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Engaging ethnography in the human-centered design technology classroom

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Abstract

In design technology 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. Given this need to comprehensively understand the user experience in design technology, ethnographic techniques are increasingly being used to holistically understand people, with the goal of improving their lives through human-centered design. To train design technology students in ethnography, this paper considers one model for teaching human-centered design, using ethnographic methods. *Designing Technology for People*, an undergraduate-level course offered at Purdue University, is co-taught by faculty from the Department of Anthropology and the Department of Technology Leadership & Innovation. Throughout the course, students gain experience conducting basic ethnographic research and analysis, in addition to developing a virtual engineer's notebook and a design mock-up, shaped by their ethnographic findings. This paper turns to one case study, "The Squirrel Squad," to ethnographically review how the course is taught and the value of co-teaching courses with specialists in both ethnography and design technology.

Keywords

Human-centered Design, Ethnography, Anthropology, Convergence Education, Design Technology Education

Introduction

In design technology education, instructors value student outcomes centered on concrete design ideas and a comprehensive understanding of prototyping. However, design technology education must consider not only the general technology design process and quality but also human-technology interactions (Briller et al., 2016; Martinez, 2023; Nguyen et al., 2022; Zoltowski et al., 2012). Inevitably, designs for people are enmeshed in complex sociocultural contexts, inseparable from human needs, values, and desires (Miller, 2018).

Given this need to understand the user experience in design technology, ethnographic techniques are often used to holistically understand people, with the goal of improving their lives through human-centered design (Clarke, 2017; Drazin, 2021; 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, to gain a deeper understanding of human behavior, considering opportunities and limitations on how people interact with current technologies. This immersive research approach provides insights into how to develop designs that will better satisfy people's needs and wants.

The aim of this article is to examine how ethnography can be effectively taught to aspiring designers. Through this case study of one undergraduate-level human-centered design course, Designing Technology of People, we focus on enhancing pedagogical strategies in design technology classrooms. *Designing Technology for People*, an undergraduate-level course offered at Purdue University, is co-taught by faculty from the Department of Anthropology and the Department of Technology Leadership & Innovation. This course employs a convergence educational model which aims for the "deep integration of knowledge, techniques, and expertise from multiple fields," (Herr et al., 2019, p. 228), allowing learners to apply these skills across disciplines through transdisciplinary teaching to create innovative solutions to meaningful problems (National Science & Technology Council, 2022). We also combine a learner-centered teaching approach, where the educators are responsible for "facilitating the acquisition of knowledge," while students are required to engage in the "hard and messy work of learning" by practicing content through the active engagement of skills (Weimer, 2013, pp. 10–11), with project-based, experiential learning. In this course, student-driven collaborative projects are central to the learning process, fostering problem-solving and decision-making (Chua et al., 2014; Han et al., 2024).

In this co-taught course, students are introduced to ethnographic research design, data collection, and analysis through a hands-on research project. This ethnographic process is combined with training in design thinking and is used to develop a comprehensive engineer's notebook and final design mock-up. This paper reviews how this learner-centered, convergence course is taught through a case study example, to consider a creative opportunity for engaging ethnography in teaching 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 design (Kramer et al., 2016; Still & Crane, 2017). 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 can 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, 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. 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 (Briller et al., 2016). This approach has important implications for the long-term success of projects. As described by Zoltowski et al., human-centered design approaches have been "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).

Of course, there are many approaches to teaching human-centered design in the design technology classroom, where the goal is to encourage students to learn how to engage "humans" in the design process as "subjects" rather than "objects" (McCarthy & Wright, 2015). Cognitive psychology, often with a focus on human factors research, has been one major approach. Mixed-methods techniques common in market research such as questionnaires, pile sorts, customer surveys, consumer demographics, and purchase records have been others (IDEO, 2015; Wasson, 2000, pp. 377–378). Other qualitative and multimodal techniques such as participatory storyboarding and drawings, social media analysis, mapping, empathic modeling, naturalistic inquiry, and participative experiences are also becoming increasingly popular (IDEO, 2015; Tomitsch et al., 2020; Tomitsch & Hepburn, 2020). Several of these methods, especially those that are "immersive," are directly or indirectly inspired by ethnography and its core methods, such as participant observation. In using a case study to present how ethnography is taught in our course, our goal is to not only list how these methods can be taught but to demonstrate how ethnography and design can be creatively interwoven into the classroom experience through the ethnographic presentation of a case study.

Ethnography as methodology

The inclusion of ethnography in design has become so popular that the design anthropologist Christine Miller asserts that "young designers have never known of a world where design happened without ethnography'" (2017, p. 89; 2014, p. 63, citing Wasson, 2000, p. 382). Yet, concerns exist that the use of the term ethnography, both in design and beyond, is being so broadly applied, that it has lost its meaning (Ingold, 2014; Miller, 2017, p. 90). For this reason, before moving into an overview of how Designing for People is taught, it is critical to provide an overview of how ethnography as a methodology and ethnographic methods are framed in the context of this course.

Dating back to the 19th century, cultural anthropologists have engaged in ethnography 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, experience where researchers can engage all of their senses as they seek to understand the lived realities of the people with whom they work.

Participant observation is a quintessential method ethnographers use to learn about people. In participant observation moments of "pure observation," may exist but the researcher's goal is not to act as a "neutral" or "outside" 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, always with consent from the participants. While gathering data, it is common for the ethnographer to

jot memos and, with the proper permissions, 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.

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 various types of interviews (e.g., oral histories, go-along interviews, 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 can also employ quantitative and mixed methods such as 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 (Negrón et al., 2024).

Ethnographers have contributed to the design of many well-known products, including Yoplait's Go-Gurt (Squires, 2021), the Xerox machine (Suchman, 2013), and MP3 players (Brown, 2012), to name a few. As Nuzzolillo highlights, anthropologists bring valuable skills to professional design, such as empathy, deep contextual understanding, cultural relativism, systems thinking, expertise in qualitative methods, and strong synthesis and storytelling abilities (2020). These skills are crucial for students pursuing careers in human-centered design. Recognizing this, companies like Intel, Meta, Universal Theme Parks, Ford, and Hewlett-Packard have hired cultural anthropologists and ethnographers to better understand the experiences, needs, and desires of their clients (Jordan, 2013; Otto & Smith, 2020). 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 researcher." 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 more closely understanding what people do and how new technologies might improve their lived experiences.

Today, within anthropology, "design anthropology" is a rapidly growing subfield (Miller, 2018; Otto & Smith, 2020), with minors and concentrations across universities becoming increasingly popular. For anthropology students interested in design, combining training in anthropological praxis with design courses such as UX research and design technology presents meaningful opportunities for these students to be prepared and competitive in seeking design career positions (Santee, 2019). The flip side of this would likely also be true for design students, who

may benefit from formal training in ethnography, whether through anthropology or a related field in the social sciences.

Designing Technology for People is a course that acts as a bridge. Although introductory in nature, it is intended to bring both experts and students in anthropology and design technology together to collaboratively practice ethnographically-driven design. By providing a step-by-step example of how we use ethnography in combination with design technology education, we hope that other design technology educators may experiment with this approach and ultimately contribute to future scholarship on teaching ethnography to design technology students.

Why share *Designing Technology for People's* approach to teaching ethnography and design?

This article was inspired by a presentation given by the authors at the 1909 Conference, an annual design technology and engineers education conference. Presented in-person by Sarah Renkert, one of the anthropologists on the teaching team, this presentation received honorable mention for the Epsilon Pi Tau Outstanding Presentation Award, which is awarded based on votes from conference participants. Throughout the conference, Renkert was approached by several attendees, all of whom are educators in design technology and engineering, interested in learning more about the structure of the course, activities, and templates used to teach ethnography. Given the excitement generated by this presentation, the authors of this article decided to move forward with publication, recognizing that other design technology educators could benefit from this pedagogical example. This article seeks to provide a clear and applicable example of how ethnography can be taught through a learner-centered approach in the design technology classroom, informed by the expertise of both cultural anthropology and design technology.

It is also important to note that this course development relates to a larger NSF-funded research program that considers novel structures for expanding convergence education. In this broader research program, enablers and barriers for expanding convergence teaching and learning overall and for design and innovation education specifically were explored (G. J. Strimel et al., 2022, 2023). By investigating in depth, the making of a Design and Innovation minor and how Colleges of Technology, Liberal Arts, and Business collaborated on this initiative over time, much insight was gained into how programs can be launched at the intersections of multiple fields. In a variety of classes and numerous ways, the research team was able to examine cross-disciplinary and collaborative teaching and what bolstered or hindered these educational experiences. Here we will take a deeper dive into a core foundational class that marries ethnographic approaches and design education and is a springboard for students developing this kind of blended mindset and applying it as they continue in their education and out into their work lives.

The decision to focus on a single case study for this article is, in itself, ethnographic. Hyett, Kenny, and Dickson-Swift explain that "Case study research is an investigation and analysis of a single or collective case, intended to capture the complexity of the object of study" (2014, p. 2). By taking an inductive look at a single project, we are better able to elucidate the process and experiences the students moved through as they started with a user group and moved toward a design mock-up. We can tell their story not in the abstract, but with rich detail (Bronk, 2012;

Flyvbjerg, 2006). Moreover, presenting the findings through an exemplar case study framework enables us to illustrate the nuanced aspects of teaching design thinking. We believe this approach can provide educators with not just a theoretical understanding but a practical guide to replicate and adapt the process in their own teaching. By doing so, a key goal is to help foster innovation and creativity in contemporary learning environments. By sharing this case study, we hope to contribute to a broader conversation about how convergence education and project-based learning can be effectively implemented in the learner-centered classroom (Chua et al., 2014; Han et al., 2024). Additionally, although convergence education via two instructors from different fields may not always be feasible, this case study will exemplify the opportunities co-teaching can present when universities bring disciplines together. As such, this case study aligns with wider conversations about how to advance convergence education moving forward (National Science & Technology Council, 2022).

Designing Technology for People: An Overview

The *Designing Technology for People* undergraduate course at Purdue University was originally 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 fact, students from 65 different majors have participated in this course. In the class, 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 variety of user groups, covering topics such as Climbers, People with Debilitating Menstrual Pain, Dog Owners, Disabled Athletes, Gamers, Firefighters, and Pilots, to name just some. The case study discussed in the latter part of this article will look at the "Squirrel Watchers" team, better known as the "Squirrel Squad," as they renamed themselves.

These teams are selected in the first week of class after students brainstorm potential user groups using an Online Sticky Note program (see Figure 1). Once several pages of sticky notes have been filled by students, students vote for their top choices by placing their initials on several sticky notes. Using these 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 combine student preferences with factors such as their majors (e.g., spreading out the social scientists, design technology, and other students) to select final teams. Students may have deep familiarity with a user group such as being a college athlete themselves- or be a complete novice. Some topics regularly come up each semester- and others, like this case study, are much more novel and surprising.

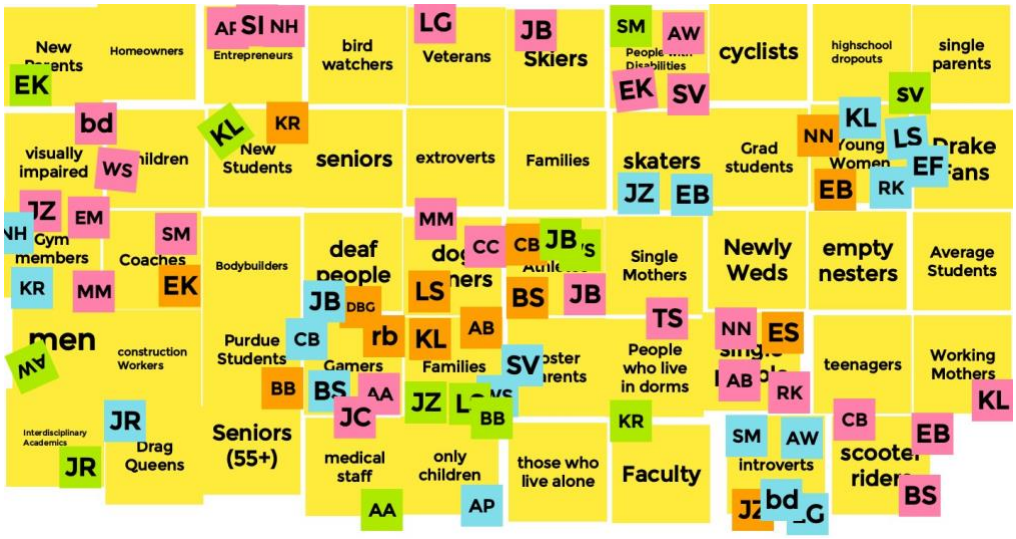

Fig. 1: Brainstorming User Groups

During the first part of the semester, students are introduced to ethnography and learn introductory ethnographic methods, with a focus on participant observation, semi-structured interviews, and the importance of triangulation in the data analysis process. Each student is then required to conduct ethnographic research using a variety of methods on three to four occasions, 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 patterns and differences, and reflect on their data using a separate "Team Planning 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 Planning Memo analysis and feedback process (the templates for Tables 1, 2, and 3 were inspired by Angrosino, 2001 and McCurdy et al., 2004).

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 searches, benchmarking and collecting stakeholder feedback). At the conclusion of the semester, students are required to present a mock-up of their design.

All data and notes recorded by students throughout the semester are kept in an engineer's notebook. Traditionally, an engineer's notebook is intended for professional engineers to record their design thoughts and report technical information for their own use and the use of others working on similar design problems. However, there are growing calls to use engineer's notebooks in the design technology classroom (Asunda & Hill, 2007; Hill, 2006; Kelley, 2011). For instructors, detailed documentation creates an opportunity for holistically evaluating students' engineering design thinking, including their reflective process (Kelley, 2011, p. 32). 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.

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 $1000. Teams are selected for the final competition based not entirely on their design in itself, but on their ability to demonstrate how their design connects to their ethnographic data.

Table 1 Research Template

Participant Observation	Interviews
Setting, Date, Context: Where are you? When is this happening? 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? • List 3-5 things that everyone observed (backed with evidence from the fieldnotes) • List key different findings of interest (backed with evidence from the fieldnotes)
Group Reflection: What was similar / different about our fieldwork experiences? • What are we learning from doing fieldwork, individually and as a team? • What is interesting and/or surprising about our different information, insights, and ways of working? • 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.

Adapted from Angrosino, 2001 and McCurdy et al., 2004

Table 3 *Team Report Out*

Team Plan Report Out *Use the 5W's below to draft your plan. You will use this plan on Wednesday to get feedback from two other teams.*
OUR PLAN
Who? Who will you be working with?
What? What will you be doing and asking?
Where? Where will you be observing? Finding other information?
When and Why? When and why will you be using this strategy?
How to move forward? How will you use these activities to learn about the user group, develop design ideas, and make progress?
Team Feedback ***Wednesday in-class****: Based on your plan, what specific feedback did you receive from other teams? Be as specific as possible to the 5W's and 'How we move forward' elements of your plan.*
Feedback – TEAM 1

Case Study: The Squirrel Squad

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 campus squirrels. Even the *Purdue Exponent*, the student paper, features a "Squirrel of the Week" photo on their Instagram page. At one point, there was an official "Squirrel Club – Purdue University," where students would gather to watch squirrels. The city of West Lafayette, where Purdue is located, has even named a park immediately adjacent to campus "Squirrel Park," which is currently undergoing 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 and others who engage with squirrels. They felt that their design needed to focus on a squirrel "problem."

To learn more about these problems, the team spent hours engaging in immersive "squirrel watching." As one student described in their fieldnotes,

> *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. (Fieldnotes #1, 9/18/2022, Student B[1])*

They also began interviewing experts. One of these students interviewed a professor in landscape architecture, with the hope of identifying a problem they could study. Although the professor emphasized that rabbits are a more significant challenge than squirrels, he noted,

> *We do have to take squirrels into consideration when it comes to urban planning. Some types of trees attract squirrels way more than others, so we have to be cognizant of what and where we plant. They also dig into lawns, and do damage to turf and soil. They eat just about everything." (Fieldnotes #1, 9/16/2022, Student A)*

This initial focus on looking at squirrels as a problem was reinforced in the Squirrel Squad's early conversations with class peers, during the first "Team Report Out" (see Table 3). Class peers mentioned that squirrels are a problem in several ways, including being a nuisance on the road, stealing food, and generally getting in the way of pedestrians. During this report out, it was also noted that humans contribute to squirrel problems by feeding squirrels, as students enjoyed interacting with them. The peer group explained that squirrels can be an attraction and that more trees could be strategically planted where people want squirrels (9/14/2022). Here we can see several squirrel problems, but also the first hints that their ethnographic data will not be universally negative.

During the second round of fieldnotes, the Squirrel Squad divided tasks, with some students conducting participant observation, while others continued with interviews. During the interviews, further squirrel problems were identified (e.g., eating through wires, and digging holes). However, like the Team Report Out, not all was problematic. A senior in landscape architecture who was interviewed explained,

> *There are a lot of pre-existing squirrel-deterring technology that [we] work with … That 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. (Fieldnotes #2, 9/24/2022, Student A)*

By Fieldnote #3, the design team explored not only on squirrel problems but ideas for appropriate human interactions with squirrels. For example, one student visited "Wolf Park," a wolf conservation center in Lafayette, IN, which is open to the public. Their goal was to observe how guests were able to interact with the 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*

[1] This team was made up four students, all of whom we thank in the acknowledgement section by name with their permission. However, in the article, we do not want to match specific quotes with names. Therefore, we have randomly assigned them as Student A (Animation Major), Student B (Teaching Design and Innovation Major), Student C (Anthropology Major), and Student D (Exploratory Studies Major).

> *constant supply of seeds and food supply for the squirrels. We could make a Purdue-related squirrel feeder. (Fieldnotes #3, 10/01/2022, Student C)*

Thinking about safe interactions with squirrels was seen as important, particularly given the tendency for students to feed squirrels, as was mentioned in Team Report Out #1. Likewise, in an interview with a Purdue undergraduate, the student mentions that they find them to be "cute and entertaining," but that the public needs help with education on how to interact with squirrels. She noted that a lot of students feed them, critically noting that this encourages squirrels to approach humans. *(Fieldnotes #3, 10/02/2022, Student D)*

By Team Memo #3, the Squirrel Squad still recognized that squirrels cause problems, but that they did not seem to be an overwhelming concern when compared to other animals, such as rabbits, especially given their potential to increase biodiversity. In light of these early observations, the students decided to start shifting 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?" (Team Memo #3, 10/03/2022)*

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. 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. (Fieldnotes #4, 10/07/2022, Student C).*

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. (Engineer's Notebook, Problem Statement, 10/19/2022)*

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.

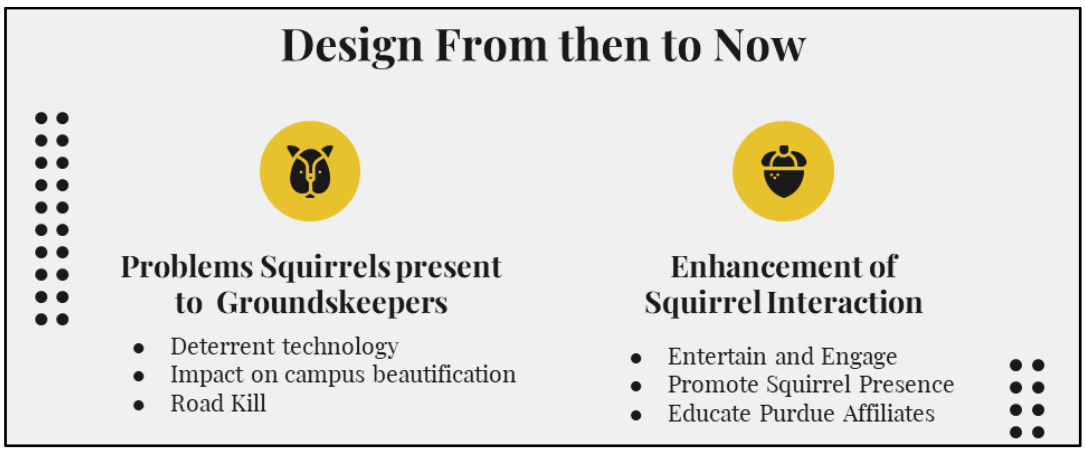

Fig. 2 "Design from Then to Now" (Squirrel Squad: Final Presentation)

Once the Squirrel Squad completed their ethnographic fieldwork and analysis, the course shifted into the design phase. This phase is when the benefits of having a co-taught course become 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 their engineer's notebooks (see Figure 3 for a view of the Squirrel Squad's Engineer's Notebook). After completing fieldwork and the collective ethnographic analysis, the Squirrel Squad opted to move forward with a Purdue-themed squirrel feeder that could be installed at central campus locations.

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 the 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 the mock-up process, spending extensive time in the Innovation Lab (a prototyping space managed by students within Purdue's Design and Innovation Program), 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 - 6 from the Squirrel Squad's final presentation to learn more about their final design.

The Squirrel Squad was selected for the final design competition, placing third. In assessing which student team will be selected for the final competition, the professors in *Designing Technology for People* are particularly interested in designs that are inspired by the fieldwork process. Specifically, teams are encouraged to share their "story," giving the audience a cohesive understanding of how the data connects to the final design. Successful teams clearly demonstrate how their ethnographic data and analysis led them to the development of a human-centered design. One of the key reasons the Squirrel Squad was selected was because they clearly described the relationship between their ethnographic observations and analysis and their final design. They effectively described their methods (participant observations, semi-structured interviews, informal conversations, secondary literature), demonstrated how their data and analysis shifted across each of the fieldwork submissions, and then had a final mock-up that was inspired by these data.

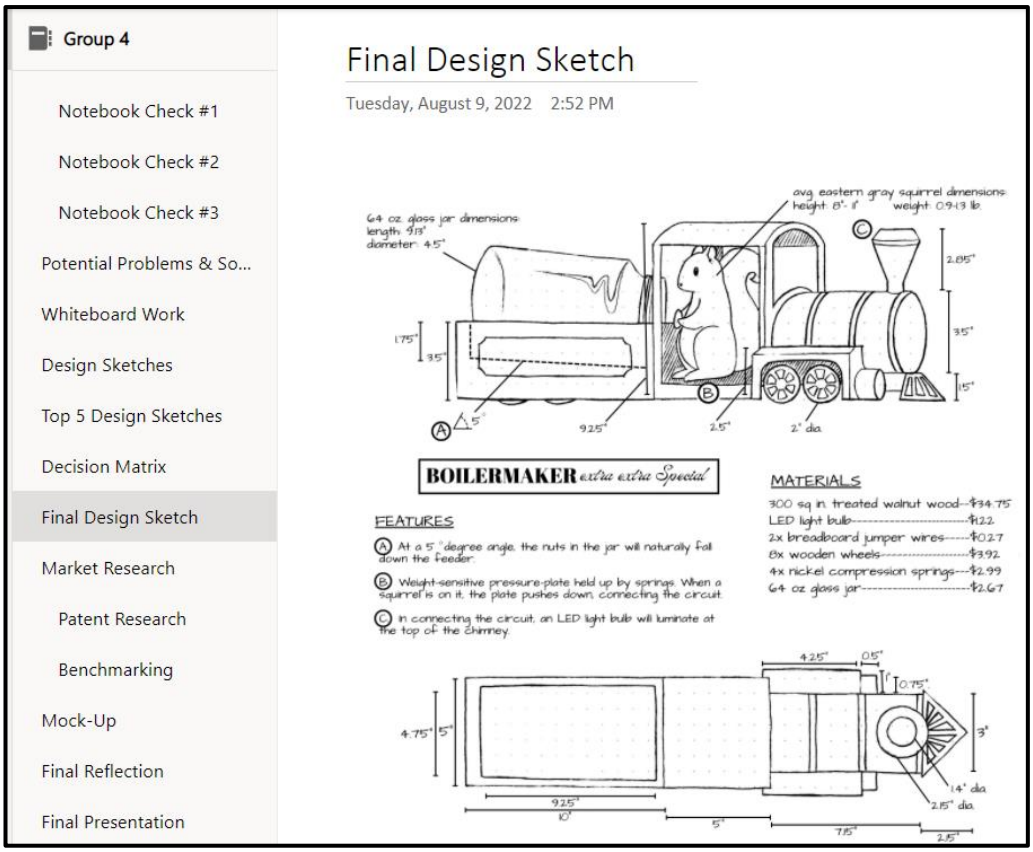

Fig. 3 **Squirrel Squad's Engineer's Notebook**

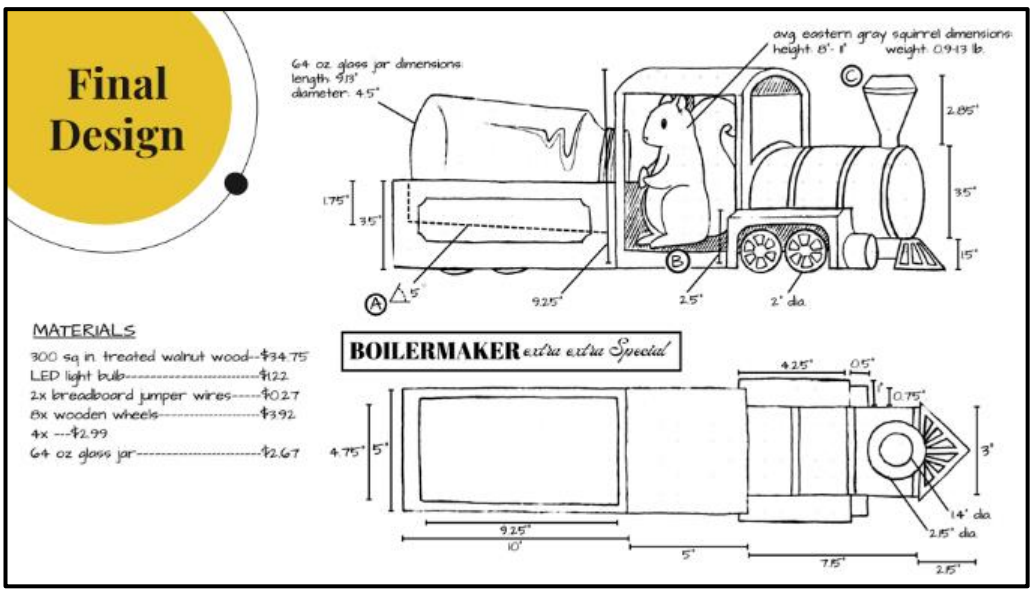

Fig. 4 Final Design

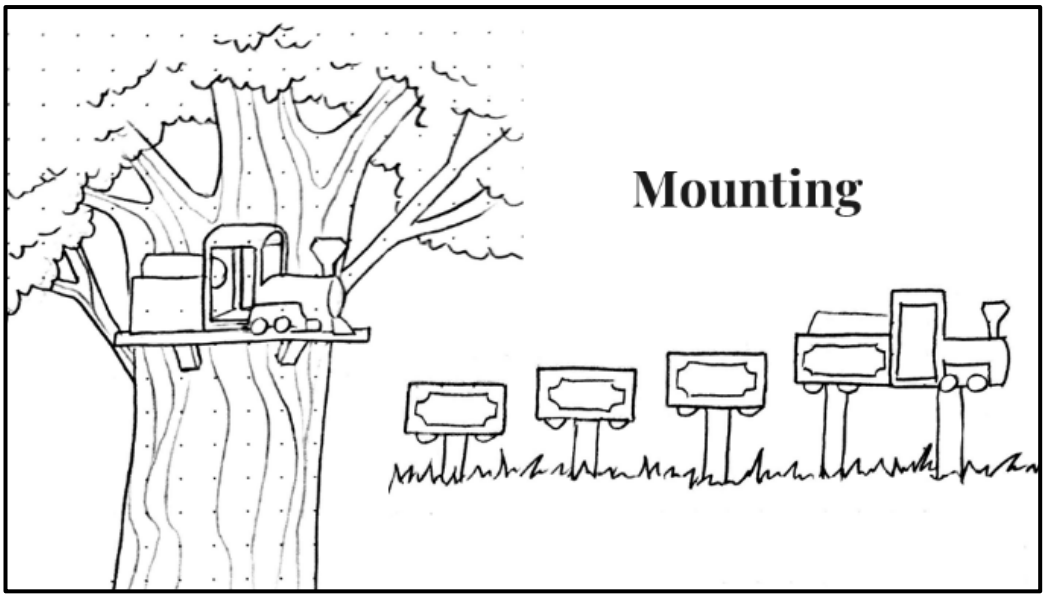

Fig. 5 Mounting

Fig. 6 Final Mock-up

The Squirrel Squad's Final Reflections

At the end of the semester, students in *Designing Technology for People* are asked to engage in an individual and group reflection process, where they consider what they learned throughout. While these evaluations are intended for student reflection, they are also critical resources for the instructors, as they provide specific insights into students' key takeaways. Overall, students on the Squirrel Squad spoke highly of the course, valuing the applied fieldwork and cross-disciplinary nature of the teaching. Among other course components, the opportunity to learn ethnography was highlighted, with a focus on how their ethnographic data shaped their final outcome.

For example, in reviewing the fieldnotes process and collective data analysis, the team's lead designer explained,

> *The format of getting each student to go into the field and create a document to share with other groups is a stroke of genius. It was quite effective at furthering our progress in developing our plan against, and eventually for, the squirrels. (Individual Reflection, 12/08/2022, Student B)*

Here we can see that this student valued fieldnotes as a tool for recording data collection and the collective review process that occurred during class. This iterative process of reviewing fieldnotes as a group was considered highly valuable. Based on each week's group analysis, they were able to determine their next steps in the project and eventually their final design.

This student's quote also highlights how conducting multiple field visits and interviews was important in shaping their design direction. When the student says that they were initially "developing our plan against, and eventually for, the squirrels," we can see the shift in the team's thinking. They began their fieldwork viewing squirrels as a problem and in turn, thought they had to design to solve this problem. However, based on the data they collected, they decided to focus on finding a way to positively enhance squirrel-human interactions. The students mused on this shift in their group reflection as well, noting, "We researched our problem to its core and found that from all of our combined efforts, our initial problem statement had gaps." The key gap they were missing is that many people enjoy the squirrels. Based on this insight, "We decided to pivot our problem statement. We want to help how squirrels are viewed and how they are interacted with". (Team Final Reflection, 12/05/2022)

One student also spoke about how learning ethnography has reshaped how they think and view problems. In their words,

> *Through making ethnographic [sic] it has made me think critically and differently in simple situations that I would not have done before. For example, finding myself intrigued in my atmosphere sometimes, looking around, seeing people read books, talking with friends, riding bikes, drinking coffee etc. From what I have learned this semester I feel that I can proceed to try fixing problems that occur to me by using the design and innovate process and ethnographic aspects. (Individual Final Reflection, 12/05/2022, Student D)*

Here, the student is reflecting on how learning ethnography, in combination with design education, has taught them to pay attention to the small, everyday details. "Fixing problems" comes from understanding and participating in the daily interactions and contexts in which problems occur. Through ethnographic engagement, and participant observation in particular, the student feels empowered to use new blended skills to try and address challenges.

Finally, one student emphasized that the convergence structure of this course changed their career trajectory. In their words,

> *I first chose this class to fulfill a requirement on my course sheet, but I was surprised to find out that I would like it so much that I would change the direction of my desired career … The Design for People class, integrating tech and anthropology and having two*

> *instructors from separate fields, was a fantastic idea … This is the only class I have ever done fieldwork in and applied demonstrations. More classes need to be like this. (Individual Student Reflection, 12/08/2022, Student C)*

Ultimately, these reflections highlight that for the Squirrel Squad team, engaging with the ethnographic process empowered them to rethink initial assumptions and observations to develop a human-centered design grounded in their research. It is also exciting that for individual students in this group, the convergent teaching and learning approach of the course has influenced their approach to everyday problem-solving while opening the door to new and exciting career possibilities.

Conclusion

Preparing both design technology and anthropology students in human-centered design is enhanced by creative pedagogical approaches, robust methodological training, and experiential, learner-centered teaching. *Designing Technology for People* is a course that is uniquely positioned to support students in developing these skills by blending ethnographic research methods and design skills while emphasizing the value of experiential education. A critical feature of this course is its co-teaching model, bringing professional ethnographers and designers together to teach students through a learner-centered, convergence model. However, co-teaching can be difficult to implement as it is resource-intensive for universities; yet, our related research and teaching experiences show that it is worthwhile (G. Strimel et al., 2022). For this reason, one of our key goals in writing this article was to demonstrate our process, using a detailed case study to elucidate how students in *Designing Technology for People* are introduced to ethnography, collect ethnographic data, and ultimately connect these data to their final design. While making the Boilermaker Extra Extra Special, a feeder to enhance human squirrel interactions, may at first glance seem like a light-hearted or frivolous activity to some, the pedagogical goal and value have a much more serious purpose. We are using convergent education, combining ethnography and design thinking, to help prepare undergraduate innovators who are comfortable, knowledgeable, and skilled in working in these vital, blended ways.

While various human-centered approaches are already common in design technology education, this article offered a focused exploration of how ethnography can be introduced from the perspective of cultural anthropology, a discipline that has relied on this methodology for over a century. By actually engaging in a hands-on ethnographic project in the classroom, students in *Designing Technology for People* are not only exposed to the value of learning ethnography for design but also putting it into practice. This learner-centered approach to teaching offers students practical experience providing them with the opportunity to materially and experientially understand how an immersive approach to learning about people will benefit their design process.

Looking ahead, future research could explore how alumni of this course apply the ethnographic skills they have acquired in their professional design roles, offering valuable insights into how early exposure to ethnography shapes long-term human-centered design thinking. By tracking how former students integrate these methodologies into their careers, we could better understand the lasting impact of ethnographic design projects and how well classroom experiences prepare students to meet the evolving demands of the design field. In the

meantime, *Designing Technology for People* aspires to inspire the broader adoption of ethnographic teaching methods across design technology programs, enriching both students' educational experiences and the long-term outcomes of human-centered design. By continuing to explore the convergence possibilities between fields such as anthropology and design technology, we open up more opportunities for exploring creative approaches in the classroom and beyond that will ideally lead to creative 21st century designers and innovators.

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Conflict of Interest

The authors declare no conflict of interest.

Ethics approval

All procedures performed in studies involving human participants were in accordance with the ethical standards approved by the Institutional Review Board (IRB) at Purdue University under protocol # IRB-2021-266.

Consent to participate

Informed consent to participate was obtained from all individual participants included in the paper.

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