digital instruction and individualized attention by varying methods of presentation.

Learning styles, knowledge bases, creativity, and global economics have fundamentally changed due to advances in technology within the last decade (Sefton-Green, 2011). The fi ld of education has been slow to embrace these changes. There is a signifi ant gap between the curriculum presented to students and what they interact with independently on a daily basis (Delacruz, 2009; Fitton et al., 2013; Freedman & Stuhr, 2004; Sefton-Green, 2011; Unrath & Mudd, 2011). Art educators are in an ideal position to embrace the technology-laden, visual culture of digital natives. Incorporating digital and social media into art curricula can engage and help meet the learning styles of contemporary students. ■

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Endnotes

[1] Pseudonyms are used throughout.

[2] All images used with permission.

Tech-Savvy Girls:

Learning 21st-Century Skills Through STEAM Digital Artmaking

Christine Liao, Jennifer L. Motter, and Ryan M. Patton

Redefining the educational model of science, technology, engineering, and math curriculum (STEM) to also include art to become STEAM (Fournier, 2013; Guyotte, Sochacka, Constantino, Walther, & Kellam, 2014) is a current method to encourage students to actively participate in 21st-century learning (Saxena, 2014). The skills emphasized for 21st-century learning include critical thinking and problem solving; collaboration and communication; and creativity and innovation (Partnership for 21st Century Skills, 2007). Encouraging students to pursue a STEM career has become an important U.S. educational policy that emphasizes teaching these 21st-century skills along with STEM knowledge in the discourse of future economic growth.

Much criticism has been given to the gender and minority imbalance in STEM fi lds (President's Council of Advisors on Science and Technology, 2010; Snyder, 2014) with only 25% of the U.S. STEM workforce composed of women (Beede et al., 2011), and 10% composed of Blacks and Hispanics (National Science Board, 2010). Many attempts have been made to encourage minorities and females to participate in STEM careers (Dean, 2000; Marklein, 2012; Robehmed, 2013). These initiatives recognize that students meaningfully engage with STEM subjects when an active learning curriculum is used, directly applying student knowledge to what they are learning (Freeman et al., 2014). However, these kinds of programs are not widespread.

As an art education model, STEAM supports students to make connections between subjects, using 21st-century tools and problem-solving methods to cross disciplinary boundaries, allowing students to creatively see the world in new, open-ended, and personal ways (Bequette & Bequette, 2012; Wynn & Harris, 2012). Students who make art projects using computer code, electronics, or even the Cartesian coordinate system, inherently apply STEM knowledge and skills in their artwork. As Peppler (2010) suggests, being able to create in the digital media arts is an important 21st-century literacy. For art educators using a project-based approach to active learning through hands-on digital art projects can directly show links between STEM knowledge and art to create a STEAM curriculum, offering students a way to see how a well-rounded education builds connections across disciplines, individuals, and the world around them (Jolly, 2014).

Several art educators have written about working with female students from diverse and underserved backgrounds to create digital artworks, such as working with girls to make videos with personal narratives (Trafi- rats, 2012; Wolfgang & Ivashkevich, 2014) and develop new technical skills and knowledge, (Grauer, Castro, & Lin, 2012). Other art educators reported working with K–12 students to create digital works with social media and other forms of creative software (Castro, 2012; Fugelstad, 2014; Keifer-Boyd, 2007; Patton, 2013). Looking at these art education projects as forms of STEAM education, these efforts are understood as alternative approaches to STEM learning, outside of directly teaching STEM knowledge. To spark the interest of girls, especially minority girls, as creators of technology, Penn State's 2010–2011 Tech Savvy Girl's camp focused on digital artmaking to develop middle school girls' 21st-century skills. Girls from rural central Pennsylvania and inner-city Philadelphia participated in the camp to directly engage with the knowledge and skills necessary for STEM-related careers.

The courses we describe below, Digital Stories taught by Jennifer Motter, My Avatar Movie and My Avatar Games taught by Christine Liao, and Games 4 Girls taught by Ryan Patton, encouraged girls to create with technology and explore different forms of digital artmaking through activities tied to storytelling, personal experience, and technology literacy by making animations, machinimas, and video games. Through our examples, we propose a STEAM curriculum framework with digital artmaking at the center. Creating animations and games are two strategies in this curriculum framework. By highlighting how the course content and activities engage students in 21st-century learning and analyzing learning outcomes through our survey, our goal in this article is to show how creating digital media enables girls to learn essential skills for the 21st century and see the creative possibilities in pursuing STEM-related careers.

Creating Animated Digital Stories and Machinima Movies

Creating animations to tell stories is our first strategy for a STEAM curriculum centered in digital artmaking. Using different tools and techniques, the courses Digital Stories and My Avatar Movie are both designed to help girls convey personal experiences and ideas through animated narratives. Digital storytelling is the practice of using a computer as a medium for artistic creation and storytelling (Chung, 2007; Robin, 2008). Digital storytelling typically has a narrative structure and focus, but also consists of digital images, text, video, and audio. Topics explored via digital stories range from personal experiences, to documentaries, to contemporary issues (University of Houston, 2011). There are many tools[1] available to create digital stories. The Digital Stories course utilized Adobe Flash to create animated stories while My Avatar Movie used OpenSim[2] to create machinima animations recording real-time rendered 3-D avatars/characters, objects, and scenes in the virtual environment.

In order to show middle school girls how women can be leaders using digital technologies and creating positive changes and how to express their ideas through digital artmaking, Digital Stories presented a curriculum to collaboratively create meaningful animated digital stories about girls/women's leadership experiences in educational settings, and workplaces and the My Avatar Movie course targeted creating stories involving social justice (Figure 1).

Creating these animations requires collaboration between students. Creating digital stories required students to serve as leaders within small groups of 4–6 students while collaboratively distributing responsibilities and performing tasks as a team (Falloon, 2010). By working with technology and other girls to create collaborative new media artworks, students learned how their abilities can play influential roles in the technology-driven 21st century.

In both animation courses, we first engage students in critical thinking, provide guiding questions, and introduce artists' or other students' works that tell meaningful stories about social justice.

Figure 1. Screenshots of a student-created machinima about women having equal power to men.

Making STEM curriculum more relevant to students' lived experiences, our STEAM curriculum encouraged girls to think about how to tell stories of women's leadership. Examples of Kara Walker and Kiki Smith were introduced and discussed as contemporary artist-storytellers who deal with confli t and race in their work. For example, students were asked guiding questions such as "How are women represented in Walker's *Darkytown Rebellion*, 2001?" These art examples guided students to question and think about the role of women in stories. After discussing visual storytelling, students shifted their focus to critically think about women's leadership. The girls identifi d a positive leader as someone who represents the following descriptors: good listener, caring, humble, motivating, intelligent, creative, and many others. Similarly, in the My Avatar Movie course, the introduction to animation using machinima included examples created by machinima artists, Global Kids,[3] and other students. The Global Kids films *A Child's War* (Global Kids, 2007) and *Race to Equality* (Global Kids, 2008) were shown. In order to encourage 21st-century learning, students were asked to critically think about situations/experiences involving injustice and how they would make positive changes to develop their stories.

Learning to create animation enabled the girls to learn 21st-century skills of collaboration as well as develop critical and creative viewpoints. As students worked in teams to create their animations, they were assigned different roles. Creating an animation using OpenSim involves multiple steps similar to traditional moviemaking, therefore, acting, directing, and producing roles were divided among the students. Students in Digital Stories and My Avatar Movie engaged in discussion about content collection such as camera angles, storyboarding, and audio engineering for digital story creation. These steps are critical to ensuring students successfully develop their group projects and enhance their collaboration skills as 21st-century learners.

Digital Stories *presented a curriculum to collaboratively create meaningful animated digital stories about girls/women's leadership experiences in educational settings, and workplaces . . .*

Figure 2. Screenshot of the student-created game *Adventures of Billy Bee and Wanda the Wasp.*

Game Making

Games as a form of art production can be found in the history of art in the rules-based work of Dada, Surrealism, Fluxus, and Situationism (Flanagan, 2009). Game making as digital artmaking is another strategy in our STEAM curriculum framework. Students in the Games 4 Girls and My Avatar Games courses created their own characters and the underlying programming, allowing game characters to move and interact with other game objects and environments. Students used the software programs GameMaker and OpenSim as platforms for creating games by navigating how digital game making could refl ct their personal interests and tell stories (Figure 2 and Figure 3). The coding and technology skills required to make a game becomes more personal and relevant to students when they can express their own ideas and interests in their projects. By creating games as programmable digital art, students learned how to make personal art projects using creative computer code (Maeda, 2004; Peppler & Kafai, 2005).

Both game courses explored game design in different ways. The Games 4 Girls course used the abstracted terms of *move*, *avoid*, *release*, and *contact* (MARC) as a way to broadly interpret game actions common across many video game genres and what those actions could mean in different contexts (Patton, 2013). Within the GameMaker software environment, MARC helped frame how students could program the character's movements and actions with other objects to avoid or engage (Figure 4). The MARC concept was kept abstract enough to allow for multiple interpretations, allowing students to question, examine, and critique rules embedded in daily life, and could be used as content for different types of 2-D games. Similarly, girls in the My Avatar Games course engaged in play through the connection to their game-playing character—their avatars. Th s allowed students to tell stories in a more personal way. Collaboration was the central approach in this course. Students created a treasure-hunting game in OpenSim for their fi al team project. The team members had different roles including building the game world, its objects, and creating interactive code scripts. Each group created a story for their game,

Figure 3. Screenshots of the student-created treasure-hunting game about finding medicine or a sick elder.

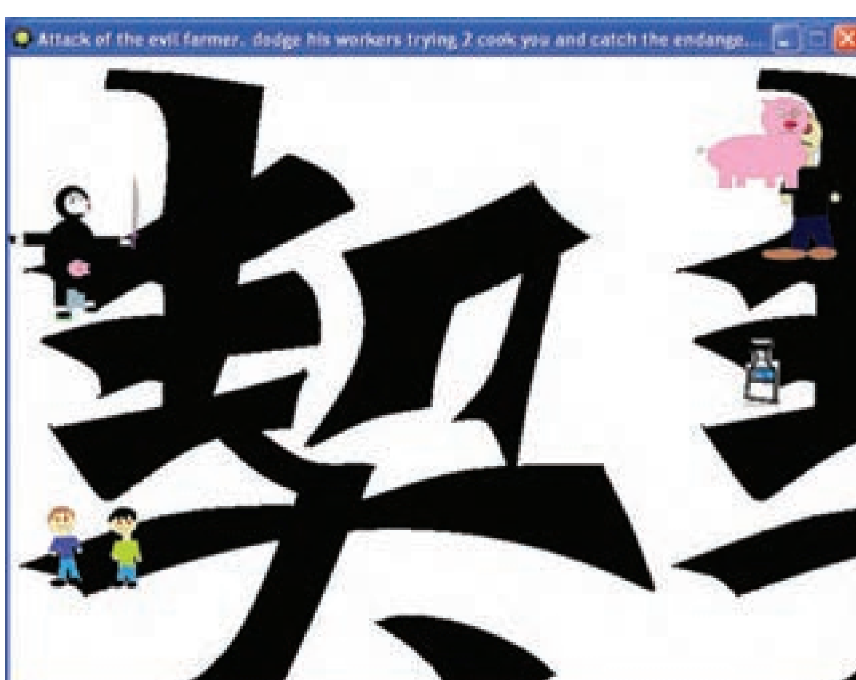

Figure 4. Screenshot of the student-created game *Ninja Cow.*

guiding the player to find the missing objects or treasure. Both courses used game design to teach 21st-century skills including critical, creative thinking, and collaboration.

Students learned 21st-century skills of technology literacy by programming, critical thinking, and problem solving to develop systems in their games, and initiative by completing their game projects. In the Games 4 Girls course, when students moved beyond the MARC actions in the introductory game making process, they built on their games with additional features like sound, gravity, health bars, and timers. This enabled students to gain a deeper knowledge of how computer code works and confidence with creating complex programmable media. In My Avatar Games, students learned not only the skills of programming code scripts, but also how their scripting affects their game objects and how they can design different narratives with computer code. In both courses, by creating interactive game systems, students could see how individual elements affect other parts of the game. As students learned how systems are created in games, they also saw how games map onto everyday life and began to understand the complexity of how systems function.

What Did Students Gain From STEAM Digital Media Making?

All students in each course successfully developed a complete project, showing how our breakdown of instruction and guiding activities works well, sending positive messages of how girls can create with technology. Girls in the animation courses learned how to collectively engage in meaningful digital art creation by exploring roles of leadership with 21st-century knowledge and skills, increasing their confidence to pursue future technology-related careers. Girls in the game courses learned to express their interests through game making and developed their ability to create programmable, digital content. The student-made digital games playfully collaged people, objects, animals, and concepts in ways that support students' personal narratives of the relationships between game objects. By learning how to create digital games, students were exposed to the possibilities of programmable digital media as a creative form for the art classroom as they prepare for 21st-century methods of artmaking and their future professions.

As students learned how systems are created in games, they also saw how games map onto everyday life and began to understand the complexity of how systems function.

We realize there are many challenges for art teachers to implement a digital art curriculum. Hurdles for teachers include equipment, time and pacing, balancing the need for traditional forms of artmaking, and professional development support for learning how to teach a digital art curriculum. On a positive note, most of the software for the courses described here is cross-platform, open-source, or free, allowing art teachers with small budgets to use these technologies. Although there are challenges for art teachers to implement a curriculum like this, our research results below provide evidence that a digital art–centered STEAM curriculum would benefit middle and high school students and could be motivation for art teachers to take on the challenges.

Our research goal is to understand if our digital artmaking curricula effectively motivates middle school girls to explore digital technologies further; appreciate and participate in teamwork; and gain interest in pursuing STEM careers. We conducted pre- and post-surveys with students before and after the courses, asking them questions about the curriculum and their interest in STEM. The overall survey results showed that students' ability and interest to further explore digital technology, perspective in teamwork, and understanding of STEM careers all improved after the courses. Below is a synthesis of our findings.

1. ***Students gained different perspectives and insights on technology as well as the understanding that women can also make a difference using technology.***

Learning to create digital media, such as animations and games, allows students to learn what it is like to work in technology fields. According to the post-survey results from all the courses, students appeared to develop a deeper knowledge of technology-related careers, became motivated to continue learning about technology, and challenged technology-related stereotypes. In one course, a student wrote: "I think that the computer and its systems are really cool and I might want to do something like that in the future for a job." Another student expressed that "I always thought guys were the ones to take up these careers, usually when people think of STEM they think of geeks, or nerds. Now after the camp I realize girls can do this career too, and are just as smart as guys in this." The experience of creating digital media enabled girls to feel they can have a significant role in technology by participating in a field traditionally dominated by men. Students in all courses realized digital artmaking was difficult at first, but enjoyed the process and seeing the end result was rewarding. Students' reflection of their experience demonstrates the effectiveness of the courses to cultivate their interest in working with computer technology.

2. ***Students learned that collaboration and teamwork skills are essential to digital media creation.***

The survey results from all courses indicated these experiences helped students gain collaboration skills and realize teamwork can enhance their projects. One student mentioned she not only learned the software, but also learned "making a movie takes a lot of teamwork, time, and concentration." Another student reflected she liked the fact she could "work with other people and get to listen to others opinions." A third student responded she liked the collaborative process because "we are all creative so with all of our ideas we can make a better game."

3. ***Students gain digital media skills empowering them to understand that everyone can learn how to use the computer as an expressive art medium.***

When students started the Tech Savvy courses, their confidence in working with digital media making was at 48.5%. After the courses, students confidence increased to 76%. Students remarked learning new digital skills by creating their own animations and games was a fun and engaging experience. Across all four courses, the percentage of students who indicated they plan to take more technology courses in the future increased by 16%. These results support the hypothesis that using computer technology for self-expression and visual communication may increase students' interest in continuing to take computer or technology classes, raising their confidence in STEM knowledge through digital media creation.

Conclusion

When developing a digital art–centered STEAM curriculum, an instructor does not have to teach a specific digital tool; rather, the curriculum can come from a big idea (Walker, 2004) or another conceptual framework that materializes through digital art. As digital tools change rapidly, our goal in this article is not showing how to use these particular technologies or propose teachers follow our curriculum; instead, we propose a STEAM curriculum framework that encourages teachers to put digital artmaking as a central activity to creatively explore the possibility of how technologies can be used for 21st-century artistic purposes. The Tech Savvy girls were encouraged to explore technology and STEM careers further because of their positive experiences creating digital media. As a student from My Avatar Games course stated, "I think it is a great way to learn new things about technology, and it opens up a world of opportunities for me. Above all, it was the best 'camp experience' I've had." We believe digital artmaking helps students learn and experience technology in creative, artful ways. A STEAM curriculum provides the opportunity to show connections between STEM and art can be thought about, used, and explored in relevant and personal ways for 21st-century learners. ■

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Endnotes

[1] Video editing, presentation, and animation applications such as Final Cut, Keynote, and Adobe Flash may be used to create digital stories.

[2] OpenSim is a virtual environment that allows multiple users to interact through digital avatars in real time. Students create their own avatars to represent themselves in OpenSim. Students also create 3-D objects for different purposes such as building their own imaginative world or create accessories for their avatars. OpenSim is a free, open-source program that can be set up by educators.

[3] Global Kids, a non-profit educational organization, used Teen Second Life to teach students machinima creation to address social justice issues ("Global Kids Online Leadership Program," n.d.).

elicit, interactive installation by Nathaniel Stern (2001–2013).
Photo by Wyatt Tinder.

Nathaniel Stern: Performing Images Into Existence

Christine Woywod

After hearing Donal O'Donoghue's (2010) Manual Barkan Award Lecture at the 50th NAEA National Convention, I could not stop wondering, what would my art classroom look like if I taught about "art of our time"? What would my students' artworks look like if I taught in a way where art was transient, not about objects, but rather experiences? What would my lessons look like? What would my classroom look like? How do I nurture a space where students can experiment and safely fail in the context of schools dominated by high stakes assessments? Answers to these questions are still unfolding in the midst of conversations about new National Core Art Standards, choice-based art education, project-based learning, and maker spaces.

enter, interactive installation by Nathaniel Stern (2000–2013). Photo by Wyatt Tinder.

Weather Patterns: The Smell of Red, 2014. This installation combined sand and spices, fans and fabric, electronics and tornado machines to create a powerful sensorial experience. Produced by Erin Manning and Nathaniel Stern, with Marcelino Barsi, at Glasshouse Project in Williamsburg, Brooklyn NY. Photo by Leslie Plumb.

Weather Patterns: The Smell of Red (detail). Photo by Leslie Plumb.

When I experienced an exhibit including interactive works by Nathaniel Stern, I got to jump and swat at projected words that fl ated past my shadow on a wall. These shadows were real-time computer-generated drawings of my moving body, using body-tracking hard- and software. My students and I giggled with glee at how entertaining and unexpected this was in a gallery space. We had control over the artwork, but it also had control over us. Leaving the exhibit, I felt like I had more fun than I could at a museum filled with historical works. In those moments we *embodied* how technology mediates our lives. As for content, it does not get much more timely than that! But how does one *teach* about such fresh, ephemeral work? I believe that one particular approach in Stern's work, "Compressionism," can offer art educators a valuable bridge between the traditional kinds of art objects we are familiar with teaching about and contemporary concepts such as *performing images into existence*.

About the Artist: Nathaniel Stern

Nathaniel Stern is an internationally known artist, writer, and professor who describes himself as an interventionist and public citizen.[1] He has created and collaborated on a diverse range of artworks including participatory installations such as *Weather Patterns: The Smell of Red* with Erin Manning and Marcelino Barsi and *Strange Vegetation* with Yevgeniya Kaganovich, performances such as *Three Mile Meal* with Sense Lab, and Internet art such as *Tweets in Space* and *Wikipedia Art* with Scott Killdall, 2009. Stern treats art as a situation or an event, rather than an object (Stern, 2013). His interactive and experience-based artworks not only challenge commonly held notions of art but they challenge us to reconsider how technology mediates our lives. Stern's creative confide ce also can exemplify for students the importance of play, experimentation, and taking risks in art.

"Compressionism"

Th ough an approach that he has come to call "Compressionism," Nathaniel Stern challenges us to move beyond the allure of images created by technology, and think about how our bodies perform images into existence. Compressionism is like the anti-Photoshop; every accidental movement, shadow, or bubble reinserts a human element into the digitally mediated images that we see.

In 2005, Stern started experimenting with movement by passing through a gallery space in Johannesburg with his scanner while the scanner head was in motion. The spaces and objects within the gallery space were compressed into an image the size of a piece of paper. Walls and plants transformed into somewhat unpredictable textures, marks, and colors. Stern often worked back into the images on his computer to accentuate elements or alter the size of the fi al image to be closer to the size of the original space. The resulting prints looked like they could have been a part of historical movements in painting, such as Impressionism or Abstract Expressionism. One might liken it to Jackson Pollock's paintings as a record of his actions and movements (Stern, 2007).

Stern eventually built a unit to hold a custom battery pack for his scanner and his laptop so he could perform in different spaces and with a greater range of movements. As he started to move through parks and ponds with a custom device strapped to his body, he also needed to explain to others what he was doing, and they in turn started to offer him advice on more possibilities for things to scan. Back in the studio, he also started reworking Compressionist images into traditional etchings, lithographs, and aquatint prints.

Most recently, Stern debuted his Compressionist work, *Giverny of the Midwest*, at the Museum of Wisconsin Art. It is a 250 square foot installation that purposely references Monet's *Water Lilies* (1914–26) by immersing viewers in images of water lilies, leaves, and the like. It is composed of close to 100 performative prints, scanned from a pond in South Bend, Indiana and digitally edited over the course of two years.

Exploring Through Essential Questions

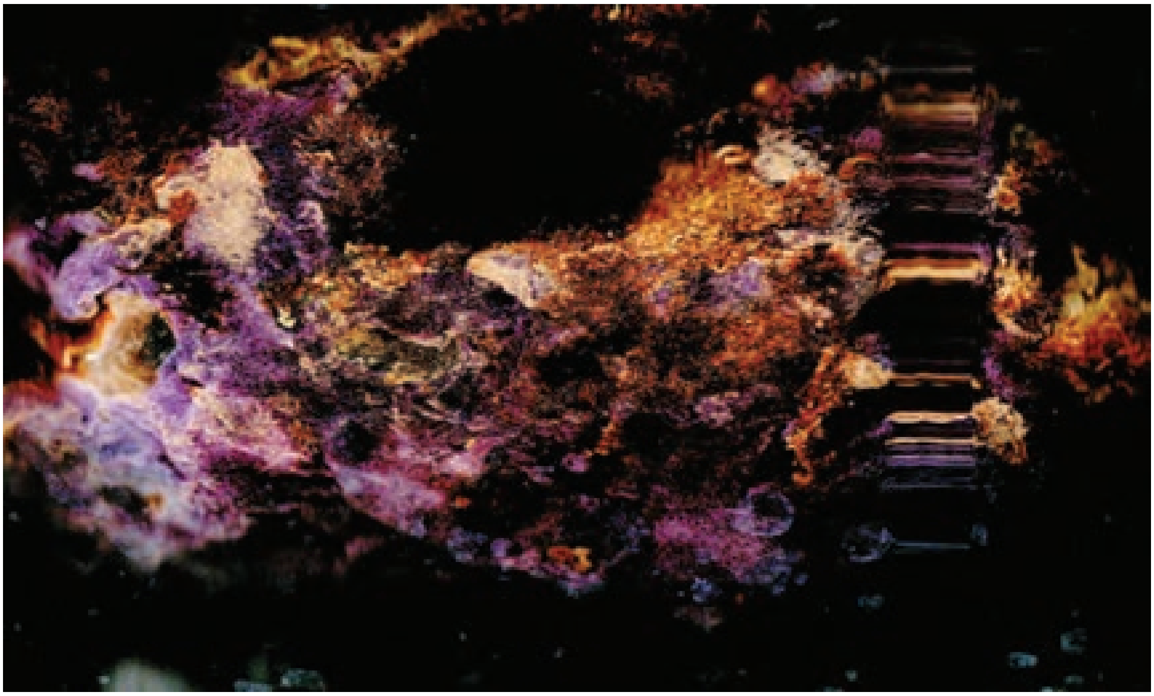
The following sections describe ways that we can learn from Nathaniel Stern's artworks, through essential questions framed by the National Core Art Standards (NCCAS, 2014).

CREATING

Essential question(s): What conditions, attitudes, and behaviors support creativity and innovative thinking? What factors prevent or encourage people to take creative risks? How does collaboration expand the creative process?

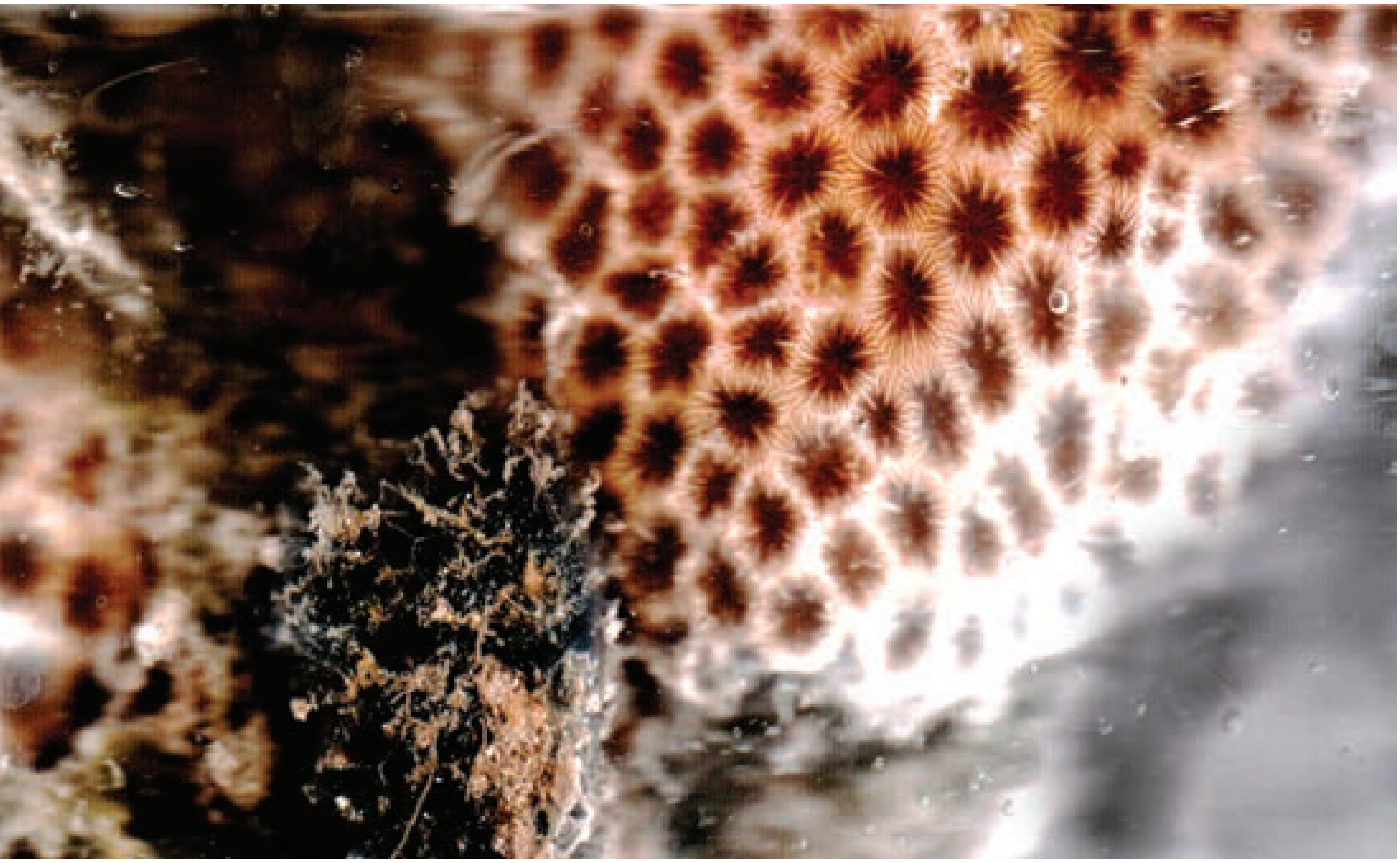
Concentration, by Nathaniel Stern. From *Printing Time*, a series of 18 performative prints, 2011. 24 cm × 42 cm, pigment on watercolor paper, edition of 5.

The artist, Nathaniel Stern, scuba diving with a scanner, computing device, and custom electronics and battery pack. Still from video by Emyano Mazzola.



Mushroom, by Nathaniel Stern. From *Rippling Images*, a series of underwater performative prints, 2014. 300 mm × 500 mm, metallic print.

Flower, by Nathaniel Stern. From *Rippling Images*, a series of underwater performative prints, 2014. 300 mm × 500 mm, metallic print.



Fishness, by Nathaniel Stern. From *Rippling Images*, a series of underwater performative prints, 2014. 210 mm × 305 mm, metallic print.

As Tom and David Kelley point out in their book, *Creative Confidence* (2013), people who are creative work through lots of failures before they get to a successful innovation. Increased successes usually mean more tries and more failures too, but creative people learn to be comfortable with daring to take those risks. As an example, view Stern's website with students in addition to the works presented in this Instructional Resource. While always about experience, there is a big range of projects there!

In 2014, Stern produced a series entitled *Rippling Images*, which combined work with his scanner and scuba diving in a coral reef off he coast of Florida. An interdisciplinary team helped him design and construct several versions of a marine-rated waterproof rig. While the idea might seem wild to some, and the version he dove with ultimately started to crack and fail, it resulted in some rather fascinating images as water and bubbles crept into his images.

Student creation challenge 1: Experiment. Choose a non-traditional tool that both interests you and could be used to make marks or that could record your movements within a space. Determine as many possible ways as you can to use each tool. Which one is the most effective? Which one is the most entertaining? Which one do you have the least control over? The most control over? Which one has the most potential for further use? Why?

In the conclusion of his 2007 video about Compressionism, Stern offers guidelines for other artists, as he wants to invite them into this exploratory space: (1) digitally capture through performance; (2) virtually edit and accent; and (3) physically reconstitute and analog archive. These would be simple rules to guide an artmaking experience.

Student creation challenge 2: Based on your experiments with a non-traditional tool, develop three guidelines that two other classmates can use to explore working with that tool as they document their movements through a space. In your group of three, exchange tools and work with them. What tool did your group mates find o be the most effective? Which one did they feel was the most entertaining? Which one did they the least control over? The most control over? What new ways did they see to use the tool? Which boundaries did they find helpful? Why?

PRESENTING

Essential question(s): What is an art museum? How does the presenting and sharing of objects, artifacts, and artworks influen e and shape ideas, beliefs, and experiences? How do objects, artifacts, and artworks collected, preserved, or presented, cultivate appreciation and understanding?

Stern's *Rippling Images* are alluring abstract photographs, but the objects alone might not help a viewer understand where, how, or why they were created. Sometimes, objects might not even be the point—they might exist to facilitate interactions, manipulate viewers, or be manipulated by viewers. As Stern's work is transient and based on experience, this is especially important information. It is part of the reason why he wrote a book about interactive art and embodiment (Stern, 2013), gives artist talks, creates and posts videos, and maintains a vibrant website. It not only rounds out the viewer's experience, but it helps one understand how these pieces fit with the artist's larger oeuvre.

Student presentation challenge 1: Beyond the resulting artworks, what would present viewers with a more complete understanding of the non-traditional tool development, guidelines, and resulting works from your creation challenges?

Student presentation challenge 2: Rather than writing a written report, challenge small groups to curate didactic displays about artists. Help others experience contexts and processes important to the artists, in relation to their artworks (or reproductions of their work).

Nathaniel Stern before his artist talk about *Rippling Images* at Tory Folliard Gallery in Milwaukee, WI. Photo by author.

RESPONDING

Essential Question(s): What is an image? Where and how do we encounter images in our world? How do images influen e our views of the world?

Thanks to social media, Stern's *Rippling Images* received a fair amount of buzz. It was shared via sites such as wired.com (Kehe, 2014) and gizmodo.com (Campbell-Dollaghan, 2014) among others. While the authors of articles wrote from a position of fascination with the images, some people commenting on the articles critiqued the work and Stern's explanation of it. One cannot help but wonder if commenters' responses would be different if not shared through the semi-anonymity of online formats!

Student response challenge: Discuss and debate. Are Stern's images art? Why or why not? Do you think they are effective in doing what the artist says he intended for them to do? Why or why not? If they aren't effective, can they still be valuable? How?

CONNECTING

Essential Question(s): How does art help us understand the lives of people of different times, places, and cultures? How is art used to impact the views of a society? How does art preserve aspects of life?

Stern's artworks both embody experience and create situations in which viewers can participate, interact, and have experiences. Taking this into consideration, an experience-based response to his artworks is fitting.

Student response challenge: Choose one of Stern's Compressionist images. What kinds of movements were used to create it? How was the scanner held and manipulated? In a small group, create a series of 3 to 4 repeated movements based on the image that can be used to give others an impression of the image you worked with. Share and discuss. What parts of the repeated movements reminded you of the image? How might different places inspire different movements? Why interpret an environment or an artwork with movement, rather than words?

Further Exploration

Nathaniel Stern's website, http://nathanielstern.com, offers videos of projects and overviews of series within his body of work, as well as a thorough collection of links to press, books, and catalogs that include his art and writing. Links to materials that complement this instructional resource are at http://nathanielstern.com/art-education. ■

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Endnote

[1] www.nathanielstern.com

CALL FOR PAPERS

Creative Activity as a Human Right

A Special Issue of *Art Education*, the Journal of The National Art Education Association

Coming May 2017!

In a survey of current research needs, the NAEA Research Commission (2014) found that social justice is an area of significant concern among art educators. For some, this finding reflects a belief that all children are creative beings and, as such, have the right to develop their creative capacities. For others, it is a recognition of the special role art and design education can play in helping learners to become empowered participants in and shapers of the histories they have inherited.

Although it is a new research priority for NAEA, justice has a long history in the arts and education. As W. E. B. DuBois, Alaine Locke, John Dewey, Maxine Greene, bell hooks, and other pioneers of emancipatory philosophy understood, there is an essential relationship between participation in creative cultural production and the making of a free, democratic society. Creative activity opens up alternate possibilities for thinking, feeling, and doing. In its most hopeful form, it enables us "to adapt, connect, relate, join forces, and pool our resources" in new ways "so that we are all less alone, less vulnerable, and less unable" (Rolling, 2016, p. 5). Creative activity is the collective and cultural fuel necessary for human survival, solidarity, and freedom. Indeed, repressive social systems are quite effective, at least in part, because they restrict creative activity and curtail participation in the making of culture. What, then, would it mean for art and design educators to conceptualize creative activity as a universal and inalienable human right? How might it change our conception of the visual arts and design in education?

Increasingly, scholars are attempting to renovate these venerable concepts for a contemporary context (Milbrandt, Zimmerman, & Miraglia, 2016), but in practice there remains a schism between the "believers" and the "non-believers." Lofty abstractions of social justice discourse often fail to resonate with many whose work is applied at the grassroots level and those who feel ambivalent about their civic role and ethical responsibility as art and design educators. Why might this be the case? What new concepts and tools of persuasion—vocabularies, metaphors, stories, and images—might expand our collective understanding of and commitment to creative activity as a human right?

This special issue of *Art Education* seeks submissions that respond to the concept of Creative Activity as a Human Right or as a means toward greater Social Justice. The issue will offer a wide range of ideas through an expanded collection of shorter articles. Contributions in this issue should be 1,200-1,500 words, but otherwise follow the journal's standard submission guidelines. Submissions may report new practice-led or research-based insights or present experimental proposals for rethinking social justice in art education. Authors may wish to respond to one of the questions listed above or below. Authors may also elect to write beyond these provocations in order to expand our understanding of the relevance and urgency of a human rights or justice orientation to creative cultural participation in school art classrooms, art museums and community-based art education.

- What happens when we boldly proclaim that creative activity is a human right, and not a privilege?
- How does creative response provide a space for understanding and interrupting conditions of inequality? What examples exist in P-16 art education that illustrate the relationship between creative activity and justice?
- What are the developmental benefits of conceptualizing art teaching and learning from a social justice perspective?
- What research, philosophies, and histories can help animate a human rights discourse for creative activity and cultural participation?
- What practical pedagogical tactics and partnering strategies are essential in promoting a justice-oriented culture of creativity?

Submission Instructions

Dr. Amelia (Amy) Kraehe, guest co-editor of this issue of *Art Education*, invites manuscripts that address the topic of "Creative Activity as a Human Right" or "Social Justice." Prospective authors should specify both in their cover letter and in the subject line of their e-mail submission that their manuscript is intended for the Creative Activity as a Human Right special issue.

Deadline for submissions: October 15, 2016

All manuscript drafts should be submitted to arteducationjournal@gmail.com, following the established submission guidelines outlined at www.arteducators.org/research/art-education and at www.tandfonline.com/uare.

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NAEA **SummerVision DC**: July 5-8, 2016, Washington, DC.

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