



Teaching Wearable Technology: Bridging Humanistic and Design Pedagogies

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This research contributes to the scholarship of teaching and learning, specifically the study of interdisciplinary teaching approaches to project-based learning that bridges the humanities and design fields (Christel, 2016; Cross, 1982; Gam & Banning, 2011; Hernández-Ramos & De La Paz, 2009; Krajcik & Blumenfeld, 2006; Krauss & Boss, 2013; MacLeod & Van der Veen 2019; Martin et al., 2013). The discussion centers on a wearable technology class project that brought together students in two upper-division undergraduate and graduate level courses: Textiles, Technology & Culture and Experimental Apparel Design. The assignment included both individual and small group work. Each individual produced a machine-embroidered design motif and wearable LED circuit component inspired by a motif or symbol from a cultural region or historical era previously covered in Textiles, Technology & Culture. This component was then coordinated with those of peers, as well as integrated with a garment design created by a student in Experimental Apparel Design. The learning objectives for both courses included technical, design, and humanistic skill building, along with social and communication skills. In what follows, we discuss the course context and project, share the results and insights from the faculty and student perspective, and highlight pedagogical modifications informing future versions.

Textiles, Technology & Culture fulfills a material culture and humanities area degree requirement for all department majors. The course draws on perspectives from social history, art history, archaeology, history of technology, anthropology, and gender studies to explore the relationship between the social, technical, and aesthetic qualities of textiles, as well as stylistic similarities and differences across cultural and historical contexts. The latter third of the semester focuses on the social, political, economic, and cultural forces that shape and are shaped by textile-related technology (especially that of the Industrial Revolution). The final weeks examine wearable technology, smart textiles and apparel. Reflecting current industry trends (Kettley, 2016), the wearable circuit assignment was introduced in both courses to encourage students to apply humanistic and design research in a hands-on project that would also allow students to develop a sense of agency (Klemencic, 2015) and self-efficacy (Bandura, 1997) in unfamiliar domains – i.e. coding, electrical engineering, and for some, graphic design and handcraft.

Assignment Parameters and Process:

The wearable circuit assignment took place over the course of approximately six weeks at the end of a 16-week semester. It required both in class and out of class work time. Students in Textiles, Technology & Culture began by forming small groups of 3-5 students; each team included one student from the Experimental Apparel Design course. In 9 of the 11 groups, the design student was enrolled in both courses simultaneously.

Assignment elements consisted of: 1) Visual, cultural and historical research related to a cultural area or historical period. Based on this research each student identified a motif that would serve as inspiration for the wearable LED circuit; 2) Documentation of ideation and the prototyping and fabrication process; 3) The completed wearable circuit component (detachable from the designed garment); and 4) A 1000-word reflection essay on group collaboration and the student experience. Students were also asked to provide feedback on the overall assignment.

The project was scaffolded by four sessions at the university's state-of-the-art makerspace, including two informational lecture demonstrations and two working sessions. The lecture-demonstrations were led by a makerspace staff member, who introduced the embroidery machine and gave an overview of the wearable circuit "kit" (Gemma circuit board, alligator clips, neopixels, conductive thread) and Arduino coding libraries to program the LED lights.

Findings:

The discussion of our findings is organized around four themes, all of which combine both faculty and student perspectives and comments.

1) Complexity and Multiple Learning Curves. This theme speaks to challenges related to the complexity of the project elements and the steep learning curves encountered by some students in the areas of designing for and operating the embroidery machine, as well as learning the basic skills for designing and programming a wearable circuit. Some students were overwhelmed by the relatively short time window in which to acquire and apply the lessons learned. This problem spurred some groups to divide labor according to strengths and experience levels, while others struggled with individuals stuck on one project aspect, unable to move on.

2) Collaboration and Coordination. This relates to the challenges of collaborating with group members with different schedules, reserving and accessing work time at the makerspace, and coordinating with the designer in the Experimental Apparel Design course. In brief, the normal communication and labor equity challenges of group work were compounded by the need to coordinate components aesthetically with the garment design.

3) Technology and Murphy's Law. This theme relates to unanticipated difficulties experienced by makerspace staff and students in working with the single embroidery machine and interfacing with the wearable circuit kit on students' own computer devices. These technical difficulties hampered progress of individuals and groups and also drained significant hours of makerspace staff time in troubleshooting issues.

4) Structure & Pacing. This theme arose most significantly in student reflection essays and in the final student critique held in Experimental Apparel Design. Most students, despite the numerous technical challenges and domain-specific learning curves, expressed an appreciation for the project and its ambition. They provided numerous valuable suggestions about facilitating peer to peer trouble-shooting and information sharing, recording instructional videos, and modifying the pacing and timeline of the assignment components. All of the suggestions of students, as well as faculty ideas for re-distributing the assignment components more evenly across the Experimental Apparel Design course and the Textiles, Technology & Culture course, will be incorporated into future iterations of the assignment.

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