

CAREER: "There is no I in team": The role of individuals in facilitating a culture primed for epistemic negotiation

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Introduction and Background

Engineering education is an interdisciplinary field that strives to transform engineering by integrating research and practice. These efforts require teams of individuals from different fields (e.g., engineering, sociology, psychology) and roles within a university (e.g., faculty, support staff, administration) [1-3]. Each of these team members brings their own values, goals, training, and knowledge into the team. The integration of these differences in thinking are key to making transformative change in engineering; however, they can create tensions and prevent progress. These tensions are often attributed to ineffective communication or project management, which overlooks the differences in how individuals from different backgrounds approach research and the application of research to practice – epistemic differences [4], [5]. The goal of this project is to explore how research teams navigate epistemic differences and engage in critical conversations to make research decisions. As part of this work, we aim to develop a conceptual model of how individual scholars navigated differences in thinking on engineering education research teams.

This paper summarizes key findings from the third year of an NSF CAREER project, which focused on analyzing data from semi-structured interviews with scholars who have experience on various engineering education research teams.

Executive Summary

In year 3, we expanded our ethnographic case study of two engineering education research teams by interviewing individual scholars. These interviews combined with the ethnographic observations provide breadth to our data and allow us to expand our preliminary findings. As part of our analysis, we developed a series of propositions. These propositions are insights from our analysis and serve as the foundation for our preliminary conceptual model of how individuals navigate differences in thinking on engineering education research teams.

Our data includes 60-to-90-minute interviews with 10 scholars. These scholars include tenured faculty, pre-tenure faculty, postdoctoral scholars, and graduate student researchers from engineering education, computer science education, and psychology. Our semi-structured interviews were conducted using a grounded theory interview protocol. The development of the protocol was informed by the data collected in years 1 and 2. Our analysis was guided by two sensitizing concepts, Epistemic Identity [6] and Critical Contextual Empiricism [7], along with our preliminary model of epistemic culture developed through an ethnographic case study [8]. Each interview transcript was coded inductively and deductively by two members of the research team using approaches from constructivist grounded theory [9]. Structured analytical memos were then written by three researchers and reviewed by the entire team. Combined, the sensitizing concepts and preliminary model guided our analysis and allowed us to explore how individuals contribute to the culture of a team.

Emergent Findings

In this paper, we highlight two propositions from our emergent analysis: (1) how individuals present themselves has a major impact on a team, especially when that individual is in a position of power and (2) the effects of individuals who embrace a posture of epistemic humility can support epistemic negotiation. Combined these findings suggest that to support epistemic negotiation on teams, individuals, especially those in a position of power, should embrace epistemic humility to encourage the integration of ideas. Furthermore, this finding offers a means for individuals to independently impact team culture.

Proposition 1: How an individual presents themselves has a major impact on the team, especially when that individual is in a position of power.

We found that how individual team members present themselves on the team, particularly those who have the most power to shape the team's structures and norms, has a major impact of team culture around delegation, discussion, and decision making. Our data shows that team members do not enter collaborations in isolation. Social identities, beliefs, previous experiences, and perspectives about research (e.g. what problems are worth solving, what methods are valid, how research should be conducted) shape both individuals' self-perceptions and views of those around them. These beliefs are also impacted by life and career circumstances (e.g. disciplines, academic rank) as well as their intersecting social identities (e.g. gender, race, ethnicity). Each team member possesses a set of interpersonal skills that can facilitate positive team dynamics (e.g. empathy, clear and kind communication) or induce negative dynamics (e.g. closed-mindedness, talking over or past other collaborators). Each of these identities, beliefs, circumstances, and experiences shape how individuals present themselves and engage with their team. This presentation of self can influence interactions with other team members and shape the team's culture around management, quality, impact, and engagement. However, those with the most power on the team, typically Principal Investigators (PIs), can facilitate conditions that cultivate positive team cultures. For example, team leaders – which may or may not include PIs – can set expectations by providing guidelines that communicate the value of each team member and modeling how to engage with ideas in productive and encouraging ways. By embodying the behavior they want to see, team leaders can shape the culture of their team in productive ways that leverage differences in thinking for knowledge generation. For example, Taylor noted that they appreciate approaching team projects with a genuine commitment to collaboration, stating:

just the way that you treat each other and the way that you, let the ball, let the idea, if you think of it as a ball, pass it back and forth as opposed to just like letting it fall or slamming it to the ground. Like I think that it definitely does affect the team dynamics and how individuals show up, for sure.

Taylor recognizes the potential benefits of approaching research team work with a true spirit of partnership and the negative consequences of resisting collaboration.

One strategy for cultivating truly collaborative cultures is by acknowledging what each member of the team brings to the group. Gabriel discussed how he leverages this approach to intentionally set the tone for collaborations. He stated: “we each have very different skills and we're all comfortable saying, ‘well, that's your stuff more than mine’ [or] ‘I'm more of this than you’ and we all respect that very clearly and openly.” He went on to describe the outcome of modeling this explicit valuing of individual team member's skills, noting that “everybody's contributing without anybody feeling defensive about they contribute or not contribute or trying

to contribute more than others, and a lot of that comes from understanding who we are and what we bring in.” Understanding the specific knowledge bases and skills that individuals possess and can contribute to collaborations can be particularly valuable in developing productive and effective cultures. Next, we discuss how recognizing limits on one’s own knowledge and possessing a willingness to learn from others can further shape engineering education research teams.

Proposition 2: One of the most beneficial traits an EER team member can possess is epistemic humility and openness to learning

Our data shows the value of team members who possess epistemic humility, or the ability to recognize gaps and potential bias in one’s own knowledge, and a posture that communicates an openness to learning. This quality is critical in interdisciplinary teams, as differences in knowledge and approaches to research can create conflicts as project decisions are negotiated. Additionally, disciplinary backgrounds often approach knowledge generation from different methodological and epistemological perspectives. This diversity of contexts can lead to productive discussions and approaches; however, conflict can occur when team members are unwilling to adopt a posture of epistemic humility or openness to considering new ways of thinking. For example, Daniel, a postdoctoral scholar, compared his experiences on two engineering education research teams, noting that:

it feels like there's a lot more disciplinary humility on this team, a lot more respecting of the ways in which we bring our expertise and knowledge generation to the team. So, there is this kind of expectation that everybody is bringing certain strengths.

He concludes by sharing that he has really enjoyed being a part of that team. In contrast, Daniel serves on another team whose leadership does not seem to be open to learning from others. In the case of this second team, he has had the opposite experience, often feeling like some team members “aren't necessarily respected or aren't given a lot of power or leeway.” He ultimately describes this team as laden with friction, in-fighting, and a sense of “beaten downness” carried by some team members.

Another participant, Krono a social scientist who collaborates with an engineer noted how much new knowledge he has acquired directly from a team member outside of his discipline. He shared “I have learned a tremendous amount through that collaboration that has really informed the theory that I develop and the measures that I develop.” Without embracing an openness to learn and epistemic humility, Krono may have missed out on this opportunity to learn from his collaborator.

We found that this posture was especially valuable when team members from various disciplines approached discussions using language informed by their different disciplinary contexts. For example, participants like Caroline, noted that when team members

go in with a spirit of curiosity rather than an assumption that everybody else is gonna get on board with your definition, that's something that I'm really, I love thinking about it. Like I get really excited going into conversations and when I realize that there's a disciplinary language mismatch, I think it's a puzzle to solve. It's delightful. If we can identify it, then it makes me really happy. If people don't identify that there's a mismatch, they can go for years thinking that everybody is

on the same page and they're really not, especially if [the language] is close but not the same.

Caroline explains that if the differences across disciplines are not identified then it can lead to team members falling under the false belief of agreement, when in reality they are not talking about the same concepts or approaches. In the moment this mismatch may not be a problem; however, as the collaboration continues and work is completed these differences can lead to frustrations. A posture of curiosity among team members can minimize this risk by individuals asking probing questions to better understand what their collaborators mean, rather than assuming agreement.

Next Steps

Moving forward, we will collect and analyze additional interview data with individual scholars to continue expanding and refining our conceptual model through theoretical sampling. We plan to disseminate our research findings and share our final conceptual model with the community. We will also continue our work to translate our researching findings to a format that supports emerging and established scholars in engineering education research.

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