Making for Social Good: A High School Elective Course With A Mission

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Image 1. Students conducted interviews and observations at Nourish Now, a food recovery based food pantry

ABSTRACT

Making for Social Good is a trimester course at the high school level at a non-profit independent school. The goal of the class is for students to identify a problem in the world, whether local or global, and to design, create and share a functional solution. Along the way, students will learn design thinking, action research, and digital fabrication skills to help them leverage the power of the Makerspace to positively impact the world. By sharing student examples, resources, and final products, it is my hope that other educators will be able to propose and implement similar courses at their schools.

Keywords

Maker Education; Makerspace; Social Good; YPAR; Design Thinking; Digital Fabrication; Service Learning

2. DESCRIPTION

2.1 Description of setting

The course described takes place in a non-profit independent school. The course is a high school elective with a mix of students from 9th to 12th grade. It is a trimester long course that takes place in the school Makerspace, called the BITlab. One-third of the students are students of color and one-third of the students have previously taken a maker or tech/engineering class in the Makerspace. This is the first time a service-based making class has been offered at the school.

2.2 Description of the educational experience

In order to add to the maker course offerings at our school, I proposed and implemented a course called Making for Social Good. The ultimate goal of the class is for students to identify a need, whether global or in their local community, and to use maker techniques and design thinking to create a tangible, shareable solution to the problem. This project will represent a form of direct and indirect service, where students are directly addressing a problem but allowing others to use and/or modify their solutions to address similar problems in their communities as well.

Maker and design thinking concepts that were addressed in this class are:

Human-Centered Design
Often objects are created based on what is cost-effective, possible technologically, or most easily manufactured. While all of these considerations are important, Human-Centered Design focuses first on the human users of a particular object. A cost-effective product that people do not like to use is unlikely to be successful. The design firm IDEO is one of the pioneers of the Human-Centered Design and students will use resources and explore projects from IDEO.org[1].

Participatory/Action Research
Human-Centered Design relies heavily on gaining a strong understanding of the needs of the end user. Action research is a way to connect students with the actual people and organization that they have identified in order to challenge their assumptions and identify issues and assets. Berkeley's YPAR Hub[2] is a great resource for activities to assist in action research.

Rapid Prototyping and Iteration
Designing an object that meets the needs of the target group requires as many opportunities to test in the real world as possible, so

the quicker a functional prototype is ready to test, the more variations can be made to reach the best possible final product. Gathering feedback on each successive iteration will help improve the final design.

Open Source Digital Fabrication
Whether the final design is 3D printable, CNC machined or made from recycled parts with a video tutorial, the ability to share out specific and helpful instructions so that others can replicate the object is critical to the Making for Social Good project. Digital fabrication allows the project to leverage the community of makers to create the object at a regional, national or global scale. The E-nable prosthetic project is an excellent example of this process[3].

Class Structure and Organization

Using an existing system of badging to introduce students to digital fabrication tools, much of the first few weeks were given to having students earn badges in 3D printing, laser cutting/engraving, and vinyl cutting. Other tools were available to the students but these three gave an understanding of how to generate and share content with the BITlab control computers, familiarity with the software to run the machines, as well as exposure to common digital sharing platforms such as Thingiverse or My Mini Factory.

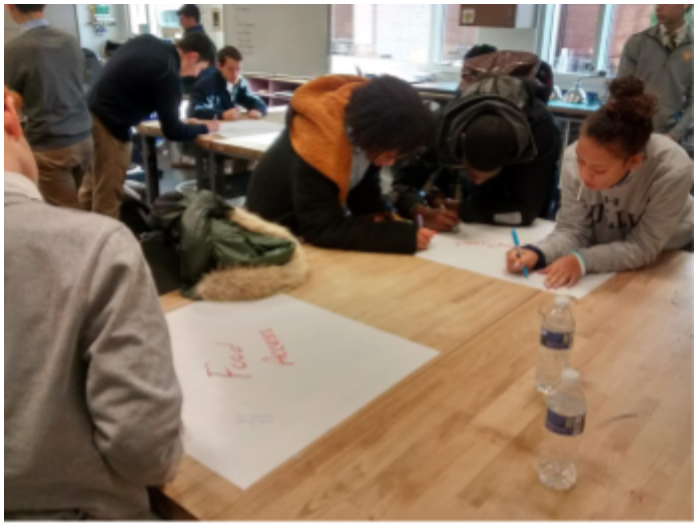

Image 2. Students ask questions and give feedback regarding several different social issues. Feedback generated helped narrow down possible projects.

Initially, I envisioned that the class as a whole would select one project after several practice scenarios and some brainstorming. After using a visible thinking strategy called Chalk Talk[4] to attempt to determine interests and narrow down options, three roughly equal groups emerged. Rather than restrict options, we decided to address three different problems; food access, homelessness, and social justice. The food access group was the largest and eventually split into two different groups focused on different clients, Manna Food Center and Nourish Now. For the majority of the trimester, four different groups worked on projects with various paces, tasks, and levels of engagement. Interspersed with this project work were one-day lessons on interviewing, goal setting, observing, prototyping and other skills as they came up.

As the projects progressed it became clear that students needed to focus on goal setting and task evaluation across the four main concepts. The last two weeks of the project were designed around a status report and group goals, the success of which was the basis for their final exam grade.

With the exception of a few specific assignments, weekly progress and effort were graded on a check, check plus and check minus scale to make the course as much of a pass/fail course as possible.

3. CONCLUSION

3.1 Results

This course has yielded a number of interesting results, both physical products and educational experiences. While results in the rapid prototyping and iteration as well as open source digital fabrication portions of the class are similar to results in other Maker classes, results in Human Centered Design and Action Research have been quite different given the service orientation of the course.

Human Centered Design Practice Results

In order to practice attempting to understand a social issue from the perspective of those affected by it, I designed a mock challenge titled "Trouble in IKEAland"[5]. An imaginary land, IKEAland, has an image based system for writing which has led to a successful furniture industry where instructions were primarily picture based so they can be nearly universal. Young IKEAlanders are becoming more text-based due to cell phone texting habits which have challenged the future success of the IKEAland furniture industry. Students were put in small groups to read statements from young and old IKEAlanders as well as the IKEAland president. They were then tasked with defining the problem, identifying possible solutions and then rapidly prototyping the best solution.

The most interesting aspect of the results of this activity is that each group proposed a similar, though not very innovative or human-centered, solution. Each proposal consisted of creating instructions with a mix of text and writing which, while being an obvious surface attempt to fix the problem, failed to address the root issue at all. One student attempted to get her group to consider the challenge as a social issue by suggesting events to build relationships between older and younger IKEAlanders, but that solution was not adopted by her group. After these solutions were presented, this provided ample opportunity to discuss why groups did not go deeper in their thinking about the problem, and how assumptions about an issue can often stop us from looking further.

Due to student absences, a group of three students did not take part in the IKEAland challenge. For this group, I created a simpler concept which yielded better results. Using the fable of The Boy Who Cried Wolf, I asked the group to identify the problem in the story and propose a solution. This group also started by considering end-result based solutions such as making the boy wear a body camera, building

a wall or some sort of security system to make it easy for parents to check on their children's surroundings. When I asked the leading question, "Why is the boy out in the woods alone in the first place?" they considered the possible social issues in the village and their final solution was to create a program of supervised children's activities to give kids attention rather than "crying wolf." When these students presented their solution to the class, many other students were able to start making suggestions for the IKEAland problem more along these lines.

Action Research Results

Given that this area was new to me, I relied heavily on the YPAR Hub from the University of California Berkeley. The three resources that were used most were the investigation tools for interviewing, observing and mapping. Two groups, in particular, used these methods successfully to arrive at their project proposals.

The group focused on homelessness conducted an interview with two staff members who were launching an initiative at the school to create kits of food, water, socks, toiletries, and other items to hand out to the homeless in the DC area. The students had the idea that they could make something in the BITlab to include in these kits. Through interviewing the staff members, one of whom had significant interaction with service-related projects on campus as well as connections with local homeless shelters, they proposed making information cards for the DC homeless kits.

One of the food access groups opened communication with a food pantry called Nourish Now, which uses "food recovery" to source their donations. During a 30 minute visit to Nourish Now, a small team of five students conducted interviews while a larger group took notes to identify assets and issues that they saw in the physical space as well as the operation of the organization. From these observations, an issue/asset map was generated to identify potential projects for Nourish Now.

Rapid Prototyping and Digital Fabrication Results

Given that the students divided themselves into four groups, the prototyping process for each was somewhat different. Each group was fairly open to creating quick early versions of their project rather than jumping directly to a "finished" product. This was particularly evident in groups that had students with previous Makerspace experience. The coin collector group quickly built a design out of cardboard, the info-card group created a design on a shared Google Drawing, the poster group asked members of the class to practice designing posters, and the Nourish Now group built a prototype of a possible snack box before that project was scrapped.

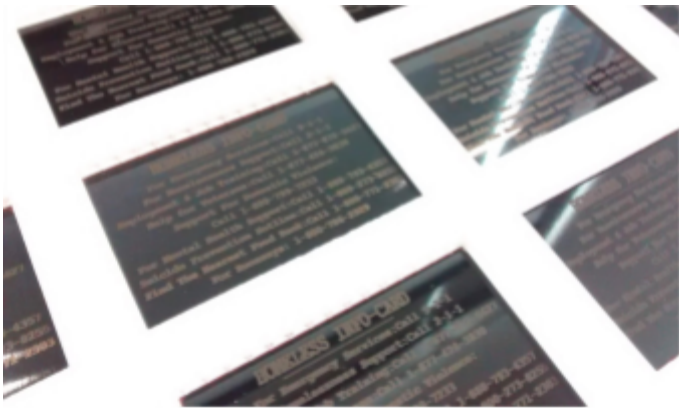

Image 3. Laser engraved information cards for homeless people. Info cards were engraved on thin metal sheets for durability and weather resistance.

The laser cutter/engraver was the digital fabrication tool of choice for the engraved info cards and the coin collector. Though students were exposed to how to use the 3D printers, these were not used in the fabrication of any project. This could be due to the complexity of designing 3D models, which was not covered due to the time constraints of the class, though at one point it was considered to create the info cards as 3D printed plastic. This proved too slow for the production time students had to work with. A large format printer was available for the poster project and students became proficient with software for that machine.

Group projects varied in their success, as would be expected. On the higher end of the spectrum, the homelessness group's info cards not only were distributed (100 cards included in kits), but they were able to create an additional version with local information on the back side of the card. The cards were engraved onto thin metal sheets to make them durable and weather resistant, two human-centered design principles identified by the students. They used the laser engraver for this process and designed a jig to allow them to engrave up to twenty cards in one job.

The social justice group worked on a poster project in which all members of the school were invited to design posters about diversity, inclusivity, and equity. These posters would be printed with the large format printer and displayed around the school in an effort to visually show support for social justice. Since this project was advocacy-focused, the challenge my students faced was communicating effectively to get other students to participate. They kept track of different communication strategies and created a website so that others could replicate their model.

The Manna Food Center group designed a custom coin collector. Manna raises money at local farmer's markets and then purchases food at the end of the market at a reduced price for the food pantry. The hope is those coin collectors placed around the market will improve donations since there was currently only one booth for people to donate as they exited the market. Due to the time of year, it has not yet been possible to test this project, however, the students completed a design that could be laser cut and engraved with Manna's logo and information, and that was farming themed.

The final group struggled to make progress on their project due to the timing of communication as well as group member engagement. The most successful aspect of this group is that they worked with me to arrange a site visit to Nourish Now which allowed all students to experience direct observation, interviewing, and creating an issue/asset map. Using this information, the students chose to create an organizer that would help with the "First In First Out" system for refrigerated food in order to save time and simplify the process.

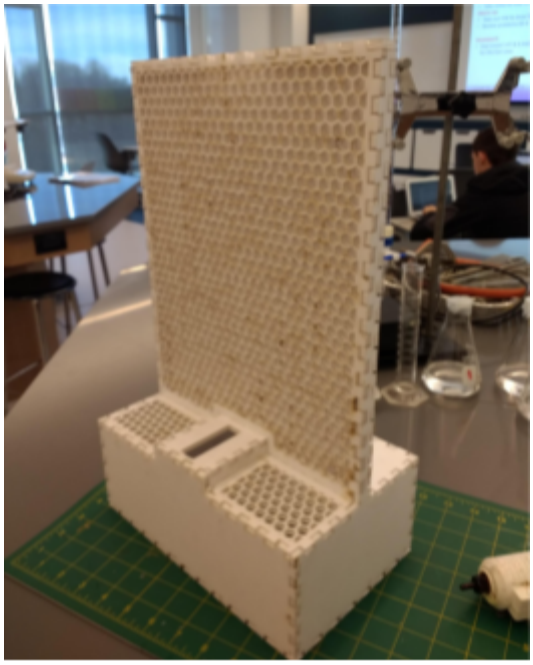

Image 4. Prototype of a coin collector for Manna Food Center made with a laser cutter.

Teacher Observations

As with any class, what individual students learned from their experience was surely variable and dependent upon circumstances outside the control of the class. It is also true that the eventual success of the final product is not indicative of what each student learned along the way., Because of the division of the class into four separate groups, each student directly or vicariously experienced in multiple ways the four different goals of the course. This was achieved by having all students in the class work to help individual groups with aspects of their project, such as the Nourish Now observation visit. Each student also took the first step in using popular Makerspace tools, even if they did not eventually play a role in the final project. All students also gained experience in goal setting, strategic thinking and project management.

It is often the contention of teachers in maker education and other constructivist classrooms that activities in this environment combat the habit many students have developed to look for only one obvious solution to a problem. I believe that it was helpful for my students to struggle with this experience and learn to dig deeper, challenge their assumption, ask more questions, and consider a wider variety of solutions. Finding a creative and impactful project that addressed a concrete need in the community was very motivating and led to a sense of pride that was expressed by many of my students.

3.2 Broader Value

Makerspaces allow students to make concrete solutions for real-world problems. Often the language around maker education is that of innovation and entrepreneurship. The ability of Makerspaces and digital fabrication to make a difference in social and environmental problems is well documented in Makerspaces outside of schools. Showing how design thinking skills and digital fabrication can be taught within the context of a service-oriented class can help educators propose these courses as well as teach their students the value of these tools to positively impact the world.

3.3 Relevance to Theme

This class offers an alternative framework within which to develop skills of design thinking, innovation, rapid prototyping, and digital fabrication. For other educators asking, “What role does Maker Education play in a world with growing social and environmental challenges?” this course can provide a blueprint on how to raise awareness among students about the potential of the Makerspace to do good things in the world.

4. BIOS

Matt Zigler has eighteen years of teaching and administration experience. He has taught visual arts, design thinking, making and creative technology classes at Noble Academy in Greensboro, NC and Bullis in Potomac, MD. He is the creator of the IDEApath Makerspace at Noble Academy and is currently the Coordinator of the Bullis BITlab. He has presented on Maker Education and integrating Making into the curriculum at many conferences and workshops including the North Carolina Association of Independent Schools Annual Conference, Lausanne Learning Institute conferences and the NAIS People of Color Conference.

5. REFERENCES

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