The STEM Gap: Perceptions of Why Female STEM Students Change Majors

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## Background to the Problem

According to the Bureau of Labor Statistics (2021), science, technology, engineering, and math (STEM) jobs are expected to make up a significant portion of the U.S. workforce in the upcoming decade. While the literature indicates that college students of today are heavily recruited into STEM degree programs, it is also true that many choose to leave or change majors. In particular, the underrepresentation of women and minority students with STEM-related college degrees is replicated within the workforce's makeup, adding another layer to the challenge (Funk & Parker, 2018). If higher education institutions want to attract and retain more STEM majors, it will be essential to understand who changes their majors in the STEM fields and why. More than 32% of women college students who declare a STEM major are likely to switch to non-STEM majors before they graduate, whereas only 25% of their male counterparts do so, and women may be as much as 1.5 times more likely than men to leave STEM fields (Appianing & Van Eck, 2018). In 2017, women accounted for nearly half or more of the workforce in the life sciences and psychology. and social sciences. In comparison, during the same year, womend for only 27% of computer and mathematical scientic

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## Theoretical Framework Social Cognitive Career Theory

In investigating female students' perception of why they leave the STEM program, I will use the social cognitive career theory (SCC). This theoretical framework primarily focuses on how one thinks and learns about their career and how this thought pattern influences their career development decisions.

The SCC will be the blueprint for my study as it incorporates various concepts and it considers the effects that intérests, abilities, values, and environmental factors have on a person. The SCC theoretical framework builds heavily upon Van Bandura's social cognitive theory, which suggests that learning comes from a person's environment and behavior. Bandura's theory of cognitive and motivational processes has been extended to many other psychosocial fields, including academic performance, health behavior, and organizational development. In turn, the SSC theory, which was developed by Hackett and Betz (1981) and Lent, Brown, and Hackett (2000), focuses on people's personal constructions of events related to their career development. Specifically, people expect outcomes that support their beliefs, and, in turn, those beliefs and outcome expectancies lead to developing their interests. Their interests predict their personal goals in their career decision-making; subsequently, and their goals lead them to select and practice activities that will help them achieve goals. These successful actions lead to goal fulfillment and atta (Roller et al., 2020).

### Literature Review Themes

### Theme 1 – Self–Efficacy

The importance of self-efficacy is a common theme throughout the literature on success in STEM majors, especially as it pertains to women. Self-efficacy refers to one's belief that one possesses the ability to accomplish a particular goal. It determines what goals we choose to pursue, how we achieve those goals, and how we reflect upon our own performances. According to Green and Sanderson (2018), women who believe they can excel in STEM are more likely to graduate with a STEM degree than are women who question whether they can do so. Research shows that, compared to men, women have lower self-efficacy beliefs in STEM majors and that women who switch their STEM majors have lower self-efficacy than do women who persist in STEM majors, even though they have equal or better levels of academic achievement (Appianing and Van Eck, 2018)

#### Theme 2 - Environment - Perception of Women In STEM Programs

One of the most critical roles of a learning institution is to create a campus environment wherein students feel comfortable, as this will enable them to grow and learn. The students will affect the environment, which will, in turn, affect the students [Banning 1978] (Evans et al., 2010). The environment of a college campus answers the question of who belongs here and who does not. Several cues create a threatening educational environment for women in STEM and discourage them from both entering and remaining in these fields; these include the number of women faculty and students in the department, the prevalence of witnessing discrimination or sexual harassment, and the perception of university of the equity (Casad, Petzel, and Ingalls, 2018). Having a sense of the mase the science identity of these Theoretical Framework

### Literature Review Themes

#### Theme 3 - Peer and Faculty Mentors in STEM

The literature review also identified the benefits of peer mentoring programs in STEM subjects. It is crucial to retain underrepresented groups in STEM to diversify these fields; moreover acknowledging the importance of classmate contact and competence helps drive the retention of these underrepresented students (Hilts, Part & Bernacki, 2018). Through peer mentoring, students can begin to feel connected with their classmates (Hilts et al., 2018). Peer mentorship plays an essential role in influencing a student's perception of competence and relatedness. Their science learning outcomes confirm that peer relationships are critical throughout the STEM fields (Hilts et al., 2018). Nehmeh and Kelly (2021) performed research on undergraduate women in physics and found that departmental cultural shifts in promoting gender inclusiveness learning have been successful in increasing the number of individual women. At the present time, women are more closely identified with STEM in college environments where there are positive messages about women in STEM and peer role models than they are in college environments where those items are lacking.

#### Theme 4 - Professional Development

Research has been done on the factors that cause students to leave STEM majors. Nonetheless, studies investigating the use of career development to predict STEM retention rates are relatively new. Career interventions, such as implementing career planning classes, are more likely to affect career outcomes when they are done directly on undergraduates. Belser and colleagues (2018) found that students who enrolled in a STEM-focused career planning course had a lower score on negative career thinking at the end of the same semester. Additional studies have supported this finding that greater reduction in negative career thinking have shown that there are higher odds of STEM majors continuing from their first to second year (Belser et al., 2018).

# Problem Statement

While the literature indicates that female college students are heavily recruited into science, technology, engineering, and mathematics (STEM) degree programs, it is not know how School of Human Ecology (SoHE) female students describe why many choose to leave or change majors.

## Purpose Statement

The purpose of this qualitative social cognitive career theory study aims to understand why female STEM students choose to leave or change their major by moving to the School of Human Ecology at The University of Texas at Austin. Hopefully, this research will add to the literature in understanding the factors that influence female students' experiences in STEM fields and help recognize the potential structural obstacles that might lead to the under-representation of women in these subjects. Understanding why women and men graduate with different majors is critical for understanding later occupational opportunities and other choices that can influence the gender wage gap, self-efficacy, environment, mentorship, and professional development.

# Research Questions

### How do female Human Ecology students describe why many choose to leave STEM programs or changing majors?

# Proposed Methodology

I will use the qualitative method to research the most important factors and perceptions influencing female STEM students to change their majors. Qualitative research focuses on generating meaning and understanding through detail and rich description. It involves collecting and analyzing non-numerical data (i.e., interviews, focus groups, observations, and documents) to understand the concepts, opinions, or experiences students have while deciding to change their STEM majors (Creswell et al., 2019).

Qualitative research helps understand how people experience the world—there are many approaches to this type of research. It is useful when studying educational problems that require understanding complex social environments and their meaning. It is flexible and gathers rich meaning when interpreting data (Walden University, 2015).

This qualitative research aims to describe and interpret information that accurately conveys the students' experiences. I believe this form of data tion allows for in-depth insights into the perceptions of our femal ert or generate new research ideas

## Participants in the Proposed Study

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### Sample Size # of Participants

The participants will be female students who have switched majors in the School of Human Ecology (SoHE) at The University of Texas at Austin. As my research evolves and changes, I might move out of the School of Human Ecology and see if I can work with female students within the College of Natural Sciences. 10 - 12 female SoHE students

### Data Collection Instruments

#### Instrument #1

Instrument #2

### **One-on-One Interviews**

I chose to use in-depth one-on-one interviews, "a guided conversation" (Lofland and Lofland, 1984, p.2), as a research instrument to allow the participants to give highly personalized, detailed, and contextual descriptions of their experiences and perceptions as to why they switched majors. Another advantage of this research instrument is that the data is received immediately, allowing the researcher to ask more probing questions to clarify or further explore the participants' answers as the interview progresses (Creswell and Guetterman, 2019 p. 218).

These semi-structured interviews will be based on pre-determined questions, but the order will be modified based upon the interviewer's perception of what seems most appropriate (Ok Jong & Jung, 2015). The question wording can be changed and explanations given; meaning questions that seem inappropriate with particular interviewees can be omitted, or additional ones can be added (Ok Jong et al., 2015). The type of content for the questions will be related to behavior and experiences, opinions and beliefs, feelings, knowledge, sensory and nonverbal descriptions, and background and

### **Focus Groups**

The second research instrument will be focus groups. Pulling from the one-on-one interview participants, I will create three focus groups to gain an extra layer of qualitative data to determine participants' feelings, perceptions, attitudes, and thinking towards why they changed their majors. This will be a carefully planned discussion in a non-threatening and thoughtful environment, with four to five participants in each group.

Ground rules will be presented at the beginning of the meeting to ensure all participants are comfortable and an environment is provided where the group has space and time to answer questions. I will use open-ended questions to get a different perspective on why these students changed their majors (Creswell et al., 2019, p. 241). Using a focus group will elicit common vocabulary and context and quickly reveal the big ideas and themes for the study. Another advantage of focus groups is that the participants can hear each other's

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