

## **Compiling Resilience: A Study on First-Generation Women Pursuing Computing Degrees**

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## **Introduction**

Under-representation of women in science, technology, engineering, and mathematics (STEM) is well-researched from a range of perspectives yet persists as an issue [1]. Among the women who have chosen to pursue a STEM degree, many are first-generation college students and face obstacles within a male-dominated field [2, 3]. First-generation women often encounter implicit biases and stereotypes, difficulty attaining leadership positions or recognition for work, and inadequate support structures for mentorship and familial support networks [4]. Given this, studying first-generation women in computing at graduate level is an important step in understanding how and why these barriers may still be faced and pave a path through them to a more diverse and equitable STEM field.

In this research paper, we share our pilot study that investigates the experiences of first-generation women in Computing (i.e., Computer Science, Human-Centered Computing, etc.) graduate degree programs and provide recommendations and strategies for persisting through their graduate programs. This pilot is methodological in nature, as we intend to use evidence from this study to inform the design of a survey protocol informed by rigorous exploratory research into the phenomenon at the center of this work. Validating the survey protocol will be the next phase of this research, followed by a broad implementation of the survey.

As pilot work, this study is our first step toward building a robust line of research that builds outward from an exploration of graduate student experiences. Using qualitative interviews to construct quantitative survey items requires structures that guide both data collection and analysis to ensure trustworthy and transferable results. We began with an interview protocol based on the methodology of critical conversations, integrating a structure for guiding and managing the ongoing discussion between two interviewers interviewing each other. During thematic analysis, a third member of our team who was not present for the interviews assisted with analyzing while providing an external assessment of the evidence collected. The themes that emerged from their interviews surrounded navigating difficult situations, including advisor-student relationships, working with research associates, traversing departmental politics, fostering grad student communities, acknowledging mental health and burn out, and finding validation in academic successes.

Understanding the current challenges first-generation women face in Computing, a once female-dominated field [5], will provide an outline for evidence-based innovation toward inclusivity and support for similar women in the field. In addition to providing scope to a

validated survey instrument, we show where future research can focus on filling research gaps and provide insight into the experiences women face in STEM as a model for other women in the field or women seeking to be in the field.

## **Proposed Study Design**

In this section, we describe our proposed methodology and pilot study for exploring first generation graduate student experiences. As first generation graduate students who are also women ourselves, the goal of this research is to provide insight into the experiences that women who are also first generation graduate students in Computing face. We also hope this research can serve as a model for other first generation women seeking graduate Computing degrees. This research is guided by the following question:

RQ: What are the experiences of first generation women in graduate Computing degrees and the challenges that they face?

This question stems from our experiences as first generation women in a Computing graduate degree program. We hope that by exploring this topic and gathering the experiences of other women, that other first generation women will recognize that they are not alone in their experiences during their graduate degree program.

Our pilot study begins with a qualitative semi-structured interview administered between the first and second authors. In total, the authors came up with 26 questions related to PhD experiences, support, goals, and opportunities, these can be found in Table 1. Next, we administered the interview between the authors, lasting approximately one hour for each interview, two hours total. Using grounded theory, the research team analyzed the interview transcripts to generate a list of codes and observed themes [6]. The themes that were observed are:

- experiences of first generation women in computing graduate programs
- navigating difficult situations
- advisor-student relationships
- departmental politics
- graduate student community
- mental health and burn out
- validation in academic success

Based on the initial interview and identified themes, the research team aims to formulate a survey that will complement the interviews where we will seek quantitative data regarding the identified themes. For the survey, we plan to utilize the identified themes to generate survey questions that will include multiple choice and Likert scales to identify participants' attitudes toward each of our identified themes. Additionally, we will collect demographic information and ensure that each participant is actually a first generation women in a Computing graduate degree program. At the end of the survey there will be a place for participants to schedule their semi-structured interview with the research team.

Table 1: Table of interview questions

#	Question
1	Who/What influenced you to start a PhD?
2	What is motivating you to stay?
3	What are the milestones for getting your phd (comps, quals, proposal, portfolio, etc.)?
4	Does your advisor require anything in addition to your department?
5	What does your dept do to facilitate a positive (or negative) phd experience?
6	Does your department have a grad student group or club to help facilitate a grad student community?
7	If you could give any advice to women seeking a CS PhD, what would your top piece of advice be?
8	How do you feel your experience differs from others (men) in your department?
9	What does your personal support system look like?
10	What does your academic support system look like?
11	What is your relationship with your advisor?
12	How important is having a relationship with your advisor?
13	Do you feel like you have faced any challenges being a woman in your department and phd program?
14	What gender-related obstacles do you think you face?
15	Do you have any personal strategies or rules to keep work life balance in place?
16	What is your worklife balance like?
17	Have you experienced burnout in your time?
18	Do you have any specific goals related to promoting women in computing and graduate degree programs?
19	What are your career aspirations after completing your PhD?
20	How would you describe the inclusivity and diversity within your department?
21	What interdepartmental obstacles have you faced?
22	Have you been involved in any interdepartmental political issues?
23	What is something you are most proud of in your current academic career?
24	What support do you provide to your research group?
25	What support does your reserach group provide for you?
26	Have you had the opportunity to participate in a conference or group that focuses on women in computing?

For participant recruitment, we plan to utilize emails and social media to help advertise our study. First, we plan to identify United States-based universities with Computing graduate degree programs. We then will identify an administrative person in the department and send an email with our recruitment information for them to forward to their graduate students. To complement this, we will also use Reddit to advertise our study, by identifying whether the same institutions have a subreddit and posting on the subreddit if so.

For our full study, we plan to distribute our survey to potential participants first to gain insight into participant experiences before conducting their interviews. At the end of our survey, participants will schedule their interview. Once the interview is complete, the research team will then transcribe and code the transcriptions in an iterative process. If any new themes are identified, then the research team will come together to discuss and reevaluate previously coded transcripts to determine if the new theme is identified within. Once all interviews have been completed, the research team will then finalize their identified themes and conduct their thematic analysis to investigate the experiences of first generation women in Computing graduate programs and identify the challenges they face while in graduate school.

## **Potential Outcomes**

Through expanded analysis, we expect similar results to our pilot study and begin to formulate a comprehensive collection of shared experiences and successful practices for sustaining through graduate school. While we acknowledge that everyone can have a different experience, it is important to investigate an individuals expected versus their actual experiences. Transitioning to a graduate program can be daunting, with new work-life balance struggles, more rigorous course work, and additional independence in research studies can lead to stress and burn out. Conversely, graduate school can be filled with many accomplishments and opportunities to learn and grow. Beginning to understand expectations and the reality of graduate school helps frame the largest challenges and successes in graduate school and how to overcome or celebrate them.

Navigating an unknown landscape of potentially archaic and systematic biases in a traditionally male-dominated field can exacerbate stress, worry, and uncertainty for new graduate students. However, knowing more about strategies and management of departmental politics can be useful for graduate students who may not know the right questions to ask or how to approach difficult situations. Understanding the potential challenges like research theft and navigating vague departmental requirements helps start a path of self-advocacy and fosters a supportive community.

We believe that community support is vital in the graduate school experience. Community support can provide a sense of belonging, encouragement, and collaboration that can translate to academic and personal success through exposure to diversity, networking, and mentorship. Post COVID-19, we experienced a severe decline in graduate student community that struggles to re-emerge and fails to maintain momentum despite effort. Understanding how community support structures are used by and maintained by graduate students can help inform others on ways to rebuild, strengthen, and find their personal community structures.

Overall, we want to give a holistic outline and overview of the first generational graduate school experiences for other women in Computing. By compiling our shared experiences we can empower, inform, and guide those on the same path through the unfamiliar and challenging to success.

## **Conclusion and Future Work**

Through our pilot study interviews we identified several challenges and themes in first-generation women in computing experiences that echo sentiments seen throughout prior research. We propose a methodology to expand on this pilot study with additional qualitative interviews and quantitative surveys that will be analyzed iterative using thematic analysis. Additionally, through expanded analysis we aim to provide a summary of real experiences from first generation women in Computing graduate programs and outline our recommendations for resilience and purpose in academic programs. We welcome any feedback on this work and encourage any women who are comfortable speaking about their first generational experiences in a Computing to reach out and collaborate on expanding this research.

## References

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