

Student use of design ethnography techniques during front-end phases of design

Ibrahim Mohedas, University of Michigan

Ibrahim Mohedas is currently a Ph.D. candidate in mechanical engineering at the University of Michigan. His research focuses on the design of medical devices for resource limited settings, particularly related to the use of design ethnography in developing these technologies. He received his B.S. in mechanical engineering from the University of Texas at Austin in 2011.

Dr. Shanna R. Daly, University of Michigan

Shanna Daly is an Assistant Research Scientist and Adjunct Assistant Professor in the College of Engineering at the University of Michigan. She has a B.E. in Chemical Engineering from the University of Dayton and a Ph.D. in Engineering Education from Purdue University. Her research focuses on idea generation, design strategies, design ethnography, creativity instruction, and engineering practitioners who return to graduate school. She teaches design and entrepreneurship courses at the undergraduate and graduate levels. Her work is often cross-disciplinary, collaborating with colleagues from engineering, education, psychology, and industrial design.

Prof. Kathleen H. Sienko, University of Michigan

Kathleen H. Sienko is a Miller Faculty Scholar and Associate Professor of Mechanical and Biomedical Engineering at the University of Michigan (UM). She earned her Ph.D. in 2007 in Medical Engineering and Bioastronautics from the Harvard-MIT Division of Health Science and Technology, and holds an S.M. in Aeronautics & Astronautics from MIT and a B.S. in Materials Engineering from the University of Kentucky. She directs both the Sensory Augmentation and Rehabilitation Laboratory (SARL) and the Laboratory for Innovation in Global Health Technology (LIGHT). SARL focuses on the design, development, and evaluation of medical devices, especially for balance-impaired populations such as individuals with vestibular loss or advanced age. LIGHT focuses on the co-creative design of frugal innovations to address healthcare challenges in resource-limited settings. Prof. Sienko has led efforts at the University of Michigan to incorporate the constraints of global health technologies within engineering design at the undergraduate and graduate levels. She is the recipient of a CAREER Award from the National Science Foundation, a Teaching Innovation Prize from the UM Provost, and a UM Undergraduate Teaching Award. While at MIT, she was a winner of the MIT \$50K Entrepreneurship Competition.

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Introduction and Background

Design ethnography seeks to understand “the broad patterns of everyday life that are important and relevant specifically for the conception, design, and development of new products and services”¹. The techniques of design ethnography, including observations and interviews, emerged from anthropology, where researchers attempt to understand cultures at a deep level². These ethnographic techniques were adapted for design processes in order for designers to better understand end-users, stakeholders, communities, cultures, and environments for which a product is developed. Techniques used in design ethnography have been advocated by some within the business community as awareness has increased that these techniques can lead to products and services that truly meet customers’ needs and provide a competitive advantage³⁻⁵. Design ethnography techniques support designers in eliciting information that informs decisions throughout design processes, but are particularly useful when defining the problem, understanding the voice of the customer, translating the voice of the customer into requirements, generating solutions, and developing and evaluating the end-product⁶.

The benefits of design ethnography have been primarily studied in the field of human-computer interaction where the difference in skill level between the designer (i.e., software developer) and the end-user is very large and, therefore, techniques are needed to ensure that the final product truly meets the needs and wants of end-users². The techniques of design ethnography have now expanded beyond human-computer interaction design to other fields where deep knowledge of stakeholders and the product use environment adds benefits to the final design. An emerging area is medical devices where designers are seeking to reduce medical mistakes caused by poor device design^{7,8}. While benefits of design ethnography during the ‘fuzzy’ front-end of design have been discussed within the product innovation literature and the benefits of investing time and money in these techniques have been documented^{9,10}, there is not widespread awareness of the value or use of these tools within both engineering education and broader design practice.

In addition, little research has been undertaken on how students learn and apply design ethnography skills. One study of graduate students using design ethnography techniques found that students’ interactions with end-users did not lead to major design changes, but instead produced superficial design adjustments, i.e. the students made changes to directly address user issues (such as adding an instruction manual or help file) instead of considering that their design might have deeper deficiencies¹¹. Another study found that the challenges students faced (such as multiple user perspectives and difficulty eliciting user feedback) when interacting with stakeholders caused them to reduce the level of their interaction with stakeholders later in the design process¹². Still another study found similar results, wherein students commented extensively to both their frustrations with using design ethnography and the benefits from its use; however, the frustrations students faced were often unrelated to design ethnography and the benefits were often superficial in nature¹³. These studies begin to show the complexity involved with using and learning the skills of design ethnography. Other research also demonstrates room for improvement in how students view the role of stakeholders in design. One study characterizing students’ perceptions of human-centered design revealed that student views on stakeholders during design varied significantly; from a complete lack of appreciation for

stakeholders during design to the development of significant relationships with stakeholders as design collaborators¹⁴.

As an increasingly appreciated methodology in engineering design, the use of design ethnography and the ways in which students learn to practice design ethnography require thorough study. An understanding of these techniques can help improve their application during design and support the development of relevant and effective design pedagogy. The research described in this paper contributes to addressing these gaps in knowledge by studying how engineering students apply design ethnography techniques in their capstone design projects. We focus on exploring the major challenges students encountered when applying design ethnography during the front-end design phases of problem definition and elicitation of user requirements.

Research Design

Study Purpose

Our study was guided by the following research question: What aspects of design ethnography do students find most challenging during front-end design phases?

To explore this question, we interviewed engineering student designers about their experiences during a design ethnography immersion program. This interview approach allowed us to come to a deeper understanding of students' perceptions of the usefulness of design ethnography. The Institutional Review Board of the University of Michigan approved the study and informed consent was obtained from all subjects before interviews began.

Participants and Context

Five engineering students, three majoring in mechanical engineering and two in biomedical engineering, were interviewed. The five students had just completed an eight-week design ethnography immersion program.

In preparation for the design ethnography immersion experience, students completed formal coursework that introduced them to aspects of design processes, including an emphasis on the use of design ethnography techniques during front-end design phases. During the course, students participated in discussions and completed activities to learn how to conduct observations (including how to use observation frameworks), design and conduct interviews with end-users and stakeholders, synthesize qualitative ethnography data into themes, and translate those themes to user requirements.

During the design ethnography immersion experience, students traveled to a teaching hospital in a middle-income country where they observed medical procedures and interacted with clinicians in an attempt to identify needs in the hospital. After identifying roughly 85 needs, the students were then tasked with selecting one need statement that would form the basis for their senior capstone design project. Afterwards, they conducted observations, interviews, and surveys to develop user requirements and engineering specifications for the selected need.

Data Collection

Semi-structured interviews were conducted with each student three to six weeks after they had completed the design ethnography immersion experience. The interview protocol guided

students through a discussion of the design ethnography techniques they used (i.e., observations, interviews, surveys, etc.) and the front-end design phases they had completed (e.g., need finding, down selection, and development of user requirements and engineering specifications). Follow-up questions allowed for further exploration when students described challenges they faced during the design ethnography immersion experience. Interviews lasted approximately one hour. Table 1 lists some of the interview questions.

Table 1: Example Questions from the Interview Protocol

What techniques did you employ to identify needs?
What techniques did you employ to develop user requirements?
Of these techniques, which was most successful? Why? Describe a time where you found this technique to be particularly helpful. Describe a time where you found this technique to be particularly challenging.
Of these techniques, which was least successful? Why? How did you or would you have adapted the technique to make it more effective?
Where did you learn to use this technique? How did your experience using this technique in the middle-income setting compare with your experience learning it in the classroom?
How well do you think you implemented the techniques? Did you feel yourself becoming more successful in the implementation?

Data Analysis

The interviews were de-identified and transcribed for analysis. An iterative inductive coding procedure was used to identify themes within the student interviews and across the various students. Established guidelines for theme identification were used to analyze the interview data¹⁵. Coding was iterated until changes ceased to be made to themes. Pseudonyms are presented below in place of student names.

Findings

Table 2 displays the most prominent themes identified. The four themes elucidate some of the major challenges students faced when practicing design ethnography in the field. Each theme is discussed in detail below with supporting quotes from the interviews.

Table 2: Themes emerging from analysis of semi-structured interview transcripts

Theme 1: Students found design ethnography to be more difficult in practice than they had anticipated.
Theme 2: Students found it difficult to apply the data that was collected using design ethnography techniques.
Theme 3: Students had difficulty synthesizing the information collected while using design ethnography techniques.
Theme 4: Students encountered difficulties when using design ethnography to identify need statements within an unfamiliar culture.

Theme 1

A prominent theme that emerged from the interviews was that students found design ethnography to be more difficult than they had anticipated. James described his experience of being overconfident when first using design ethnography.

“I was kind of cocky...[I] didn’t think it would be all that difficult. I figured it would be easy...the class made sure [that I knew that] it was work to do ethnography but I still felt that...[I had] a handle on it.” (James)

Throughout the interview, however, James spoke to the intricacies and challenges of performing design ethnography and interviewing different stakeholders within the clinical setting. His pre-immersion confidence dissipated when he realized how difficult design ethnography techniques can be to implement. Other students commented on the difficulty of performing design ethnography because of the unpredictable nature of how the data is collected. For example, Luke commented that the process of data collection using design ethnography was more complicated than he previously anticipated:

“I felt that it went a little bit more messy than I thought. When it’s in your head...It’s all super clear...[the doctor] is going to tell me the answers that I’m looking for...then we’re going to go to the next step...Sometimes, they give the answer that you’re not looking for, and you think, ‘Am I thinking [of] something else?’ Then, you have to consider all these things...it becomes a little bit more messy.” (Luke)

Luke felt that the practice of using design ethnography did not match their expectations. Stakeholders did not respond in a predictable fashion, and he was not able to determine whether he was phrasing his questions poorly or if he did not understand the answers. Luke continued to summarize his experience applying design ethnography techniques learned during the pre-immersion design ethnography course.

“[Design ethnography in the field] was so different [than in the classroom] that it wasn’t similar at all...we didn’t have control of the language...we had to use more simplistic language...everything was a barrier for us. It wasn’t working as well as it was theoretically taught to us.” (Luke)

Luke, as well as the others, had difficulty applying design ethnography techniques learned in the pre-immersion course to the front-end design phases during the design ethnography immersion experience. They had anticipated a smooth transition between how design ethnography was taught in the classroom and how it would be practiced in the clinical setting, however, the complex nature of performing design ethnography and the large (and sometimes conflicting) amount of data collected during design ethnography precluded this smooth transition.

Theme 2

Another theme that emerged during interviews was students’ difficulty using the design ethnographic data that they collected. Holly spoke about how this was an especially large problem towards the beginning of the immersion experience.

“I think at the beginning it was overwhelming...where you’re frantically writing down things that you see and you don’t necessarily know what’s important yet.” (Holly)

The open-ended nature of observations meant that students were not observing to find a particular need, but instead were observing in an attempt to identify any and all needs that the hospital had. It was therefore difficult for the students to know how to use all the observational data they were collecting. Similarly, Luke spoke about the difficulty he faced when performing observations because he was not sure of precisely what was occurring during a surgical procedure.

“We need[ed] more time to deduce from [our] observations. We need[ed] to observe the normal and then to look for abnormalities...when you only see the abnormalities, you don’t know if it’s an abnormality or not...” (Luke)

Luke struggled because he was not able to differentiate between when a procedure was being performed correctly and when it was not. The student struggled to effectively use the information he was obtaining during observations because he did not have the reference of a correct procedure with which to compare his observations.

Theme 3

Students also faced difficulties when synthesizing the data that was collected while using design ethnography techniques. For example, James spoke about the difficulty in interviewing patients; specifically, the challenge of not being able to piece together the information received in order for it to be useful.

“Interviewing patients a lot of the time just felt like we weren’t getting much useful information...we talked to four, five, or six women about their blood pressure...and didn’t really feel like we learned much...we didn’t really see a trend in their answers or it seemed like they never understood the questions.” (James)

The students were not able to find a ‘trend’ among the various responses they received from stakeholders and, thus, did not know precisely how to use the information collected. Students were looking for the same responses from all stakeholders so that synthesis would be straight forward. In reality, complete agreement amongst stakeholders would rarely occur and this presented a major challenge for students. The variation among stakeholder responses was also mentioned by Katy who expected various stakeholders’ opinions to better align with each other.

“We never really got a clear confirmation, whether [a feature should be included]...I think that we kind of expected people to just have a flatter answer to that, and they didn’t.” (Katy)

Observations and interviews both caused problems, because the students continually had to make sense of large amounts of qualitative data that needed to be synthesized and reconciled – a significant departure from typical engineering coursework.

Theme 4

Another theme that emerged in our analysis was students’ difficulties in using design ethnography data to identify need statements in a culture unlike their own. Students believed they were not as effective in their observations because they had difficulty separating cultural

differences from medical needs. For example, Shawn commented on the need to be able to ignore cultural differences in order to be an effective observer.

“...I [had to] stop looking at some things that were probably more cultural...[to] stop worrying as much about doctor-patient interaction.” (Shawn).

The large contrast in doctor-patient interaction between US hospitals and the hospitals within the middle-income country made it more difficult for students to identify true technology gaps. James summarized the challenge of differentiating true medical needs from medical procedures or devices that were simply different from what he was used to.

“We got better at identifying the actual issues...just as we became more familiar with the environment itself. What is actually a [design] challenge and what is [just] different from what we are used to.” (James)

The use of US hospitals as their reference guide for observations caused the students to notice more cultural issues than true medical needs that could be improved through technological interventions. Shawn commented on how overcoming this challenge was the biggest step to becoming an effective observer.

“I’d say the biggest thing for me to overcome was being able to separate the culture from actual need statements, and that just took time...getting used to the culture. Once I felt more comfortable, then it was easier for me to be a little bit more focused.” (Shawn).

All of the students cited the difficulty experienced in attempting to filter out cultural differences during their design ethnography immersion experience and several referred to this as the biggest challenge during the immersion experience.

Discussion

During their design ethnography immersion experience, students encountered a variety of challenges while employing design ethnography techniques. The four themes discussed above represent the most common challenges that students faced. The nature of the challenges sheds light on where to focus the development of design ethnography pedagogy and the challenge of teaching design ethnography within a classroom setting.

In the first theme, the students discussed how their experience conducting design ethnography in the field was considerably more difficult than anticipated. All students had gone through a formal pre-immersion course where they learned the techniques associated with conducting design ethnography during problem definition and user requirements elicitation and were able to practice using design ethnography. Despite the pre-immersion training, students were unable to anticipate the degree of difficulty they would have using design ethnography outside of a classroom setting. Developing pedagogy to mimic the specific challenges (i.e., Themes 2 and 3) students face in the field would increase the value of classroom learning and prepare students for the difficulty of employing design ethnography.

The second and third themes were the challenges students faced when attempting to collect, synthesize, and apply design ethnography data during front-end design phases. Students struggled to use ethnographic data because they were not sure what they were looking for. Furthermore, the immersive experience naturally led to the collection of large amounts of information from a variety of sources which required students to actively perform extensive synthesis. Engineering students may be particularly ill-prepared for the concept of qualitative data collection and analysis; therefore, design ethnography pedagogy must reflect these key areas.

The fourth theme was the challenge students faced in conducting design ethnography during front-end design in an unfamiliar setting. The differences in culture and environment increased the difficulty of identifying technology gaps by drawing the students' attention to cultural differences and away from true medical needs. While students perceived the cultural differences as a challenge that needed to be overcome, it could also be viewed as a significant learning outcome. Students were forced to critically analyze the international setting and determine how it affected their design decisions. The reflection that is needed during design ethnography may bring these types of cultural differences to a student's attention and allow him/her to gain more from the cultural immersion.

The results found in the study are comparable to the limited research performed on students' use of design ethnography techniques. As seen in previous studies, students struggled to effectively implement the methodologies learned in the classroom to their design projects¹¹⁻¹³. Students faced extensive challenges when collecting and synthesizing data collected during design ethnography and were challenged by the unfamiliar culture in which they were performing these techniques. Our findings reinforce the need for more effective pedagogy structured around overcoming these common challenges.

This study focused on performing an in-depth exploration of a small sample of students utilizing design ethnography during front-end design phases. The small sample of students interviewed as part of this study must be considered when transferring these results to other contexts. For example, students used design ethnography within an international clinical setting. Some of the themes emerging from the interviews could be directly attributable to either the international cultural context or the clinical context. Further studies would need to be performed within diverse contexts to better understand which challenges are common to all forms of design ethnography use and which are particular to certain cultural contexts or clinical settings.

Conclusions

The purpose of this work was to identify challenges students face when applying design ethnography in the field. While benefits of design ethnography have been promoted in both academic and business literature, research on how students learn and apply the skills of design ethnography is limited. Engineering graduates need to be exposed to emerging design methodologies, such as design ethnography, in order to perform effectively within industry. This study, however, demonstrated that learning and applying the complex techniques associated with design ethnography introduces numerous challenges for students. The challenges identified within this study should be incorporated into design pedagogy in order to better prepare students to perform design ethnography during design courses. Pedagogy that anticipates students'

struggles with design ethnography may allow students to more easily overcome these challenges in the field when instructor feedback is not immediately available. Furthermore, reducing the challenges associated with design ethnography should lead students to better appreciate the utility of design ethnography during the design process and increase their likelihood of continuing to use the techniques beyond front-end design phases.

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