Cross-Functional Team Course Design Project in Engineering

Dr. Nicholas D. Fila, Iowa State University

Nicholas D. Fila is an assistant research professor in the Department of Electrical and Computer Engineering at Iowa State University. He earned a B.S. in Electrical Engineering and a M.S. in Electrical and Computer Engineering from the University of Illinois at Urbana-Champaign and a Ph.D. in Engineering Education from Purdue University. His current research explores engineering students' experiences with innovation, empathy across engineering education and engineering design settings, design thinking in the course design process, and novel uses of qualitative research methods in engineering education.

Dr. Diane T. Rover, Iowa State University

Diane Rover is a University Professor of Electrical and Computer Engineering at Iowa State University. She has held various faculty and administrative appointments at ISU and Michigan State University since 1991. She received the B.S. in computer science in 1984, and the M.S. and Ph.D. in computer engineering in 1986 and 1989 (ISU). Her teaching and research has focused on embedded computer systems, reconfigurable hardware, parallel and distributed systems, visualization, performance monitoring and evaluation, and engineering education. She has held officer positions in the ASEE ECE Division, served as an associate editor for the ASEE Journal of Engineering Education, and served on the IEEE Committee on Engineering Accreditation Activities, the IEEE Education Society Board of Governors, the ABET EAC (2009-2014), and EAC Executive Committee (2015-2018). Dr. Rover is a Fellow of the IEEE and of ASEE.

Dr. Mani Mina, Iowa State University

Mani Mina is with the department of Industrial Design and Electrical and Computer Engineering at Iowa State University. He has been working on better understanding of students' learning and aspects of technological and engineering philosophy and literacy. In particular how such literacy and competency are reflected in curricular and student activities. His interests also include Design and Engineering, the human side of engineering, new ways of teaching engineering in particular Electromagnetism and other classes that are mathematically driven. His research and activities also include on avenues to connect Product Design and Engineering Education in a synergetic way.

Dr. Phillip H Jones III, Iowa State University of Science and Technology

Phillip H. Jones received his B.S. degree in 1999 and M.S. degree in 2002 in electrical engineering from the University of Illinois, Urbana-Champaign. He received his Ph.D. degree in 2008 in computer engineering from Washington University in St. Louis. Currently, he is an Associate Professor in the Department of Electrical and Computer Engineering at Iowa State University, Ames, where he has been since 2008. His research interests are in adaptive computing systems, reconfigurable hardware, embedded systems, and hardware architectures for application specific acceleration. Jones received Intel Corporation sponsored Graduate Engineering Minority (GEM) Fellowships from 1999-2000 and from 2003-2004. He received the best paper award from the IEEE International Conference on VLSI Design in 2007.

Designing a Course Together: A Collaborative Autoethnographic Study of a Cross-Functional Team Course Design Project in Engineering

This work-in-progress research paper describes an ongoing community autoethnographic study that explores the intersection of cross-functional teamwork and design thinking within the course design process. This paper intends to give the reader an overview of the ongoing study but is not presented in the full autoethnographic form, save for individual sections attributed to their primary authors.

Mani: Read at your own risk!

Motivation for Investigating Experiences of Team Course Design

Nick: Recent years have seen an increase in collaboration among educators when designing and implementing courses. In part, this increase responds to the multifaceted and dynamic nature of engineering work. By engaging multiple educators across disciplinary boundaries, we can create more robust and responsive learning experiences for our students as they prepare to engage with an ever-changing world [1],[2]. This increase also responds to the diverse nature of course design and implementation, in which educators often take different approaches [3],[4] and fulfill a variety of functional roles [5]. By working together, educators can focus on specific facets and learn from others. Yet, designing a course together can be challenging. Some have noted challenges in resolving pedagogical, ideological, and functional differences [3]. Others have also reported time management challenges and concerns over autonomy [2]. In our experience, reward structures, personal bandwidth concerns, and collaboration dynamics can also play a role.

We (the authors) have begun engaging in a novel cross-functional team structure, informed by design thinking, to support more rewarding, responsive, student-centered, and productive course design and teaching experiences. This structure, while informed by prior work [5],[6], was novel and experimental in an engineering education context. Thus, we sought to understand how this structure informed the course design process and our experiences therein, and how it might apply to other engineering educators. To do so, we used the emergent research method of community autoethnography [7]. This technique allowed us to deeply investigate our experiences in the novel culture created through team course design and generate insights that might inform a broader community of individuals who experience related cultures.

Identifying a Method for Team Course Design

Diane: This study exists within the context of the electrical and computer engineering (ECE) department at Iowa State University. As part of a departmental initiative, we have begun to utilize cross-functional course design teams (x-teams) to redesign several core courses. The x-team instructional model shifts the paradigm from the traditional single-instructor course, in which an ECE professor designs and teaches the course, to a multi-designer model with either single or multiple teachers. This model is inspired by the work of Bess and associates [5]; he argued that the notion that college teachers are only lecturers has become greatly outdated in higher education since the instructional process is complex and demanding and requires a range of expertise that cannot be expected from any single individual [8]. Twenty years since its publication in 2000, their argument is even more compelling. Bess identified seven major

domains in the process of teaching: 1) Pedagogy, 2) Research, 3) Lecturing, 4) Leading discussions, 5) Mentoring, 6) Curricular and co-curricular integration, and 7) Assessment. He recommended a style of team teaching in which faculty form teams of specialists based on these domains of process knowledge. Aspects of the model are put into practice to varying extents when multiple faculty, staff, and students are involved in the development and delivery of a course. Increasingly today's flipped classrooms are involving process experts in course development, more commonly as a service orthogonal to a particular course. Features may be glimpsed in Stanford's ME218 Informal Learning Loops via coach and expert roles [9], and in programs from Harvard [10] and ASEE (I-Corps L) [11].

Nick: Within the x-team structure, we also attempted to leverage design thinking to support a more student-centered, creative, and adaptive process [6]. Design thinking has been previously leveraged in course and curricular design contexts through several process-focused models [12],[13]. Here, we attempted to enact a more holistic approach, informed by a research-based design thinking framework [14] that emphasized five themes (user focus, problem framing, visualization, experimentation, and diversity) across three levels (tools, practices, and mindsets). This approach involved exploring tools, practices, and mindsets as they supported the five themes. Thus, while we leveraged extant understanding of design thinking within a course design context, we also attempted to adapt such methodologies within the x-team structure and understand how and why such adaptations might inform our team (i.e., using autoethnography).

Using Community Autoethnography

Nick: Autoethnography is a research method that emphasizes using autobiographical writing to analyze one's experiences within culture and, more broadly, inform understanding of a culture or cultural experience [15]. Here, writing serves as both data collection and analysis, with each iterative cycle further enhancing our understanding of our experiences within the x-team culture and pointing to new considerations for future writings and revisions. This blurring of lines between participant and researcher has caused some to challenge the rigor of autoethnography as a research method [15], especially within engineering education [16]. However, this blurring has become essential to us as we have explored the nuances of experiences and perspectives only accessible to those within the x-team.

More specifically, we have employed a community autoethnography approach [7]. This approach emphasizes two facets in addition to individual autoethnographic studies. First, community autoethnography engages participation among multiple actors; here important because of the collaborative nature of the course design project. Second, community autoethnography promotes team-building. Pragmatically, this has become important as a tool to aid our course design process. However, we have also found that through building trust and understanding others' perspectives, we have been able to reflect on our own experiences in new ways and deepen understanding of our shared cultural experiences.

Mani: We enacted community autoethnography through an iterative process that emphasized movement between individual and team reflection. The process started with each team member writing and reflecting on a shared topic. These topics were each agreed upon by the team based on salient topics identified in previous writings and discussion. We encouraged each team member to reflect upon his or her experiences, uncertainties, surprises, and interactions.

Approximately every two weeks, we met to read and discuss each other's writings, to see and engage with their perspectives and their experiences. As we all wrote, read, and shared, and we became comfortable with our perspectives, the ideas of others, and their approaches. We found overlaps, connections, and distinctions. We then made recommendations for each other to consider in revising their previous writings and set new prompts for future writings.

Throughout this process, we engaged an iterative, reflective cycle that shifted our focus between individual experience, shared experience, and extending the experience. Our cycle could be summarized as follows: (1) confront the self through individual autobiographical writings, (2) let go of the self when sharing reflections with others, (3) own the experience together when reading and discussing reflections as a team, (4) let go of the shared experience when considering broader connections, and (5) create a holistic vision of collaboration and course design, including how it might be shared and communicated across external cultures (e.g., department, other universities, global engineering education cultures).

Emerging Themes

Nick: As we continue to reflect and write, we draw new insights about ourselves, our team, and that team's place in the larger cultures (e.g., department, college, and discipline). Each cycle brings us closer to the nuanced vision that signifies meaning for both us and others in the field. Currently, five themes have emerged. To identify these themes, we engaged in an iterative thematic analysis process [17] using our initial writings as data. The themes are presented here, briefly, with example excerpts from our initial writings. It should be noted that each authors' experience of the themes differed in some way and may further differ from others experiencing similar contexts and cultures. Thus, we intend this presentation as a snapshot of the larger, ongoing autoethnographic study and a collection of ideas around which readers might begin to reflect and connect to their own contexts.

Responding to Uncertainty

Nick: The first theme reflects the uncertainty inherent in developing a shared vision for the course. At a basic level, we all agreed. We wanted to make the course more student-centered. We wanted to incorporate more professional formation elements. We wanted to use the course and the x-team to support larger departmental change in how both students and instructors approach courses. Yet, when we reflected on what that change might be and how it might manifest, we recognized inconsistencies in both between ourselves *and* within ourselves. Mani described this in an early writing.

Mani: *Change at the early stage is a hope, it is a vision, and it is assumed to be GOOD! Why not? As different perspectives are presented... I feel the specter of change… Giving us hope, giving us perspectives, and providing us a reason to move on… Change! What is it? How is it? Should we change the class? Where do we start? What are our guidelines?*

Navigating the team

Nick: The second theme focused on understanding and interacting with the team. This included attempting to understand and engage with others' (not always obvious) perspectives, explore team dynamics, and investigate the role oneself and others play or might play. Here, I wrote of

my attempts to understand Diane and how those thoughts affected my consideration of my own place on the team.

Yet, her almost Quixotic optimism seems to conflict with her recognition of the reality of innovation in engineering education (entrenched dogma, the massive undertaking course change is). She says, "Let's not go crazy!" and champions focusing on a few smaller changes. I'm excited to work with and learn from these people, but I think, "How are we ever going to get anywhere?" Especially if we can't resolve our own inner tensions and uncertainties. At present, I certainly can't resolve my own competing roles as a former student, backwards design enthusiast, empathy researcher and advocate, and budding design thinking expert who's trying to figure out where that might fit in.

Navigating the self

Nick: This theme coupled with the previous theme by reflecting one's considerations of their own perspectives and approaches as mirrored back to them by their experience on the team. Here, for example, Diane echoed our tendency to reflect on prior course design practices and consider how oneself might be changed and work towards change as part of the x-team process.

Diane: *I have been surprised with some of my own difficulties in breaking my habits of course design to embrace and fully utilize design thinking strategies in course redesign. I'm not sure whether it's simply that old habits are hard to break, or more time is needed for training, or I need to sharpen my own learning skills.*

Navigating the system

Nick: In addition to navigating the team and the self, our experience in the x-team incorporated considerations of the larger system within which the x-team resided. In part, this system featured the status quo of engineering instruction at a general level. More frequently, we considered the role the x-team played in our more immediate departmental culture; how this culture informed our process and experience and, as Phillip noted, how our process and experience might inform the departmental culture.

Phillip: *For the concept of cross-functional teams to last, it must operate within a culture that wants to improve through a change process. Thus, x-teams must play a major role in creating and maintaining such a culture... Our current x-team has made some small attempts at enacting this change in department culture (a few faculty activities at retreats and faculty meetings), but thus far they have been fairly weak with respect to what I believe we are capable.*

Process

Nick: The final theme reflects growing awareness of the course design process, particularly design thinking elements, and how they may be enacted and successful. Often, this theme incorporated not only what was successful but how and why it became successful.

Phillip: *I was then surprised once I started to get the mindset and purpose of DT [design thinking] tools how incredibly useful DT tools could be in generating ideas and uncovering aspects of problems had not been initially thought of… I was surprised how these tools can be*

used to help those with diverse expertise work together as a team within a shared framework, and aid in seeing the bigger picture view of a problem being solved, and also digging in to the low-level details for how to solve the problem, and identify new aspects of the problem that are important.

Closing Discussion

Nick: This work-in-progress paper has presented an ongoing study that investigates how a team of engineering educators has crafted and experienced a cross-functional, design thinking-inspired course design process through community autoethnography. The five themes presented (uncertainty, navigating the team, navigating the self, navigating the system, and process) are preliminary and will continue to evolve. Still, these themes demonstrate connections to extant literature (e.g., challenges working across approaches and functional roles [3]) as well as extensions of prior knowledge (e.g., the role of reflecting on and questioning one's prior perspectives and approaches). We encourage other educators to explore these themes in their own course design experiences as we continue to explore and expand them in our autoethnographic study and collaborative course design experiences.

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