

Work in Progress: A Mixed Methods Approach to Better Understand Researcher Identity

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WIP: A Mixed Methods Approach to Better Understand Researcher Identity

Abstract

This Work-in-Progress (WIP) paper details a mixed method approach to explore undergraduate student researcher identity. In recent years, the concept of engineering identity has increased in usage in engineering education as a factor affecting undergraduate engineering students' career choices and persistence in the field. While this expansion has laid a foundation of understanding, additional research using mixed methods to analyze identity is needed as mixed methods can provide both general trends and deeper insights into students' identities. Our constructivist-framed research contributes to this understanding by exploring engineering students' research experiences through an interweaving of quantitative survey data and connected qualitative interviews. By integrating quantitative and qualitative data, we can better understand students' researcher identities and ultimately better support their research academic and career choices.

Introduction and Background

Undergraduate research experiences (UREs) give students the opportunity to understand what it is like to be a researcher while enhancing their metacognitive and problem-solving skills [1]. Exposure to UREs can help prepare students for a thesis-based graduate program and, more broadly, can help them clarify their career plans and goals. UREs have been shown to increase students' confidence in their abilities to conduct research and improve their technical and oral skills by giving the students opportunities to present and publish their research [2]. We posit that these skill-building experiences also lead to the development of a researcher identity.

While identity has become an important area of research in the engineering education community, the "use and discussion of identity theories in STEM education (including engineering education) is still relatively narrow and underdeveloped" [3]. That said, the body of work related to identity in STEM is growing. For example, Godwin [4] has published work on building a quantitative measure of engineering identity that assesses the constructs of recognition, interest, and performance/competence. Building on Godwin's work, Verdín and her colleagues [5], [6] have expanded the work to understand first-generation college students' engineering identity. Researchers have investigated what factors influence identity [5] and how engineering identity influences persistence of effort [6]. Others have also quantitatively measured identity using surveys, measuring identity either through a single item or multiple items [3]. For example, Meyers et al. [7] used a direct single item ("Do you consider yourself to be an engineer?") to measure identity and then evaluated what actions defined "being an engineer" through additional questions. Similarly, Rohde et al. [8] used a single survey item, "I see myself as an engineer," to study the interactions between engineering identity and sense of belonging for first-year engineering students in a mixed methods, multi-institution study.

For our work, we combined the use of a single quantitative item with follow-up interview questions. This approach allowed us to both explore the efficacy of a single quantitative item and consider students in light of wider individual and interpersonal contexts. By combining these approaches, we were able to prompt students to unpack their definitions of research and researchers to explore the ways their definitions aligned with their perceptions of themselves as a

researcher. In the language of mixed methods research, we qualitized [9], [10] the quantitative measure to gain a deeper understanding of the students' UREs and additional knowledge related to the validity of such an approach to measuring researcher identity. For this paper, we compared and contrasted responses across these two strands to answer our research question: *What are the similarities and differences between how students conceptualize their researcher identity on a quantitative survey item and during an interview?* These insights provide evidence of the deeper understandings afforded through mixed methods related to researcher identity. Throughout this work, we employed a constructivist worldview and let the responses of the participants guide the work. We were not interested in the accuracy of students' responses related to researcher identity but rather were interested in their interpretations and changes over time.

Methods

This WIP is part of a larger mixed methods, grounded theory project aimed at developing a conceptual model to understand the epistemic thinking and researcher identity of engineering students [11]–[13]. For this work, we are specifically focusing on the researcher identity piece of the larger study and the use of a mixed methods approach to understand students' perspectives on their researcher identities. The larger project began with a survey administered in 2016 to undergraduate students at six different institutions [14]. Follow-up interviews were conducted with 20 participants who completed the survey. Following IRB approved procedures, we linked the quantitative and qualitative responses. At the time of the interviews, a few months to a year after the survey, participants had been in college two to six years and had participated in a variety of research experiences.

For this work, we operationalize quantitative and qualitative strands using Creamer's [15] definitions: the quantitative strand is deductive in nature and the qualitative strand is inductive. With that framing, our quantitative strand includes participants' responses to the survey question, "Do you see yourself as a researcher?" To answer this question, participants responded on an anchored scale from 1 to 7, with 1 being anchored as "No, not at all" and 7 being "Yes, very much." Using this approach allowed the participants to define being a researcher individually and to understand researcher identity from the students' perspectives. For our qualitative strand, we asked participants to define being a researcher and where they saw themselves on the scale at the time of the interview. For a subset of participants, we also asked them to define the anchors of the scale. We then told all participants the score they provided on the survey. We used that score as an opportunity to interpret how they viewed the scale as well as comparing their location on the scale during the time of the survey and interview during the interview. One benefit to using the scale was that it provided students with something to talk from that bounded their definition. It also made the participants consider how they saw themselves as researchers with respect to how they define research. Following the interviews, participants' names were replaced with randomly assigned gender-neutral pseudonyms and interview responses were transcribed and inductively coded, which is described in our previous work [16], [17]. For this paper, we focused on explanations for students' scoring on the survey and descriptions of the anchors on the scale.

We acknowledge that there are limitations to our approach. Most importantly, we only used one quantitative item to measure researcher identity in the survey. When we began this work,

instruments to measure researcher identity (e.g., [18]) were just being developed in engineering education and were not widely available. Additionally, we believed that a single item measure of identity was an appropriate starting point for our work given the use of follow-up interviews. This approach also aligned with other researchers' approaches to measuring identity (e.g., [7], [8]). While one item to measure identity impacts the interpretation of our results, the findings still provide a valuable contribution to the mixed methods literature related to identity measurement. We also acknowledge that there may be an inconsistent maturation effect due to the time that passed between the survey and interview for each participant. In our interview, we asked questions related to change over time to address this limitation as best as possible.

Initial Results

The results below are from the quantitative and qualitative strands of this work. The results are presented separately and then mixed in the following section.

Summary of Quantitative Results

Quantitative results for the 20 interview participants from the survey and interview are reported in Table 1, located in the Appendix. Only two of the 20 participants reported a higher score in the interview relative to their original survey responses. Most years in school and both genders were represented in the sample.

Summary of Qualitative Results

Participants' qualitative explanations of their researcher identities could be grouped into two categories based on our coding and analysis: those who felt like researchers and/or wanted to pursue research as a career, and those who did not feel like researchers and/or did not want a career in research. While all participants who identified as a researcher rated themselves in the upper half of the 7-point Likert scale, none rated themselves as a 7 during the interview. Some participants explained that they were missing something that prevented them from rating themselves as a "full" researcher, such as lacking a publication, not having enough research experience, or lacking a higher degree (such as a Ph.D.). Other participants explained that they could never be a true researcher because the nature of research meant that they were always learning and approaching being a researcher.

I would probably say a six. I think it's really hard to say that you're ever at a full 100% researcher, but I think that's also because my interpretation of it is there's always room to learn and stuff and be exposed to other things. (Taylor)

Still other participants exhibited resilience in their researcher identity development. Their researcher identity remained strong even in the face of failure or a bad research experience.

It was not the best experience as far as my relationship with my mentor, but I still really enjoyed the process of trying to discover something that I knew that I could do a PhD, and felt like you almost have to have a bad lab experience to know, yeah, I can still do it [...] I've experienced failure in research, but I think that's also made me feel like a researcher, because that's always what people say. Like it's never going to work out exactly how you want it. (Riley)

On the other hand, participants that did not feel like researchers or did not want to pursue a career in research rated themselves between 1 and 5 during the interview. Those participants that

rated themselves at 5 felt confident in their research abilities but felt they could not lead their own research.

I don't feel like, that, I could come up with a problem myself and solve it myself. If it was totally independent, I don't think I could finish. (Kelly)

Mixing the Data Sets

Challenging the idea that maturation explains changes in views, only two of the 20 participants reported higher researcher identity ratings in the interviews as compared to their survey responses. Mixing the quantitative and qualitative data during the analysis revealed that while some participants reported lower researcher identity ratings during the interview, they did not necessarily feel less like researchers than when they completed the survey. Without both strands of data, we would not have seen this detail. The participants attributed changes in their researcher identity rating to a recalibration of their researcher identity scale. For example, Frances said that she did not feel like she could attain a researcher identity rating of 7 as an undergraduate, but she did rate her researcher identity at a 7 in her survey. The interviewer reminded Frances of her survey response, and she responded to this realization below.

Interviewer 1: That's interesting, because when you took this survey, you actually did rate yourself a seven.

Frances: I did?

Interviewer 1: Yeah. Do you know what might have changed?

Frances: I think I may have just been viewing it a little bit differently in terms of what is a researcher. There were definitely a lot of ideas that I contributed to the studies themselves, but when I think about the overall goals of the study and where were those original ideas coming from, those were not mine. I think until you really have to be that person that starts from square one, that for me was what defines a seven where I think I started from kind of beginning middle.

From the excerpt above, Frances' change in researcher identity rating was due to a change in her perception of a researcher and not how strongly she identifies as a researcher. She explained that while she contributed ideas to the research, the original idea for the research project was not hers, so she could not rate her researcher identity at a 7. Additionally, she amended her researcher identity to "beginning middle" at the time she was responding to the survey.

Initial Discussion and Implications

Our results indicate that changes in how students rate their researcher identity on a scale can reflect the fluidity of someone's researcher identity which often changes with experience. This finding would not have been possible without our use of mixed methods. Increasing awareness of what is required to conduct research can explain why some participants chose to recalibrate their score on their researcher identities. This recalibration is also indicative of the fluid nature of identities. The value of students' identities as researchers lies in the alignment of research skills with important aspects of their ways of knowing engineering concepts and how to practice engineering (i.e., their epistemic thinking). The outcomes of understanding how undergraduates develop and express perceptions of their researcher identities in surveys and interviews will inform the development of experiences to provide meaningful ways for students to engage, function, and learn in both traditional and research-based learning environments.

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Appendix

Table 1: Participant, identity score reported from survey, interview, and selected demographic data. Carnegie classification reported at time of publication. Note that scores marked with an (^a) were an average based on the range reported by the participant. For example, Aubrey reported she was between a 5 & 5.5.

Participant	Survey Identity Score	Interview Identity Score ^a	Institution & Type	Years in College	Gender
Ari	5.0	5.0	3, R1	4	F
Aubrey	5.0	5.25 ^a	6, ES	3	F
Bay	4.0	4.0	6, ES	2	F
Clay	6.0	4.5 ^a	4, M1	4	F
Dana	6.0	4.5 ^a	1, R1	3	M
Eli	5.0	1.5 ^a	6, ES	2	F
Frances	7.0	6.0	2, R1	4	F
Hayden	7.0	3.0	6, ES	4	F
Kelly	6.0	5.5	2, R1	3	F
Kennedy	3.0	3.5 ^a	2, R1	4	F
Logan	6.0	5.0	5, R1	5	M
Max	6.0	2.0	1, R1	2	F
Pat	6.0	6.0	1, R1	5	M
Peyton	6.0	5.0	2, R1	2	M
Reed	6.0	1.0	3, R1	6	F
Riley	6.0	6.0	1, R1	3	F
River	6.0	4.0	4, M1	4	F
Sage	7.0	5.5 ^a	1, R1	3	F
Sam	4.0	3.0	2, R1	4	F
Taylor	5.0	5.5 ^a	4, M1	4	F

For Institution Type: R1 – Doctoral Universities: Very High Research Activity, ES – Special Focus Four-Year: Engineering Schools, M1 – Master’s Colleges & Universities – Larger Programs