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Establishing a Culture of Trust within Interdisciplinary Engineering Education Research Teams

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Establishing a Culture of Trust on an Interdisciplinary, DEIJ-focused Engineering Education Research Team (Work–in–Progress)

Abstract

Working on teams with a range of disciplines and life experiences can help engineering education researchers generate novel approaches to DEIJ work. However, in order for teams draw from this wealth of knowledge and experience, individual team members must feel confident in their ability to take intellectual risks (e.g. sharing ideas, asking questions) without risk of embarrassment, rejection, exploitation, or punishment (i.e. feeling psychologically safe). Groups with high levels of psychological safety often experience a shared sense of responsibility, high-quality decision making, healthy group dynamics, and greater innovation. In this paper, we took an exploratory ethnographic approach to study the culture a of single, interdisciplinary research team working to promote equity in engineering education. This team includes members with a wide range of disciplines, social identities, and academic positions (e.g. faculty, graduate students, and undergraduate students). In this study of this team, we addressed two research questions: 1) What are the beliefs held by individuals which impact their willingness to engage in intellectual risk taking on an interdisciplinary EER team? 2) How do the members of an interdisciplinary EER team foster a culture of trust and psychological safety? We identified three beliefs which influenced how team members engaged in intellectual risk taking related to: conceptual or methodological expertise, professional or academic position, and discomfort with their own positionality. We also identified three ways this team facilitated a sense of psychological safety. As we continue this work and study other research groups, we will develop interview questions to further explore the role psychological safety plays in how and why individuals engage in intellectual risk taking.

Introduction

> *Good science is making sure you have a diverse team that has this, why not make up a term, cognitive access... the access to someone doing research in DEI or someone doing research [where] it's a different way of thinking or maybe even a different way of conducting research.*

Working on interdisciplinary teams comes with a set of unique benefits and challenges. As this quote from Dr. Green, an engineering faculty member working on a team focused on promoting equity in engineering education, demonstrates - it gives you access to valuable and unique funds of knowledge and ways of thinking. Another member of this team with a background in engineering education, Dr. Shea, argues that having a team with varying levels of understanding of diversity, equity, inclusion, and justice (DEIJ) topics also helps them expand the reach of their efforts. He explains,

> *It helps us get out of the same people talking to the same people. It helps us have conversations with folks who hey, are like, 'Okay, well, I'm not trying to be racist', or 'I*

have a decent understanding of what I thought racism is in America, but I don't know what to do next.'

Bringing these diverse voices and perspectives together also requires the team to navigate differences in thinking due to differences in disciplinary backgrounds, methodological preferences, and personal experiences and identities. Effectively navigating these differences is critical to preventing miscommunication and finding novel approaches to the generation and application of knowledge [1], [2]. Working in a DEIJ space can add a level of complexity as a team must also navigate nuanced and sensitive topics such as racism and oppression. To draw on each of the perspectives on a diverse team, individual team members must be willing to take intellectual risks (e.g. asking questions, expressing doubt or uncertainty, posing new ideas). In a previous paper, we proposed that individuals may be hesitant to engage in risk taking because it could impact the team's trust in their expertise or competence [3]. For example, a graduate student on a team might hesitate to voice a concern that has not been identified by the faculty members – resulting in the team having to navigate a preventable issue later in the project.

Cultivating a sense of psychological safety is one way to encourage team members to take intellectual risks [4]. In this paper, we draw on Edmonson's [4] definition of psychological safety: an environment where individuals feel confident in their ability to speak freely without risk of embarrassment, rejection, exploitation, or punishment. Their seminal work, which explored the influence of psychological safety among 53 teams within a furniture design firm, revealed that the teams which experienced a sense of psychological safety were more likely to engage in learning behaviors such as asking for help, communicating errors, and accepting feedback. This relationship also affected team performance; the teams which engaged in more learning behaviors were more likely to become aware of potential issues and work collaboratively and creatively to address them. Many studies have explored the factors which contribute to a sense of psychological safety (e.g. supportive leadership, strong interpersonal relationships) and the considerable benefits of facilitating a sense of psychological safety on work teams [reviewed in 5]. Groups with high levels of psychological safety often experience a shared sense of responsibility and commitment, healthy dynamics and relationships within the group, successful error identification and mitigation, and high-quality, innovative work [5], [6]. On interdisciplinary teams, psychological safety has been shown to encourage individuals with differing expertise and social power to express their perspectives [7], [8], [9] and ultimately increase research quality and productivity [10].

Given the importance of psychological safety on encouraging intellectual risk taking, like engaging in learning behaviors, in this exploratory study we aimed to investigate how psychological safety manifested on an interdisciplinary engineering education research (EER) team and impacted how they engaged in critical conversations about research and DEIJ topics. An additional factor which emerged during this exploration was a series of personal beliefs

which appeared to impact how individuals engaged intellectual risk taking on their team. This work-in-progress paper aims to communicate initial insights to answer two research questions:

1) What are the beliefs held by individuals which impact their willingness to engage in intellectual risk taking on an interdisciplinary EER team?

2) How do the members of an interdisciplinary EER team foster a culture of trust and psychological safety?

Sensitizing Concepts

For this initial exploratory analysis, we used psychological safety, trust, and intellectual risk taking as sensitizing concepts (i.e. initial ideas we used to gain insight into our research problem [11]) to help guide our analysis of the team's culture. In particular, we used these concepts to generate questions to guide our exploration of the data. For example, one of our guiding questions was "What actions contribute to each team member's sense of psychological safety?". We define *psychological safety* as an environment where individuals feel confident in their ability to speak freely without risk of embarrassment, rejection, exploitation, or punishment [6]. A sense of psychological safety emerges when team members trust and hold mutual respect; this fosters a belief that speaking up will not threaten how the team members view them personally or professionally [4].

Trust, or the awareness and assessment of others' goals, behaviors, and risk to engage in a context, has been identified as a precursor to the development of psychological safety for groups [12]. Cultivating trust within teams can lead to more inclusive and authentic groups and create a space where members are more willing to take risks. Inherent to the concept of trust is the idea that individuals are dependent on one another but cannot compel each other to act in accordance with any individual's expectations. Trust is a particularly important trait to cultivate within interdisciplinary teams where team members may have different approaches to research. Individuals who feel trusted by others will reciprocate the trust shown to them [13] and high levels of trust contribute to increased rates of psychological safety [12]. As such, we aim to explore how groups generate cultures based in both trust and psychological safety, as both can be key to developing high-performing EER teams.

We use both concepts to explore how a group's culture that fosters trust and psychological safety affects individual team members' willingness to engage in *intellectual risk taking*. We define intellectual risk taking as engaging in behaviors that put the individual at risk of making mistakes or appearing less competent than other team members (e.g. asking questions, sharing ideas). We also sought to understand any personal beliefs or concerns that might prevent team members from engaging in intellectual risk taking. Within teams, intellectual risk taking is an important behavior because it is integral to enhancing existing practices, challenging the status quo, and generating new ideas.

Methods

Participants

We focused on our data from a single, interdisciplinary engineering education research team, Team W. This team includes an engineering administrator, tenured and tenure-track faculty, and graduate and undergraduate students. This team has weekly meetings where they discuss research decisions and progress. Trust and psychological safety are particularly important for Team W because of their different disciplinary backgrounds and domains of expertise; their positions at their universities; their individual identities and life stages; and their work on DEIJ in engineering.

Data Collection and Analysis

Our data for this paper comes from a larger ethnographic study [14]. We received IRB approval for the study procedures which included observations of team meetings and interviews with individual team members. For this paper, we analyzed interview transcripts, collaborative fieldnotes, and structured analytic memos (SAMs). We developed collaborative field notes and wrote structured analytic memos (SAMs) for 13 recorded team meetings. These SAMs focused on describing how the team approached collaboration, navigated differences in ideas, and made research decisions. For more information on the development of these meeting observation SAMs, see [14]. As part of the larger study, we also conducted interviews with seven team members. These transcripts were coded inductively and deductively to identify the individuals' perceptions of the team norms, perceptions of their role on the team, and feelings associated with interacting with the team. The coding of these interviews was informed by insights from the observations, particularly as we investigated team norms and the participants' perceptions of these norms. We wrote SAMs for each participant based on this analysis.

For this exploratory analysis, we ran code reports from the interview data in Atlas.ti for any codes related to psychological safety, trust, and intellectual risk taking (e.g. Team Standard – valuing and seeking out diverse perspectives, Team Standard – creating space for all to contribute). We looked across these code reports and the individual team member SAMs to identify the actions that contributed to individual team member's sense of psychological safety. We also identified 1) how they responded to these actions and 2) any additional feelings or beliefs which influenced their willingness to engage in intellectual risk taking. Finally, we organized these actions and beliefs into the categories which are presented below in Preliminary Findings.

Preliminary Findings

Through our initial analysis of the data, we identified three beliefs that impacted an individual's willingness to engage in intellectual risk taking on this team and three ways Team W facilitated psychological safety within their group. We use the nongendered singular pronouns of they/them

to refer to our participants to protect their identities. We recognize that this choice removes context from our work; however, we are prioritizing the protection of our participants [15].

Beliefs that Could Impact Individual's Engagement in Intellectual Risk Taking

Belief 1: I do not have enough subject matter or methodological expertise. Like many EER teams, Team W is composed of researchers from a variety of disciplines including engineering, science, and engineering education. Each of these individuals bring their own expertise and beliefs about how knowledge is generated and validated. On this team, two of the team members with a background in technical engineering expressed doubt in their ability to engage with engineering education or qualitative research. For example, one of the technical engineers on the team, Dr. Green, recalls a conversation with Dr. Shea, a member with a background in engineering education research,

> I remember Dr. Shea asked me, 'so what are your favorite methods of assessment?…'[and] I remember I was like 'I don't have any'… because that was a completely inaccessible question to me… and we've talked a lot about psychological safety so it's fine but Dr. Shea has his list of favorite things and I'm not even sure I'm on the right list.

Another team member with a background in engineering, Dr. Bailey, feels that they have gained new knowledge by being a part of this team but still feels some doubt with regard to their own expertise. Dr. Bailey explains,

> So, I don't come from a background in [qualitative methods]…It's been super helpful to be on this project, and be working with [team members] who have more of a background in [qualitative methods and engineering education]…I definitely know more what I'm doing than I did before… and maybe I'm not giving myself quite enough credit for what I know… but I still feel like I don't know what I'm doing.

Belief 2: I do not have the professional or academic position to contribute. Many project teams, like Team W, include individuals across professional and academic positions. When these positions span across ranks (e.g., early career faculty, administrators, students), individuals may feel hesitant to share their ideas [16]. One of the student researchers on Team W reflected,

> I was very uncomfortable from the get-go because… I'm around like rockstar talent super stars and you have a little bit of that imposter syndrome when you're just doubting your own ability and what you have to add to the conversation…. I really appreciated that, especially with students that may have those identities that are hyper marginalized, who are always used to being silent, I appreciated them understanding that and always asking me for my input and [creating] ways where I could slowly but surely warm up and then have that space to become more vocal.

They expressed that having the more experienced members of the team actively seek their perspective, allowed them to move past their feelings of imposter syndrome and become more comfortable engaging with the team.

Belief 3: I feel some discomfort with my own positionality when doing DEIJ work. DEIJ-centric work inherently involves discussing sensitive topics such as racism and oppression. The members of Team W hold various intersecting identities in terms of gender, race, ethnicity, and age. Additionally, the team includes members with varying levels of expertise in DEIJ topics. These two factors can make team members hesitate to share their questions and ideas about topics which don't reflect their own lived experiences or fall into their realm of expertise. One team member, Dr. Bailey explains:

> I do worry that, like, 'oh, I don't know anything about this', and, hopefully, I'm not gonna say something stupid, and that, you know, also, the dynamics, the social dynamics around your race and gender. I mean, we're trying to deal with issues of racism. Oh, and I'm an [gender and race person] who, you know, has evolved significantly over the course of my life. Um, you know, I still teach at a predominantly white institution. I'm working hard, but, you know… I think [I have] some discomfort with my own positionality and sort of what gives me the right to work on this.

Ways the Team Facilitated Psychological Safety

In addition to expressing beliefs which influenced how the team members engaged in intellectual risk taking and learning behaviors, the team members also discussed three ways the team helped facilitate psychological safety.

Approach 1: The team dedicates time at the start of each meeting for non-research related discussion. During this time, individuals share about what is going on in their lives outside of the project and/or work. In their interview, one team member notes "our catchups at the beginning of the meetings, I think those are super important…because to me, the way you establish rapport and trust is in that pre-meeting and post-meeting chit chat."

In addition to building trust, these check-ins supported individuals' sense of belonging within the team. For example, one team member stated

> I enjoy [talking with team members]...I love to hear about [this colleague] and their kid going to college and [this colleague] getting married. I truly enjoy that, and so, yes, there is value. And [the check-ins] have certainly helped, to some extent, my belonging.

Edmonson [4]'s work suggests that forming strong, healthy interpersonal relationships is foundational for building trust among work teams. Much like Team W, the teams which experienced these relationships tended to demonstrate care for each other as people and hold mutual respect.

Approach 2: The team engages in robust discussions with the aim of trying to understand each other's perspective and viewpoints. During discussions, the group works to ensure that there is space for each team member to participate. We observed individuals keeping their own responses brief and then stating that they would like to hear from others who have not yet shared their perspectives. For example, one team member shared:

> I'm very certain we have exceptional equity of voice. That's certainly one of our norms... but we got some common shared vocabulary and some norms around that like 'Hey Dr. Shea, now it's your turn you haven't talked. What do you think?' And 'I'm going to pass it off to Dr. Bailey. I want to hear what Dr. Bailey says'. So it's almost a little corny, but it really works for us.

These actions of actively seeking out each other's perspectives and deeply engaging with each other's viewpoints have demonstrated to contribute to a sense of psychological safety [4], [8], [9].

Approach 3: The team works to ensure that all team members are comfortable with group decisions. This is done, in part, by asking each other directly "are you okay, with this? Or, what suggestions do you have? What concerns do you have about this, and [then, let's] try and work through them." One team member stated: "part of [making sure everyone was involved in conversations] was coming up with some group language, which was intentional. For example, [saying] "'Hey, everybody shared.' And now I'm specifically going to ask '[individual team member], you haven't talked recently.'" These strategies and approaches to cultivating psychological safety have resulted in a space where all team members are comfortable engaging within this specific group. This finding aligns with work which suggests that having a shared vision and goals are factors of successful collaborations [7].

Limitations and Future Work

There are two limitations to this Work in Progress paper. First, the beliefs and approaches we report come from the data of a single team. As we continue the larger ethnographic study, we will interview members from several additional EER teams and continue to investigate 1) the beliefs that impact how individual team members engage in intellectual risk taking and; 2) the approaches the teams take to cultivate a sense of psychological safety. Additionally, we will seek to understand how the specific approaches taken by each team impact the beliefs which are held by individual team members. Our second limitation is that the interviews for this paper were conducted to investigate the participants' perceptions of team norms and their role on the team; they did not include any prompts directly related to psychological safety or trust. As we continue interviewing researchers on interdisciplinary engineering education research teams, we will include questions to explicitly explore the role psychological safety plays in how team members

engage in research discussions and decision making. Our hope is that this work will help engineering education research teams draw from the diverse perspectives on their teams and generate novel solutions for promoting equity in engineering education.

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