9. Maker Ed in the Art Studio: Preparing Preservice Artist/Educators to Integrate Maker Education Into P–12 Art Studio/Classrooms

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Abstract: This paper presents a model for preparing preservice artist/educators to integrate digital and analog materials and methods in P–12 art studio/classrooms. Over the past 3 years, as part of a precertification 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's 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. Preservice 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 they design lesson plans that use these artists as mentors.

Artists Are Makers

Artists think through materials (Hafeli, 2014). 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 predefined problem. Art making, in this case, can be a process of what has been called problem construction or formulation rather than problem solving (Csikszentmihalyi & Getzels, 1988).

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. Preservice artist/educators need to learn how to cultivate artists' ways of thinking and doing in their future classrooms.

Learning in Digital Visual Cultures

Learning in Digital Visual Cultures (DVC) is a required course for undergraduate art education students as part of a precertification 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, DVC 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.

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 that move from step-by-step instruction through guided practice to student-driven research. We begin with marble runs and simple circuits, making LED circuit cards and then Arduino via ATtiny microcontrollers. Laser cutting and 3D printing come next, and toward the end of the semester, they create interactive stories and games with Scratch. For their final project, they combine at least two of the technologies from the class, along with prior knowledge and experience in art making in an independent project (see Figure 1). Every step of the way, they are asked to reflect on what they bring as artists and art educators into these new making experiences.

Figure 1. This is an example of student work: a laser-cut lantern that incorporated LEDs programmed with Arduino.

Keeping Future Budgets in Mind

Most of the preservice 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 (see 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 students to realistically project doing these kinds of activities in their future classrooms with public school budgets.

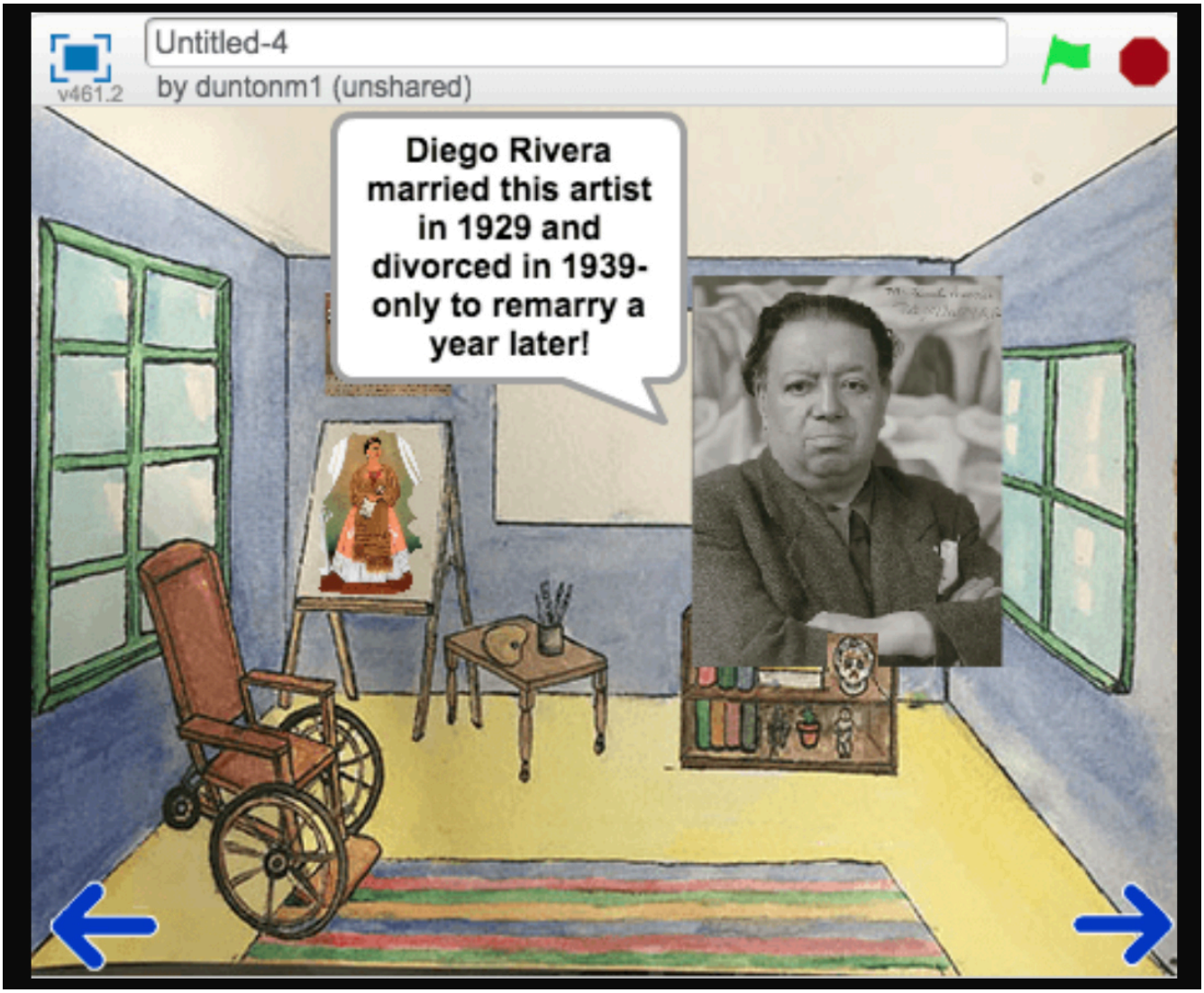

Figure 2. A screen shot of a student's Scratch game, based on La Casa Azul, artist Frida Kahlo's home.

Family Maker Day

During the 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 10th week of the 15-week semester (see 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, and students have used many of our actual Maker Day activities in subsequent semesters in the Saturday Arts Lab.

Figure 3. A Family Maker Day activity inspired by research on phosphorescent fish, using simple circuits, LEDs, and pipe cleaners combined with a variety of other art materials.

Class Blogs

Students reflect on each activity or project in personal blogs, in which 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 deeply into aesthetic and conceptual concerns that are characteristic of visual art as a discipline. For example, reflecting on her laser-cut lantern (see 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 [led] 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.

Conclusion

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

Results

In their final semester as student teachers, and as students approach the job market, they incorporate lessons and projects from DVC alongside a 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.

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 preservice 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' personal artistic and creative experience and goals, a successful and distinct approach to the integration of art and technology can be forged.

References

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