Maker Ed in the Art Studio: Preparing Pre-Service Artist/Educators to Integrate Maker Education into P-12 Art Studio/Classrooms

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ABSTRACT

This paper presents a model for preparing pre-service artist/educators to integrate digital and analog materials and methods in P-12 art studio/classrooms. Over the past three years, as part of a pre-certification art education program, I redesigned and taught a course, Learning in Digital Visual Cultures (DVC.) Art teacher candidates with little to no previous knowledge of digital tools, circuits or coding learn to adapt these new methods and materials borrowed from maker education to suit the learning objectives of the art studio. This approach flips the popular STEAM approach: technology is put at the service of art education, rather than art being used to enhance STEM education. The arts prioritize conceptual and material exploration in the service of personal meaning-making and aesthetic expression. In DVC, staples of the maker movement, such as simple circuits, Arduino and Scratch coding, are used to expand students' personal engagement, arts learning and connections across the curriculum. Pre-service artist/educators study the history and current potential of digital visual cultures in art and education. They research and present on contemporary artists who incorporate digital technology in their work, and design lesson plans that use these artists as mentors.

KEYWORDS

Art education; P-12 education; Maker Education; Digital Art

1. ARTISTS ARE MAKERS

Artists think through materials[1]. Ideas emerge in the process of making. Artistic thinking can be distinguished from design thinking, in that artists often engage in making for its intrinsic rewards, rather than to please a client or solve a pre-defined problem. Art-making, in this case, can be a process of what has been called problem construction or formulation, rather than problem solving.[2] Through the art-making process, an artist externalizes internal thoughts, feelings, and perceptions in physical form, and is able to play and respond to unforeseen possibilities. As an artist's "first thoughts" accumulate in the process of transforming material into form, she begins to respond, not only to procedures, techniques and concepts she brings with her, but also to what is happening in the moment. A dialogic process ensues between bottom-up perceptions interacting with top-down concepts and strategies. Pre-service artist/educators need to learn how to cultivate artists' ways of thinking and doing in their future classrooms.

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[1] Hafeli, Exploring studio materials: Teaching creative art making to children.

[2] Csikszentmihalyi & Getzels, Creativity and problem finding

Figure 1: Example of Student Work: A lasercut lantern that incorporated LEDs programmed with Arduino.

Figure 2: A screen shot of a student's Scratch game, based on La Casa Azul, artist Frida Kahlo's home.

Figure 3: An activity inspired by research on phosphorescent fish, using simple circuits, LEDs and pipecleaners combined with a variety of otherart materials on Family Maker Day.

2. LEARNING IN DIGITAL VISUAL CULTURES

This is a required course for undergraduate art education students, as part of a pre-certification program in a regional public university with a strong arts program. The majority of students have no experience with technology except as consumers. At the start of the semester, there is a high level of anxiety and reluctance to engage with technology among most students. In previous iterations, this was taught with a greater emphasis on visual culture. I have shifted and redesigned the course to be much more hands-on, incorporating the kinds of activities more typically found in maker education, such as simple circuits, while maintaining a strong connection to contemporary arts and arts education practices. Students also consider the historical relationship between art and technology. Design thinking processes are introduced and adapted to help students learn how to plan lessons based on course methods and materials.

2.1 The Curriculum

Students in DVC are guided through a series of collaborative and individual projects that build confidence and competence with digital materials. They progress through assignments which move from step-by-step instruction through guided practice to student driven research. Initially, many students express a lot of anxiety, stating "I'm just not good with computers!" Previous negative experience with STEM subjects, predisposes them to think they are just not going to "get it." We begin with a marble run team-based game, which combines technical challenge and collaborative problem solving with some healthy competition. Scored on a variety features, some quantitative (such as longest time) and others qualitative (such as surprising or unusual use of materials) students gain confidence that, just as in art class, there is no single correct response. This helps prepare them for the rest of the semester, by introducing them to a trial and error "design thinking" mindset, as well as establishing the foundation for peer to peer support which will be critical as they tackle more challenging projects.

Moving onto simple circuits, they are challenged to integrate their prior knowledge and skills in traditional art-making with the new materials of LEDs, motors and copper tape. One early assignment asks them to create a card to honor a specific person in their lives who is important to them: this assignment motivates them to be more ambitious, push through frustrations, and yields diverse and aesthetically powerful results. They learn to solder for the first time— not so different from using a hot glue gun— and then are ready to try coding with Arduino via ATTiny microcontrollers. This is a huge ask for most art students, but by this time (halfway through the semester) they have built up their confidence and peer support systems to handle it.

Laser cutting and 3-D printing come next, and toward the end of the semester, they create interactive stories and games with Scratch. In Scratch, they only use artwork they have made themselves. They then create a 4-8th grade Scratch lesson that incorporates important art learning. For their final project, they combine at least two of the technologies from the class, along with prior knowledge and experience in artmaking in an independent project. Every step of the way, they are asked to reflect on what they bring as artists and art educators into these new making experiences.

2.2 Keeping Future Budgets in Mind

Most of the pre-service teachers in our art education program will end up teaching in public schools with very limited budgets. With this in mind, in DVC there is a heavy emphasis on open platform software such as Tinkercad and Scratch (Figure 2.) When working with microcontrollers, we focus on Attiny 85s rather than the more expensive Lillypad or MicroBit. This limits what we can do, but it introduces the concept of physical computing in the art studio classroom, and makes it possible for them to realistically project doing these kinds of activities in their future classrooms with public school budgets.

2.3 Family Maker Day

During first week of class students learn that they will be organizing a Family Maker Day. Families from the local community are invited to participate in open-ended "maker-activities" on a Saturday afternoon around the tenth week of the fifteen week semester (Figure 3.) Students are challenged to design their own arts-based maker activities¨ based on what they have learned so far¨ and workshop them in class. I point them toward resources and offer technical advice¨ but they decide what and how to structure their activities. This takes place as an introduction to our Saturday Arts Lab, a student-run art program that is an integral part of our teacher preparation program. Before Family Maker Day was instituted, Saturday Arts Lab activities primarily used traditional art-making materials and techniques. After planning and implementing Family Maker Day, students have confidently and enthusiastically adapted many of our actual "maker day" activities for use in subsequent semesters in the Saturday Arts Lab.

2.4 Class blogs

They reflect on each activity or project in personal blogs, where they are asked to describe their learning process and how this activity connected (or not) to their prior knowledge of art and art education. They are also asked to consider how they might use and/or adapt each activity in an art classroom. These reflections often dig deep into aesthetic and conceptual concerns that are characteristic of visual art as a discipline. For example, reflecting on her lasercut lantern (Figure 1) as inspiration for her final independent project (a plexiglass laser cut piece incorporating programmed LEDs) one student wrote:

> It's been interesting for me to try and wrap my head around the idea of light in my life, and how light can be expressed symbolically in my art. I did some research to see how light has been represented historically, its role scientifically, and its place in spirituality. My research has lead me to more questions than answers … the fairly broad association of light as the sun and the moon, and the ways in which they sustain and influence life on earth. In addition to this literal concept of light as a means for one's livelihood, I thought about the things in my life that I believe are brightest and bring me warmth in the way that light does so well. For me, one of the greatest and brightest parts of being a person is our ability to empathize and have compassion for one another.

This student's thought process, moving from the literal to the conceptual and metaphorical, typifies the kind of inquiry that is encouraged and supported in the DVC class. Her thinking demonstrates that technology has become just another tool in her artist's toolbox. She has figured out how new tools and materials can be used in the service of her personal aesthetic and creative goals.

3. CONCLUSION

During the first couple of iterations of this course, students often struggled and grew frustrated with projects, and questioned why it was necessary from them, as future art teachers, to master these new skills. In the current iteration, through carefully scaffolding tech skills, like soldering and coding, while keeping artistic and creative goals at the forefront, leveraging students' prior skills and knowledge in the visual arts, all students can be successful in this course.

3.1 Results

In their final semester as student teachers, and as students approach the job market, they incorporate lessons and projects from DVC alongside more typical visual arts curriculum. They have adapted DVC skills and techniques into various media, such as painting and ceramics, and several recent graduates are continuing to incorporate this knowledge in their teaching.

3.2 Broader Value

Artist/educators can bring unique perspectives and ways of thinking and working to maker education. At the same time, the methods and materials of the maker movement can feel quite foreign and daunting for pre-service artist educators who are much more comfortable with clay and paint. STEAM approaches, adding the Arts to STEM education, tend to add arts-based materials and methods as an afterthought. By foregrounding contemporary art practices and leveraging students' own personal artistic and creative experience and goals, a successful and distinct approach to the integration of art and technology can be forged.

4. BIOS

Andrea Kantrowitz is an artist, educator and researcher who uses cognitive psychology theories and methods to study the hidden dynamics of artists' thinking processes. Her work includes a randomized control trial that demonstrated the impact of an interdisciplinary art curriculum for students growing up in poverty. She has lectured and led workshops on art and cognition internationally, recently as Outstanding Educator in Residence for the Singapore Teachers' Academy of the Arts. She is interested in drawing as a trans-disciplinary tool of thought and collaboration in teaching, learning and research, as well as art and STEM integration and its impact on educational equity in high-poverty schools and communities. Her work in K-12 teacher preparation and professional development is grounded in arts-based research and contemporary arts practices.

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