WIP: Pilot Testing an Interview Protocol to Explore Perceived Bias and Engineering Identity in Graduate Engineering Students

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Abstract

This WIP research paper describes pilot testing of an interview protocol developed to explore engineering graduate students' (EGSs') experiences of perceived bias and the impact bias has on engineering identity (EI) development during graduate education. The interview engages participants to think about their graduate experiences, EI, and social/personal identities (e.g., sex, race/ethnicity). We hypothesize that perceived bias can have a negative impact on EI. To test this, a pilot interview protocol was developed based on previous research in bias and scaffolded by best practices in qualitative research. Seven 45-65 minute pilot interviews were completed via WebEx video-conferencing with EGSs from anonymous institutions. Pilot testing demonstrated the need for a clearer introduction of the interviewer and restructuring of experience questions to elicit participant narratives. The final interview protocol will be used with approximately 15-20 demographically diverse EGSs from across the US.

Keywords: Engineering Identity, Graduate Education, Qualitative Research, Bias

Background

This WIP research paper describes pilot testing of an interview protocol developed to explore engineering graduate students' (EGSs') experiences of perceived bias and the impact bias has on engineering identity (EI) development during graduate-level engineering education. Here, we use the term EI to describe how students see themselves as engineers in the larger context of how they define engineers or engineering. Prior research on EI development has focused primarily on undergraduate students,[1-3] however, research has begun to uncover the unique ways in which graduate students experience engineering education and how those unique experiences impact EI. For example, results from qualitative research indicate graduate students' EI has distinct components from undergraduates' EI and provides a useful theoretical framework to explore the experiences of EGSs.[4,5] EI at the graduate level has subcomponents similar to undergraduate EI of persistence/competence, interest, and recognition, but the main components are focused on graduate student activities of research and science in addition to engineering.[5-10] This project is part of a larger study that seeks to use this graduate level EI theoretical framework to explore how instances of perceived bias influence EGS identity framework components of researcher, scientist, and engineer.[4,5] We hypothesize that 1) EGSs who hold one or more minority identities perceive bias in engineering graduate programs and 2) perceived bias experiences negatively influence engineering identity development, 3) ultimately leading to decreased persistence and performance.

To test these hypotheses a pilot interview protocol was developed based on previous research in bias and scaffolded by best practices in qualitative research. The purpose of pilot interviews is to

test the efficacy and clarity of an interview protocol,[11,12] and beginning a study with pilot interviews is standard qualitative practice.[11] In addition, pilots can be useful in verifying that participants are comfortable with the interviewer, topics, questions, and mode of the interview.[11] These potential issues can be addressed at the end of an interview by directly asking participants about their experience of the interview. For instance, "Did you have any difficulty logging-in to the video-conference?" or "Were any of the questions I asked difficult to understand?" Interview protocols can then be adapted to increase efficacy and clarity of the protocol.

The pilot interview protocol for this project was designed to engage EGSs in thinking about their social and personal identities (e.g., sex, race/ethnicity), how being an engineering student interacts with those personal and social identities, and how perceived experiences of bias impact their developing graduate EI. We specifically engage participants in thinking about their social and personal identities through questions about how they introduce themselves to others in various situations. Participants are asked to compare their responses and elaborate on why aspects of their identity are salient in introductions (see Appendix A). Participants are then asked about experiences of being given special treatment or being treated differently.

Participants

EGS participants were recruited for interviews from a list of students who had previously participated in a large national study investigating EI and motivation and who indicated willingness to contribute to future research. To date, we have completed seven 45-60 minute pilot interviews via WebEx video-conferencing with EGSs from anonymous institutions. The participants included six women, with a balance of international and domestic students, and a variety of racial/ethnic identities (see Table 1). All participants self-identified as heterosexual, and one had completed an MS and was no longer enrolled; all others were current engineering Ph.D. students. Pseudonyms are used throughout to protect participants' confidentiality. All procedures and materials were approved by the authors' institutional review board.

Results and Discussion

Participants described their identities in various ways. The initial pilot questions asked, "How would you introduce yourself to someone over the phone?" All participants included type of engineering in their introduction. They connected their experiences back to the type of engineering they studied throughout their interviews by beginning comments referencing their program type. *"In Biomed, people are from all over the world and women are 50% or more at all levels"* - *Phoebe*. International students all included their nation of origin as part of their introduction. They also used this as a reference to their experiences in engineering in their countries of origin often contrasting their experiences in the US. *"In [nation of origin] it [sexism] was terrible."* - *Phoebe*. These participants did not see being an international student as influential on their EI. However, responses rarely included personal aspects of sex, race/ethnicity, or disability.

Some participants did not discuss sex or race/ethnicity without prompting. This led to the major alteration in the interview protocol of adding the first question "tell me about your experiences as a graduate student". This question allowed more natural probing into relationships and identities of others in the EGS sphere, while also allowing probes on how program and university

influenced the lived experiences of EGS. While participants responded in a variety of ways, their responses allowed probes about the people with whom they engaged during an activity (class, lab), what their relationship was (peer, advisor), and how they felt performing that activity with that person or people. The narrative richness of these responses and the subsequent probes brought forth detailed responses about the importance of social and personal identities of sex, race/ethnicity, international student status, disability, while also engaging participants in how those experiences shaped (or did not shape) their EI.

In the final pilot interview and final interview protocol, the initial question was refined to: *"I'd like to start by getting a picture of what it's like for you to be a graduate student in engineering day-to-day. Can you start by telling me what it's like being a graduate student in engineering?"* The responses to this question were clearer and more consistent descriptions of the day-to-day activities and interactions of students. For example, in talking about her lab group, Mindy mentioned lab meetings and how she did well at the beginning, but that changed after a semester or so. Her advisor began treating her differently from her male peers: *He treated me differently, he never yelled at me in any way, like he yelled at the guys. He wouldn't get into discussions, or I would say arguments [with the guys], with me, like, he would with others in the lab. I thought it was very clear I was treated differently. – Mindy.* Mindy was conflicted about both wanting equal treatment vs. her desire to not be yelled at by her advisor. The day-to-day event of being in the lab and attending lab meetings led directly to Mindy discussing how her advisor treated her differently. The interaction style of the advisor changed based on Mindy's gender.

Female participants had multiple examples of how males treated them differently; some were explicitly sexist comments while others were sexist behaviors. *Like who is going to order the coffee, or who is going to set the meeting, who is going to talk to everyone and let them know what's going on, who is going to figure out where are we going to go? Like those jobs are all women's. It's sort of like a male dominated lab. – Kamelia.* Recognition is a key component of EI. Experiences of sexism made participants question how they were being recognized in engineering. All of the participants expected to be recognized for their knowledge and research in engineering, rather than for their gender.

Interview questions deliberately allowed for positive associations with perceived bias. For instance, a participant could recognize an experience of perceived bias, but view the outcome of that bias as positive. No participants in the pilot interviews reported perceived bias in this way.

The intersection of race/ethnicity and sex was meaningful for Kamelia who self-reported her race/ethnicity as Latina. Racism and sexism are pervasive for her and directly shaped her experience of engineering. At the end of the interview, when she was asked why she hadn't discussed racism or sexism, she compared them to a serious medical condition, which impacted her daily life: *Because they don't affect me on the daily or maybe I'm already like so apathetic about the racism or sexism that exists. Like I don't know, it's not like I don't want to talk about it. But it's so obvious like of course, my name is Arroyo so like it's kind of written on my forehead. And then I show up and I'm on stage where I'm like giving a talk and it's like Hispanic women, whatever you know? – Kamelia.* These ubiquitous experiences were part of her experience as an EGS, and she could not separate her EI from these experiences.

At the end of the interview, participants were asked about difficulties with the interview questions and procedures. Kamelia was clear that she was uncertain about talking about racism with a white male interviewer, *"it would be easier if the person asking the questions was brown or black, because that makes everyone more comfortable talking about it."* The subsequent discussion about why and how that could be addressed in future interviews led to a clearer introduction that included personal details about the interviewer: *"My interest in STEM graduate education grew from my husband's experiences as a Uruguayan graduate student in cell biology."* Kamelia thought this would help future participants better understand the interviewer's position and motivations in pursuing this research. Subsequent participants did not mention similar concerns. Participants were asked if speaking with a white man about these issues gave them concern. Responses were either simply no concern, or specified the introduction statement as alleviating any concerns. *"The way that you introduced yourself and everything, I felt comfortable." – Sara.*

Conclusion

The final interview protocol will be used with approximately 15-20 demographically diverse EGSs from across the US. Future research could explore similar experiences in other underrepresented student populations and non-minority student populations. The use of pilot testing for qualitative research is often overlooked in preparation for qualitative interviews. The changes to our interview protocol significantly improved the quality and depth of the responses we received from participants as the interview proceeded.

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Table 1: Participant Demographics

Participant Pseudonym	Sex	Race/ Ethnicity	International/US student	Program	Disability
Mindy	F	Hispanic	US	Mechanical	None
Robyn	F	Asian	US	BioElectrical	None
Kamelia	F	Latina	US	Biomedical	Medical
Shreyas	M	Indian	International	Computer Science	None
Sara	F	White	US	Construction	Learning
Phoebe	F	White	International	Biomedical	None
An	F	Asian	International	Textile	None

Matthew Bahnson

Matthew Bahnson is a doctoral student at North Carolina State University in Applied Social and Community Psychology. His research interests include engineering identity, diversity, bias, stereotypes, and STEM education.

Mary Wyer

Dr. Mary Wyer is Associate Professor in Psychology and Women's & Gender Studies at North Carolina State University. She has worked with issues related to underrepresented groups in science and engineering since 1984. Dr. Wyer has published nine edited collections or special journal issues, three of these developed in collaboration with scientists/engineers and focusing on

gender issues in STEM, in particular, Women, Science, and Technology (Routledge, 2014), with Mary Barbercheck, Donna Cookmeyer, Hatice Orun, and Marta Wayne. Her empirical research explores how persistence is influenced by students' images of STEM professions and professionals, their attitudes toward gender equality, and assessments of the classroom climate.

Cheryl Cass

Dr. Cheryl Cass is a teaching associate professor in the Department of Materials Science and Engineering at North Carolina State University where she has served as the Director of Undergraduate Programs since 2011. Her current research focuses on the intersection of science and engineering identity in post-secondary and graduate level program, and she is a previous recipient of the ERM division's Apprentice Faculty Grant.

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Appendix A

Interview Protocol Pilot

Interviewer: Thank you for agreeing to participate in our research project. Before we begin, I would like to confirm you are willing to participate and have our conversation video and audio recorded. You can withdraw from the research at any time, simply by telling me you would like to stop the interview. The recordings will be transcribed and analyzed for themes. Your privacy is very important to us and we will protect your confidentiality by using password protected files and pseudonyms. Do you agree to participate and be recorded? We will not use your name or university in any publication of the research. Would you like to choose a pseudonym for yourself and your university?

Let's begin our conversation. First, let me introduce myself. My name is (NAME) and I am a student at North Carolina State University in Applied Social and Community Psychology. I am interested in how students experience graduate education and how those experiences influence their identities. Do you have any questions for me before I get to my questions?

Identity

1. How would you introduce yourself to a new person over the telephone to tell them a bit about yourself? In a different scenario, how would you describe yourself, if we were to meet at a party of graduate students, how would you introduce yourself?

a. How would you introduce yourself to a new engineering faculty member?

b. Or a new peer graduate student?

c. What about a family member or friend that knows you well?

i. How would that person introduce you to a new person? What things would they think were important to know about you?

d. What about in other social situations? Like, how would you introduce yourself on a dating website? (if they are uncomfortable with this idea, add 'or some other social media website.)

e. Some of these were different, why is that? (Prompt: Pointing out specific differences, why are these different? Are those differences important?)

(Prompt: social identities like being a particular race or ethnicity; professional identities like being a graduate student)

2. Several identities came-up in different situations such as (include most mentioned comments). How have these identities influenced your choice of projects in graduate school?

3. How have your identities been influenced by graduate school?

4. Do you think of yourself as an engineer? What does that mean to you?

5. Did your program help or hinder your identity as an engineer?

Bias

1. Have you had any experiences in graduate school where you felt you were given special treatment? When, by whom, what happened, how did you respond?

2. Have you had any experiences in graduate school where you felt you were treated differently? When, by whom, what happened, how did you respond?

3. Did you speak to anyone about your experience? Who and how did that conversation go?

4. If you had negative experiences, did you talk about this experience with your advisor or a program official? Why or Why not? How did the conversation go?

5. Have you found your program to be supportive of all students? Why or Why not?

6. Have you found engineering as a field to be supportive of all students? Why or Why not?

7. What about being supportive of students like you?

8. Are there things your university could do to be more supportive?

a. What about your program?

b. What about your advisor?

What aspects of your experiences in graduate school positively or negatively affected your identity as an engineer?

Interview Protocol Final

Interviewer: Thank you for agreeing to participate in our research project. Before we begin, I would like to confirm you are willing to participate and have our conversation video and audio recorded. You can withdraw from the research at any time, simply by telling me you would like to stop the interview. The recordings will be transcribed and analyzed for themes. Your privacy is very important to us and we will protect your confidentiality by using password protected files and pseudonyms. In addition, please refrain from naming specific people and places to protect third party identities as well as your own. If you do, we will use pseudonyms for everything. Do you agree to participate and be recorded? We will not use your name or university in any publication of the research. Would you like to choose a pseudonym for yourself and your university?

Let's begin our conversation. First, let me introduce myself. My name is (NAME) and I am a student at North Carolina State University in Applied Social and Community Psychology. I am interested in how students experience graduate education and how those experiences influence their identities. My interest in STEM graduate education grew from my husband's experiences as

a Uruguayan graduate student in cell biology. Do you have any questions for me before I get to my questions?

Engineering Graduate school

I'd like to start by getting a picture of what it's like for you to be a graduate student in engineering day-to-day. Can you start by telling me what it's like being a graduate student in engineering?

- What does a typical day look like for you, what kinds of activities are you engaged in?

- Which of those activities are meaningful for you and how?

- Who is with you when you do [activity]?

- How do you relate to them or not relate to them?

- How do you feel when doing those activities?

Who is in the lab and your classes with you?

- What is your relationship like with that person? (How do you interact?)

How does being in graduate school make you feel?

(Identity) We have talked about your graduate school experiences. I am also curious about how you think about engineers. What encouraged you to become an engineer?

1. What is your favorite activity when you are not being a graduate student? How would you introduce yourself to a new person in that activity? In a different scenario, how would you describe yourself, if we were to meet at a party of graduate students, how would you introduce yourself?

a. How would you introduce yourself to a new engineering faculty member?

Probe on engineer identity: What does it mean to you to be an engineer?

Probes: What experiences let you to feel like an engineer?

How did (experiences/people from section 1) influence your feeling like an engineer?

Bias – experiences not discussed previously

Thinking about the demographic survey you completed, what demographic categories are most meaningful to you?

1. Can you give me an example of a time in engineering grad school when you felt your ideas or perspectives were/weren't especially encouraged?

2. Probe for weren't encouraged: Did you speak to anyone about your experience? (Advisor, Peers, program or department staff, counselors?) Who and how did that conversation go?

3. Have you found your program to treat all students equally? Why or Why not?

4. Have you found engineering as a field to be supportive of all students? Why or Why not?

5. What about being supportive of students like you?

6. Are there things your university could do to be more supportive?

1. What about your program?

2. What about your advisor?

7. How did your program influence how you think of yourself as an engineer?

8. How did your engineering college or university influence how you think of yourself as an engineer?

9. How did these experiences influence your feelings of being an engineer?