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"It allowed me to see a whole different world": Student researchers' perceptions of the value of interdisciplinary research teams

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ERM Work in Progress (WIP): "It allowed me to see a whole different world": Student researchers' perceptions of the value of interdisciplinary research teams

Abstract

Engineering Education research teams are often interdisciplinary, bringing both benefits and challenges to groups of individuals with various backgrounds. However, it is unknown how student members of EER teams value interdisciplinary collaborations. The purpose of this study is to examine student researchers' perspectives on the value of contributing to an interdisciplinary research team that is outside of the students' core discipline. Using the epistemic identity framework as a lens, we constructed a composite narrative drawing on data from multiple student members of two research teams to present their perceptions on the value of participation in EER teams. Findings highlight how participants understand the benefits of exposure to various disciplines and methodological approaches and the positive effects of collaboration on identity development that come from their engagement in interdisciplinary research contexts. Results from this study provide a needed student perspective within the literature and underscore the need for increased opportunities on EER teams for undergraduates in disciplines outside of their primary area of study.

Introduction

This Work-in-Progress empirical research paper explores how student members of an Engineering Education research team describe the value of contributing to an interdisciplinary research team that is outside of the students' core discipline.

Engineering Education marries multiple disciplines, resulting in an inherently interdisciplinary field [1]. While literature demonstrates the benefits of interdisciplinary research teams, including robust diversity of thought and enhanced potential solutions [1], [2], there can also be challenges. Research teams in engineering education must work across disciplinary backgrounds to solve complex problems, and individuals on these teams contribute different technical knowledge and approaches to problem solving. Collaborations between scholars from varying disciplines with different research approaches and methodologies can result in delays in progress, as teams must navigate differences in backgrounds while working toward group goals [3].

Not only are Engineering Education research (EER) teams comprised of faculty and researchers from various disciplines, but they can also include undergraduate and graduate students from majors outside engineering. The benefits of participating in research for students are plentiful. Studies demonstrate that research experiences are valuable in clarifying and confirming career choices, as well as developing specific research skills. They have also been shown to benefit students' personal, professional, and intellectual development [4]. Additionally, research experiences for students can increase their disciplinary understanding, confidence, and awareness of opportunities within their major of choice, as well as their own strengths and areas of improvement [5]. However, while the body of research that highlights the outcomes of participation in research for students is robust [6], there is less so on the participants' perceptions of the value of the experience itself [7], especially within research team contexts. Therefore, the

research question that informs this study is "How do student members of an Engineering Education research team describe the value of contributing to an interdisciplinary research team that is outside of the students' core discipline?"

Theoretical Framework

As "a descriptive tool for better understanding collaborative and cognitive practices in interdisciplinary spaces" [8, p. 228], epistemic identity serves as a valuable lens for examining how individual researchers perceive, value, and apply knowledge generation and expression. The four interconnected components of this framework – belonging and differentiation, perspective, values, and affect– provide a frame of reference for analyzing individuals' epistemic identity. An individual's feelings related to being a part of a community and their distinct role within it (belonging), perceptions of one's own as well as others' work (perspective), ideas about what constitutes quality science (values), and feelings related to values (affect), especially those in conflict with one's own, shape an individual's epistemic identity.

We employ Osbeck and Nersessian's framework of epistemic identity [8] to investigate how student researchers interpret the value of interdisciplinary research and collaborations. Epistemic identity allows us to focus our analysis on how the participants considered and made meaning of their identities as learners and problem solvers within an interdisciplinary team context.

Methods

Our data comes from multiple student members of two research teams. The research teams included researchers from natural sciences, engineering and engineering education, and these teams intentionally created a space for all voices to be heard. We conducted 60-minute, semi-structured interviews with two of the women students within the teams with backgrounds in the sciences. Data was coded inductively and deductively in atlas.ti, with the latter codes predetermined using Osbeck's [8] epistemic identity framework. Sample codes included "Perceptions of Field/Community," "Value_Team Working Together," and "Tensions Between Values of Different Communities." The research team employed thematic and narrative analyses to identify how the student researchers interpreted their experiences and identities as both students and team members.

The use of composite narrative, a methodology that incorporates data from multiple participants, allowed us to generate a first-person account that demonstrates the complexity and nuance of the data in a clear and comprehensive manner [9], [10]. Instead of identifying categories of the data, narratives enable researchers to tell a single, often complex story, from the perspective of the research participants. In capturing the lived experience of the participants in this study, we were able to generate a more generally representative account of the student members on EER teams while protecting individuals' anonymity. In line with scholarship on narrative construction [11], [12], we heavily relied on data from multiple participants to craft one composite narrative whom we refer to as "Stacy". When necessary, we added text to provide context or clarity and indicate supplemental text through the use of italics.

Preliminary Results

In constructing "Stacy's" composite narrative, we found that she appreciated the opportunity to learn different methodological approaches. Stacy also recognized how this exposure facilitated the integration of various disciplinary knowledge bases to generate the most effective solutions. She describes how collaborating on an interdisciplinary team has helped develop her identity as a scholar with a minoritized social identity in STEM. Stacy also highlights how she is able to contribute different ways of knowing within the team and provides examples of successfully exposing group members to research approaches and ideas from disciplines outside of engineering. Finally, she describes how including collaborators from outside of engineering seemed to particularly help humanize engineering work and challenge the notions of positivism.

Our results also indicate that student researchers recognize the importance of individual team members' positionality and the value that diverse backgrounds offer to groups as they work towards shared goals. These perspectives are especially important to cultivate in early career researchers as diverse perspectives and multiple ways of knowing can result in empathetic, informed, and innovative engineering education work. Below is Stacy's composite narrative, most of which comes directly from participants' data. Any text added by the authors for clarity or context is indicated through the use of italics.

> This *team* was the first time where I got to kind of hear the different ways in which folks from these different backgrounds and fields discussed their research and what their goals were. I think the most important part of the project in terms of preparing me for a career in STEM education was *learning* how you work on a team, where everyone's bringing something completely different to the table. I think sometimes people think, "oh, no, that's gonna lead to disagreements, and you're gonna have to educate individuals on your perspective, and it's gonna be time consuming, because there isn't that huge, shared body of knowledge." But I felt that that actually wasn't the case. I think having folks with a lot of different backgrounds, educationally, helped produce better science that doesn't see itself as objective, but reduces the subjectivity that's inherent in engineering, which is something that I had not really considered a lot before joining the project. The other thing that I think helped produce good science there was that we did a lot of the work collaboratively. So, there was a lot of communication, like *in* drafting a case study protocol, we all read a book on case study research methods. We would meet to discuss it, and we'd share our notes on it, and then once time came to actually write this protocol, it was done collaboratively. And we had *team members* you know, from different backgrounds, socioeconomically, race, gender, sexuality; we had a wide variety of personal identities. *This diversity among our team members facilitated conversations about* how do we humanize *our engineering work and because of all of these factors,* I think the main trait that I identified as *critical to constituting* good science…was interdisciplinarity.
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> *As an aspiring scholar with a minoritized social identity who values her culture,* it really helped having that sponsorship *from my team* to be able to move forward *using different research methods, theories, or* sets or paradigms to make our fields more diverse and

open to different ways of thinking or practices and not settled on one universal truth. I think we're all heading towards, at least our ultimate goal, which is ensuring that the future of engineering education or again, just STEM in general, has that diversity that it needs because that's how we innovate and that's how we get all those different perspectives and drive ahead, instead of having that one type of viewpoint. *The reality is that* we may have our different viewpoints, but *our team always aimed to* stick back to the common goal *because* we can have very different values, but we're connected *through* this common goal of trying to mitigate or erase racism in engineering education and make this space more welcoming for students, staff and faculty. *And we do this work* because we care about increasing the inclusion of who or what is being taught in engineering. So, I think that was important to them, defaulting to the common goals and objectives.

I hope that in the future there are more collaborations with different disciplines, because I felt it allowed us to really see the dynamics, the different opposing viewpoints, but *also* where do they align? Where do they contrast? Where do they intertwine and how we can work together to solve the issue? You know, I'm usually just with my people in my field, but I really appreciated working with engineers, because it allowed me to see a whole different world. And I hope that I see more instances where that interdisciplinary approach is *present,* so we can build a better and brighter future.

Discussion

The limited research focused on the importance of exposing undergraduate students to interdisciplinary research highlights the criticality of preparing students for careers in which they will collaborate with colleagues outside of their primary discipline [13]. The current study supports this prior scholarship, underscoring the relevance of undergraduates' engagement in interdisciplinary research by providing a much-needed student perspective which has been absent from the literature (for an exception, see [7]). Findings from this study also demonstrate the importance of faculty sponsorship of student researchers on their teams, which in the case of our participants supported their identity development both as aspiring researchers and in their own social identities. This is a critical finding as it may encourage more EER teams to recruit and engage more undergraduate students in their research.

Future Work

Additional research should consider the ways in which participation in interdisciplinary research teams may vary by degree level (i.e. undergraduate versus graduate). Future research might also explore how students on research teams from the core discipline represented perceive the value of researchers from outside their own subject areas. Finally, exploring the perspective of faculty on including undergraduates in EER teams should be considered, especially as there may be more training and supervision required of researchers who commit to including students in their interdisciplinary research.

Acknowledgements

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