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# Engaging Anthropology in the Human-Centered Technology Design Classroom

SESSION I: Design Thinking and Practice

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## Abstract

This paper considers one model for teaching design technology students human-centered design, through the use of ethnographic methods in a design course. "Designing Technology for People," an undergraduate-level course offered at Purdue University, is co-taught by faculty from the Department of Anthropology and Purdue Polytechnic. Throughout the course, students gain experience conducting basic ethnographic research and analysis, in addition to developing a comprehensive virtual engineer's notebook and a design mock-up, shaped by their ethnographic findings. This paper examines how the course is taught, in addition to considering the value of teaching a human-design course with instructors from both anthropology and technology design.

## Introduction

In technology design education, educators value student outcomes centered on concrete design ideas and a comprehensive understanding of prototyping. However, technology education must consider not only the general technology design process and quality but also human-technology interactions. Inevitably, designs for people are enmeshed in complex sociocultural contexts, inseparable from human needs, values, and desires (Miller, 2017).

Given this need to comprehensively understand the user experience in technology design, ethnographic techniques are increasingly being used to holistically understand people, with the goal of improving their lives through human-centered design (Hashizume & Kurosu, 2013). A growing number of companies are hiring ethnographic researchers to gather data on how consumers use and react to existing services and products, while also informing new product development (Goffin et al., 2012). Ethnographic market research draws on qualitative methods, such as participant observation and semi-structured interviews, to gain a deeper understanding of human behavior, considering opportunities and limitations in how people interact with current technologies. This immersive research approach provides companies with insights into how to develop designs that will better satisfy consumer needs and wants.

To train design technology students in ethnography, this presentation looks at one model for doing this in a human-centered design course. *Designing Technology for People*, an undergraduate-level course offered at Purdue University, which is co-taught by faculty from the Department of Anthropology and the Purdue Polytechnic Institute. During the course, students gain experience conducting basic ethnographic research and analysis, in addition to developing a comprehensive engineer's notebook and a design mock-up, shaped by their ethnographic findings. This paper reviews how the course is taught, in addition to drawing on a case study to consider the value of teaching a human-design course with instructors from both anthropology and technology design. Ultimately, this presentation aims to provide one example of how technology design educators can incorporate ethnographic methods in a course, helping students build a foundation for professionally engaging ethnography in human-centered design.

## Human-centered design

Human-centered design is an approach to building effective and useful designs for people by centering human needs and perspectives in the design process (Zoltowski et al., 2012). As designers shape and reshape our material, informational, technological, and social world, humans should be central to this process. The goal of this design approach is to innovate in ways that will consciously and carefully improve the lives of people and society more broadly. As described by IDEO, "Human-centered design offers problem solvers of any stripe a chance to design with communities, to deeply understand the people they're looking to serve … and to create innovative new solutions rooted in people's actual needs" (IDEO.org, 2015, p. 9).

In shifting from technology-centered design to human-centered design, rather than simply imagining what will help people, designers turn to the "experts," the everyday users, who will benefit from new design ideas (Zoltowski et al., 2012). By combining this expert knowledge with an analysis of broader contextual and structural factors, designers have the opportunity to systematically, effectively, and creatively produce designs in service of people. This approach has important implications for the long-term success of projects. As described by Zoltowski et al., human-centered design approaches have been show to "shown to increase productivity, improve quality, reduce errors, reduce training and support costs, improve people's acceptance of new products, enhance companies' reputations, increase user satisfaction and reduce development costs" (Zoltowski et al., 2012, p. 30).

In teaching design and technology courses, the development of "mutually responsive relationships" between participants and designers is essential for students, as they learn how to combine their design and technology training, with the goal of pursuing innovative solutions that strive to be truly beneficial for users (McCarthy & Wright, 2015, p. 9). As described by McCarthy and Wright, it is critical for students to learn how to engage "humans" in the design process as "subjects" rather than "objects." This learning process requires hands-on experiences and opportunities to practice collecting and analyzing data which can be used for the development of human-centered design innovations (IDEO.org, 2015).

## Ethnographic Methods

Cultural anthropologists have a long history of employing ethnographic methods to understand diverse human experiences, in all of their complexities (Barnard, 2000). Put simply, ethnography is a methodological approach that focuses on "learning about people by learning from them" (Roper & Shapira, 2000, p. 1). The goal of the ethnographer is to immerse themselves in the lived experience of the people they are studying (Ehn et al., 2015; Mannik & McGarry, 2017). This experiential approach provides researchers with the opportunity to engage in an "embodied, sensorial experience" where researchers can use all of their senses as they seek to understand the lived realities of the people they are working with (Renkert, 2022, p. 72).

Participant observation is the quintessential method ethnographers use to learn about people. In participant observation, the researcher does not act as a "neutral" observer, watching from a distance. Rather, the ethnographer participates. As Michael Wesch explains, "We do not just observe other people in our attempts to understand them. We join in. Only then can we move closer to their experience and understand them with depth and detail" (2018, p. 12). During participant observation, the researcher not only actively engages, but also systematically records their observations. While gathering data, it is common for the ethnographer to jot memos and, with the proper permission, take photos and audio/video recordings. After each participant observation opportunity, the ethnographer writes detailed fieldnotes, recording their experience in as much detail as possible. The fieldnotes will ultimately serve as a primary source for data analysis. It must also be mentioned that although participant observation aims to get as close to people's lived reality as possible, ethnographers must always seek the consent of participants to collect data in any non-public event.

Although participant observation is the method that sets ethnography apart, ethnographers will often aim for data triangulation, employing a variety of methods to gain a fuller understanding of the relationship between the people and the social phenomenon they are studying (Bernard, 2011; Teddlie & Tashakkori, 2008). As Fetterman explains, triangulation is at "the heart of ethnographic validity," where the ethnographer compares information sources to test the quality of the information (and the person sharing it), to understand more completely the part an actor plays in a social drama, and ultimately to put the whole situation into perspective" (1998, p. 93). Most ethnographers will combine participant observation with interviews, oral histories, or focus groups. They may also use other qualitative and multimodal methods such as photovoice, participatory video, asset mapping, participatory GIS, social media analysis, and open-ended questionnaires (Gubrium & Harper, 2013; Snodgrass, 2014). Ethnographers may also employ a variety of quantitative methods including surveys, pile sorts, social network analysis, cultural consensus, and cultural domain analysis (Bernard & Gravlee, 2014; Kronenfeld et al., 2015). The combination of these methods, among others, allows for a data-rich analysis, focused on the complexities of the human experience and in applied settings, critical insights into potential solutions in service of people.

Companies as diverse as Intel, Meta, Universal Theme Parks, Ford, and Hewlett-Packard are hiring ethnographers, as they seek to better understand the experiences, feelings, needs, and wants of current and potential clients. While traditional information-gathering techniques such as human factors research, user surveys, demographic surveys, focus groups, and product sales history can all be helpful for understanding clients, Jordan explains that they often "depend on past history and what the user tells the research." She adds, "For all of us, what we say we do and what we actually do are two very different things." (Jordan, 2013, p. 90). The inclusion of diverse ethnographic methods allows design specialists to move towards the goal of truly understanding what people do and how new technologies might concretely improve their lived experiences. Today, "design anthropology" is a rapidly growing subfield (Otto & Smith, 2020). For anthropology students interested in design, combining training in anthropological praxis with design courses such as UX research and design technology is presenting meaningful opportunities for these students to be both prepared and competitive in seeking design career positions.

**TECH 220/ANTH 384: Designing Technology for People**

The *Designing Technology for People* undergraduate course at Purdue University was designed to be co-taught between a design technology professor from Purdue Polytechnic and a cultural anthropologist from the College of Liberal Arts. The course is cross-listed across several disciplines, creating a diverse student body with students from the social sciences, engineering, UX, and technology design, among other fields. In the course, students are divided into teams, where each team is tasked with developing a design aimed to benefit a specific "user group." There have been a huge variety of user groups, covering topics such as Squirrel Watchers, Climbers, People with Debilitating Menstrual Pain, Dog Owners, Disabled Athletes, Gamers, Firefighters, and Pilots.

Throughout the course, students are introduced to ethnography and learn introductory ethnographic methods, including participant observation and semi-structured interviews. Each student is then required to conduct ethnographic research with their user group and submit fieldnotes that will be collectively analyzed by the team. Table 1 contains an overview of the fieldnotes templates students complete as part of the assignment. After each fieldnotes submission, teams collectively analyze and reflect on their data using a separate "Team Memo" template. Each team will then meet with another team, who will review their analysis and offer reflective feedback. See Tables 2 and 3 for an overview of the Team Memo analysis and feedback process.

*Table 1: Research Templates*

| Participant Observation | Interviews |
|---|---|
| **Setting and Context:** Where are you? What's going on? | **Interview Focus:** What is the focus of this interview? Provide a description. |
| **Description of Participants:** Who is there? Describe them. | **Setting and Context:** Where are you? How are you conducting this interview? |
| **Chronology of Events:** Document what goes on while you are there; be detailed. | **Description of the Interviewee(s):** Who are you interviewing? Describe who they are. Why are you interviewing them? |
| **Describe technology being used:** What technology is employed? How is it used? | **Interview Questions and Responses:** What questions did you ask? How did they respond? (List in order) |
| **Conversations:** What gets discussed verbally or otherwise? | **Self-Reflection:** What are your key takeaways, insights, feelings, thoughts? Keep in mind, this is your initial analysis. |
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*Table 2: Team Memo*

| Team Memo Template |
|---|
| **Patterns of Behavior:** What was similar / different in what you observed?<br>• List 3-5 things that everyone observed (backed with evidence from the fieldnotes)<br>• List key different findings of interest (backed with evidence from the fieldnotes) |
| **Group Reflection:** What was similar / different about our fieldwork experiences?<br>• What are we learning from doing fieldwork, individually and as a team?<br>• What is interesting and/or surprising about our different information, insights, and ways of working?<br>• How can we make the best use of team-based ethnography going forward? |
| **Design Ideas:** Share ideas about how technology use is going, what may be missing, innovation possibilities, etc. |

*Table 3: Team Report Out*

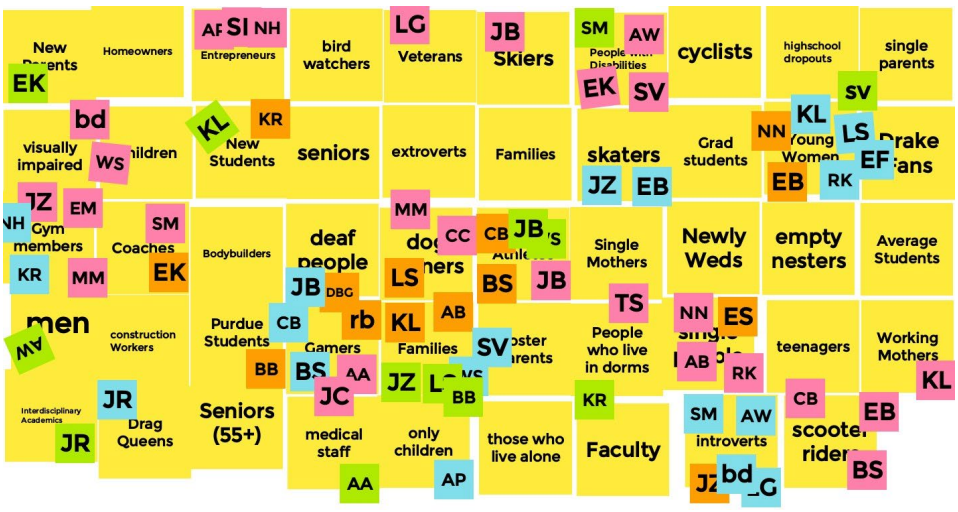
| Team Report Out | | |
|---|---|---|
| | **Our Report** | **Their Feedback** |
| **Progress** | | |
| **Learning** | | |
| **Activities** | | |
| **Need to Know** | | |
| **Other** | | |

Once students complete the data collection portion of the course, they move into the design phase, led by the design technology professor. Students are tasked with creating a final design sketch and mock-up that is informed by their ethnographic data (students will have the opportunity to turn their mock-up into a prototype in the subsequent course, *TECH 340: Prototyping Technology for People*, which is co-taught by a design technology professor and a professor from the business school). Once they have a final design sketch, students are also tasked with conducting market research (e.g., patent search, benchmarking) and collecting stakeholder feedback. At the conclusion of the semester, students are required to present their designs. Top-performing teams will have the opportunity to participate in a competition in front of a panel of expert judges. All teams selected for the final competition will win prize money, with the top team taking home $1,000.

## Case Study: The Squirrel Squad

On the second day of the course, students brainstorm potential user groups using an Online Sticky Note program (see Figure 1). Once several pages of sticky notes have been filled, students vote for their top choices by placing their initials on several sticky notes. Using this data, the professors will select final teams. Outside of class, students will complete a survey ranking their top choices from the final list. The professors will use this data in combination with factors such as their majors (e.g., ensuring that there is a social scientists on every team) to select final teams. In Fall 2022, one of these final teams was the "Squirrel Watchers," or the "Squirrel Squad," as they renamed themselves.

*Figure 1: Brainstorming User Groups (Jamboard)*




Purdue University is a campus known to celebrate its vibrant squirrel community (The Exponent, 2013). The squirrels are so beloved by many students that there are several social media sites dedicated to the topic and at one point, there was an official "Squirrel Club – Purdue University." Immediately

adjacent to Purdue's campus there is even a "Squirrel Park," where the city of West Lafayette, IN recently approved major renovations and improvements (Nair, 2023). Despite all of this excitement about squirrels in West Lafayette, team "Squirrel Squad" started their research by focusing on potential challenges squirrels might present to campus. They felt that their design needed to focus on a "problem."

To learn more about these potential design problems, they spent hours engaging in true "squirrel watching." As one student described,

> Sitting on a very nicely placed concrete bench, I already hear the snickering of the wildlife. In campus [sic], I saw an overwhelming majority of Grey squirrels and Fox squirrels … The squirrels are borderline sedentary. They lie down on the concrete borders, strut up to people without a care in the world, and feast on their choice of nuts in the open. The Fox squirrels are most often found on the ground, and while they do climb trees, I never saw them actually do it. I would chase one around and it would grab onto a tree and just hide on the other side.

They also interviewed professors and groundskeepers with expertise in wildlife management. Some problems were identified (e.g., eating through wires, digging holes), but even these experts were not overly concerned about the squirrels. As a professor in landscape architecture explained, deterrent technology on campus is often focused on rabbits, who frequently destroy plants. Squirrels, on the other hand, were seen as helping promote the "biodiversity of native species." This was echoed by a senior studying landscape architecture, who said, "Squirrels actually add to the biodiversity of an environment. Sometimes they store seeds for the winter and never dig them back up. They plant plants without even realizing it."

Given their own playful squirrel experiences while engaging in participant observation and feedback from the "squirrel experts," by Team Memo #3, it became clear that the students were ready to shift gears. In their words,

> We have learned that squirrels are everywhere and are universally funny to watch. No matter how hard we look for problems, there is no point to trying to solve them. … By shifting our focus from "what squirrel-related problems can we solve?" to "how can we enhance squirrel-related experiences?"

Inspired by their initial ethnographic findings, students started to creatively think of ways to enhance squirrel interactions, that were safe for both the humans and the squirrels. For example, one student visited "Wolf Park," a wolf conversation center in Lafayette, IN, which is open to the public. Their goal was to observe how guests were able to interact with wolves from a safe distance. Reflecting on the experience, the student wrote in their fieldnotes:

> We have to learn, observe, and educate others on animals. With our squirrel problem, we need to figure out how to Live with them around and learn about them so we and the squirrels live safely. … I think that a squirrel viewing area for an obstacle course or stylized feeder would be very cool. We would need access to woodworking and a constant supply of seeds and food supply for the squirrels. We could make a Purdue-related squirrel feeder.

This idea of enhancing the squirrel-watching experience on campus was also appealing to many students they interviewed. As one team member described in their notes:

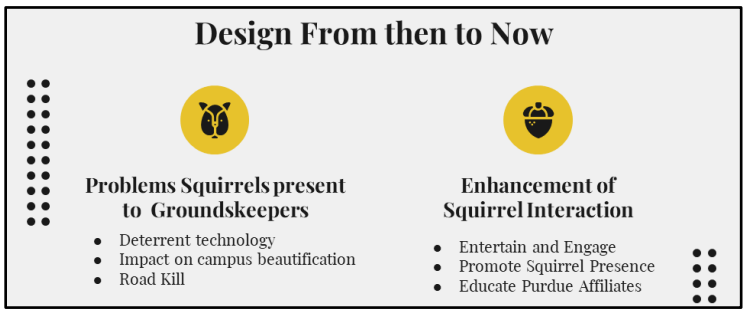
> [The interviewee] said that it would be cool to see like a swing or small table hanging from the tree for the squirrels to sit on and eat. She said to make sure that the food is natural food for the squirrels. She felt that even benches with feeders would be cool and appeal to many of the visitors for that are on campus [sic] … She said that she sees a lot of squirrels in the trash cans so having a feeder for them if anything should give them a healthier diet.

By the time the students wrapped up their data collection, the Squirrel Squad provided the following "Problem Statement" inspired by their ethnographic data:

> Squirrels are a center of Purdue's campus life and are loved by anyone who comes to Purdue University. People find them hilarious, cute, and entertaining. There are a few exciting ways to encounter these squirrels in a safe way too. We want to find a solution to enhance the squirrel watching experience. We desire to develop Purdue themed squirrel feeders to place around campus in order that affiliates can observe, learn, and appreciate their unique presence and activity around Purdue campus.

By combining participant observation, interviews, and secondary sources of data (e.g., virtual research, documentaries), in combination with analysis and reflection, the Squirrel Squad was ultimately able to move away from their own perceptions of what the design should focus on (a "squirrel problem"), to a human-centered design ("enhancing squirrel interactions"), inspired by their ethnographic research.

*Figure 2: "Design from Then to Now" (Squirrel Squad: Final Presentation)*




**Engineer's Notebooks**

Inventors, engineers, technology specialists, and designers are all required to carefully record their thoughts, observations, and processes (Kelley, 2011). One way this can be done is through an engineer's notebook. Traditionally, an engineer's notebook is specially designed for engineers to record their design thoughts and report technical information for their own use and for the use of others who are working on similar design problems. There are increasing calls to use engineer's notebooks in the design technology classroom (Asunda & Hill, 2007; Hill, 2006; Kelley, 2011). The engineer's notebook allows students to "optimize, troubleshoot, and redesign efficient and effective products that meet a human need" (Asunda & Hill, 2007, p. 40). Conveniently, it also provides students with a thorough legal tool to protect their ideas (Kelley, 2011, p. 33). For instructors, detailed documentation creates an opportunity for holistically evaluating students' engineering design thinking, including their reflective process (Kelley, 2011, p. 32). Reflection is critical, as it allows students to communally and systematically engage in a "meaning-making process," where they can deeply understand how their ideas connect while evaluating their own growth throughout a project (Rodgers, 2002, p. 845).

Traditionally, engineer's notebooks have been hardcover, measuring approximately 9"x 11 1/2", and have approximately 100 to 150 pages (Green & Conner, 1997). Increasingly, engineer's notebooks

are virtual, using programs such as Box, Google Drive, Dropbox, and Microsoft OneNote. On team projects, virtual engineer's notebooks allow for better collaboration and real-time contributions among teammates.

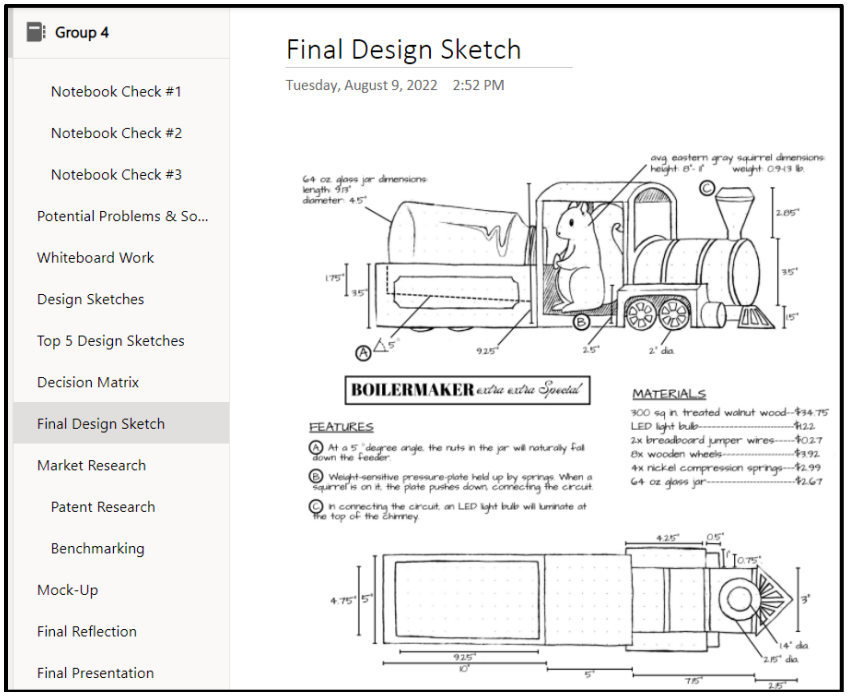
Virtual notebooks are currently being used in *Designing Technology for People*. The students begin using the engineer's notebook at the beginning of the semester and document the entirety of their process, including their ethnographic research, design process, and final design sketch. Reflection is also consistently built into various sections of the notebook. See Table 4 for an overview of the components included in the course's engineer's notebook. See Figure 3 for an engineer's notebook example from the Squirrel Squad.

*Table 4: Engineer's Notebook*

| **Engineer's Notebook** | |
|---|---|
| **Meet the Team** | Upload a photo of each team member. Also include your major, year at Purdue, email, and results from your personality tests (including your strengths and weaknesses). |
| **Team Norms and Organization** | List your team norms and regulations here. These are norms that you have all agreed to follow. |
| **Team Communication** | Post all team communication here. For example, if you have a WhatsApp group, take screenshots and post images here. |
| **User Definition** | Give a concise and clear user definition and create a clear rationale for the definition. Your team should revisit 3 times or more. Add date. |
| **Problem Statement** | Please create a concise and clear problem statement and a rationale for the definition. Your team should revisit 3 times or more. Add date. |
| **Fieldnotes** | Upload fieldnotes here. We have included templates. Use the "Interview" template if you conduct an interview. Use the "Participant Observation" template if you conduct participant observation. |
| **Team Memos** | Your team should complete the following Team Memo after submitting fieldnotes. |
| **Team Report Out** | Please use the following template to share your team's reflections with another team. Write their feedback in the adjacent column. |
| **Gantt Chart** | Please create a Gantt Chart (or an acceptable alternative), where you track all design tasks and assign tasks to team members with due dates. |
| **Whiteboard Work** | Includes images from all work conducted on classroom whiteboards, digital whiteboards, or other written notes. This can also include memos or CAD drawings. |
| **Criteria and Constraints** | List criteria and constraints your team must consider in developing a potential design. The criteria and constraints should be inspired by your ethnographic data. |
| **Initial Design Sketches** | Draft at least 35 unique design sketches. |
| **Top 5 Sketches** | Include sketches for your top 5 design ideas. Keep in mind that these sketches should have great detail. Be sure to number and title your sketches. |
| **Final Design Sketch** | Your final design sketch should go here. This design sketch should be highly detailed, showing both process and a variety of angles. |
| **Patent Search** | Include any relevant patent designs. **Do not** simply include links. Rather, include screenshots of the patent and a description of the design, including how it relates to your project. |

| | |
|---|---|
| **Benchmarking** | Include any products that relate to your design. **Do not** simply include links. Rather, include screenshots of the product and a description of the design, including how it relates to your project. |
| **Stakeholder Feedback** | Provide a detailed description of your stakeholder feedback. Include how you collected the data (e.g., Who did you speak to? How did you gather the data?), what you learned, and how this feedback impacts your design (positively and negatively). |
| **Final Mock-up Image** | Include images of your mock-up. Highlight different angles and functionality. |
| **Final Project Description** | Please write a one-paragraph description of your final mock-up. Explain exactly what you have designed and how it will benefit your user group. |
| **Final Presentation Slides** | Please include an attachment to your final presentation slides. |
| **Final Team Reflection** | Write a 500-word final team reflection. The following are suggested (but not limited to) prompts for completing this assignment:<br>• What are some things you learned about people/research that you did not know before this class experience?<br>• Describe some specific design techniques and elements of the overall design and innovation process.<br>• When did you experience obstacles or moments of frustration? How did you overcome these challenges?<br>• What are your thoughts at the end of our semester-long experience with designing technology for people? |
| **Notebook Checks** | The instructors will complete the Notebook checks. The rubric for the notebook check (attached here) will be used for your final grade. |

*Figure 3: Squirrel Squad's Engineer's Notebook*



**Case Study: Squirrel Squad's Mock-up**

Once the Squirrel Squad completed their ethnographic fieldwork and analysis, the course shifted into the design phase. This is when the benefit of having a co-taught course becomes most visible. The anthropology professor continues to support students by ensuring that their design is connected to their data and that they collect quality stakeholder feedback once they have a final design idea. Meanwhile, the design technology professor works closely with students to critically consider how to effectively create the design, while providing substantial feedback on the engineer's notebook. Tasks include supporting students in developing criteria and constraints, sketching, market research, material considerations, and designing the mock-up.

As described in their Problem Statement, the Squirrel Squad opted to move forward with a Purdue-themed squirrel feeder that could be located on central campus locations. Their criteria included: 1) Maintenance/ease of use; 2) Visual appeal and entertainment; 3) Squirrel intractability; 4) Mounting versatility (location); and 5) Ease of Construction. Their constraints included 1) Durability; 2) Cost; and 3) Environmental Impact. They had several creative feeder designs but ultimately decided on the "Boilermaker Extra Extra Special," modeled on Purdue's Boilermaker Special, the train that serves as university's official mascot. In addition to creating a permanent campus feeder, based on the stakeholder feedback they received, they also opted to create an "easy-to-build kit," which could be purchased for home assembly. The students put a lot of work into mock-up process, spending extensive time in the Innovation Lab (a lab run by Purdue's Design and Innovation Learning Community), where they took advantage of tools such as 3D printing and laser cutting. Ultimately, they were able to develop a functional mock-up. See Figures 4 - 7 from the Squirrel Squad's final presentation to learn more about their final design.

*Figure 4: Design Ideas*

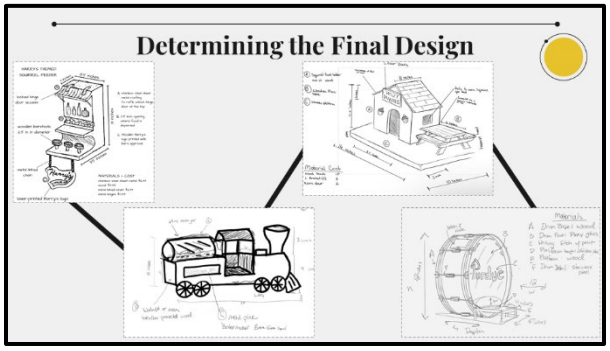



*Figure 5: Final Design*

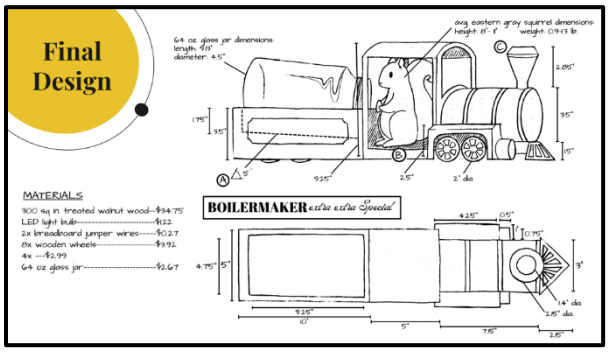


*Figure 6: Mounting*

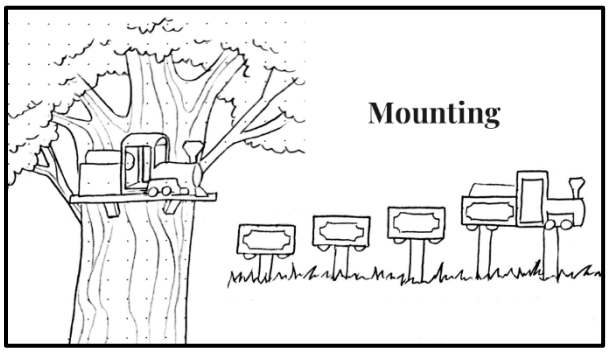



*Figure 7: Final Mock-up*


## Conclusion

Preparing both design technology and anthropology students in human-centered design requires both methodological training and practical experiences. *Designing Technology for People* is a course that is uniquely positioned to support students in gaining these skills through a combination of ethnographic research methods, design technology skills, and the pedagogical value of experiential and interdisciplinary education. Co-teaching is not common in universities, as it is resource intensive. Nonetheless, as this course demonstrates, interdisciplinary courses are beneficial to students as they learn how the combination of different disciplines can improve their design skills. If at its core design is intended to improve the human experience, understanding people is critical, and learning how to collect quality data about people is necessary. It is for this reason that anthropologists are increasingly getting hired in design positions because of their strong ethnographic skills (Jordan, 2013; Otto & Smith, 2020). For design technology students, training in anthropology will expand not only their methodological approaches but also how see the world and understand people. These skills will widen the career opportunities available to them, while epistemologically and functionally strengthening their skills as designers.

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