The intersection of Sex and Field: An examination of Career Choice Factors and Dropout Intentions in STEM and non-STEM degrees

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Abstract. Female under-representation in male-dominated degrees is a worldwide concern. However, female students are over-represented in non-predominantly male degrees. Previous research has identified five critical factors influencing student participation rates: career choice, satisfaction, self-esteem, discrimination, and dropout. Based on a sample of 402 students, this study examines the educational experiences of female students in male-dominated STEM degrees compared to those in female-dominated non-STEM degrees. The study also compares results between male students in STEM and non-STEM degrees. The findings reveal that STEM female students are less likely to choose their studies based on vocation, associated with dropout intentions. Moreover, STEM female students have higher dropout intentions and feel less self-esteem. For female STEM students, dropout intentions are related to self-esteem, discrimination, and satisfaction. This study highlights differences between minority groups in STEM and non-STEM degrees and offers valuable information to address the under-representation of female students in technical fields.

Keywords: career choice, dropout intentions, female students, STEM degrees, under-represented minorities

1 Introduction

The under-representation of female students in STEM (Science, Technology, Engineering, and Mathematics) is a global concern and threatens workforce diversity and societal equality (World Economic Forum, 2021). Despite institutional efforts, some STEM programs have as low as 20% female graduates (NCSES, 2021), while non-STEM fields have consistently increased female graduates, with some majors surpassing 50% (NCSES, 2021). Addressing this disparity requires urgent attention from researchers and policymakers to encourage female students to pursue STEM careers (UNESCO, 2021). Increasing the representation of female students in STEM careers goes beyond numerical parity, as the high wages and job growth of STEM professions (NACE, 2022) can also contribute to gender equality in economic and professional terms. Additionally, increasing female representation will lead to more role models for future generations (Kricorian et al., 2020; Moè et al., 2021).

Research on female under-representation in STEM has mostly focused on comparing male and female students within the STEM field (e.g., Beasley & Fischer, 2012; Casad et al., 2019; Yang & Barth, 2015), leaving a gap in understanding differences between female students in different fields. Since non-STEM majors retain more female students, it is essential to compare STEM and non-STEM fields to identify the unique challenges female students face in STEM fields and improve STEM education. Furthermore, few studies have compared the effects of predominantly male environments on female students and the effects of predominantly female environments on male students. This comparison can provide valuable insights into the experiences of minority groups in predominantly opposite-gender environments. Therefore, this study aims to address this gap by examining the experiences of students enrolled in STEM degrees and comparing them with those enrolled in non-STEM degrees.

1.1. Theoretical framework

The under-representation of female students in engineering degrees has been related to the strong stereotypes present in this field, which traditionally link engineering to the male population, a profile that makes up the majority of students enrolled in engineering degrees (Beasley & Fischer, 2012; Cundiff et al., 2013; Makarova et al., 2019; Moè et al., 2021).

On the one hand, stereotypes play a significant role in shaping individuals' career choices. Research has consistently shown that careers that do not align with established gender roles are often not even considered (Gottfredson, 2002; Moote et al., 2020), leading to a scarcity of female students who aspire to enrol in STEM academic fields (Makarova et al., 2019; Moote et al., 2020). Achieving parity in STEM studies thus requires a closer examination of the career choice processes and the factors that influence them.

Psychological research has shed light on several key factors that may impact the decision to pursue a certain career. Prominent theories on motivational and self-evaluative aspects of career decisions, such as the Expectancy-Value Theory (Eccles, 1994) and the Social-Cognitive Career Theory (R. W. Lent et al., 1994), indicated that individuals are more likely to choose a career in which they feel capable and anticipate major successes or results. However, in STEM studies, the strong male stereotype can make female students feel a lower self-perception of ability in these areas compared to non-STEM degrees in which they can feel more competent (Ertl et al., 2017; Moote et al., 2020). Despite this, some studies have raised doubts about the adequacy of using confidence in abilities as the sole measure of female students' aspirations in STEM, as confidence in abilities does not currently account for male and female disparities in STEM as much as it has in the past (Seymour & Hunter, 2019).

Moreover, support and guidance from parents and teachers can greatly impact an individual's career choice (Ikkatai et al., 2021; Sjaastad, 2012). Parental involvement and encouragement, particularly from mothers, have been shown to positively influence students' interest and performance in STEM subjects (Wang & Degol, 2013). Similarly, teachers can encourage students to pursue STEM careers through their teaching methods and enthusiasm for the subject (Hill et al., 2010). Contrarily, lack of support or discouragement from parents or teachers can reduce interest in STEM fields (Wang & Degol, 2013). Additionally, practical considerations such as financial rewards and job security play a role in career choices. STEM fields are often associated with high-status, well-paying, and stable careers, making them attractive to many students (Hall et al., 2011). Some literature suggests that STEM and male students prioritize individual and professional goals, such as achieving a high salary or having a recognized job, while non-STEM and female students prioritize altruistic goals and a stronger purpose of helping society (Diekman et al., 2010; Fernández et al., 2006; Garibay, 2015; Yang & Barth, 2015).

Although numerous studies have examined the factors influencing students' career choices, differences between male-dominated and female-dominated degrees are still unclear. Some studies only analysed one factor of career choice, so there is a lack of comparative studies to determine which are more relevant to students' career choices depending on the field of study. Some studies have not found differences in the occupational goal of female students in STEM degrees versus non-STEM female students (Wolter et al., 2019). Furthermore, less is known about the motivations of under-represented students who manage to break through established barriers and enrol in engineering degrees as many studies have focused on prior levels of education, such as elementary and secondary school (Bian et al., 2017; Riegle-Crumb & Peng, 2021). To address these gaps, this study analyses career choice factors of both STEM and non-STEM students, including self-perceptions, and extrinsic and intrinsic motivations, to offer a more comprehensive view and identify potential strategies to encourage more females to pursue STEM careers.

On the other hand, the stereotypes can also affect the academic experience of those minority students who manage to break through the barriers and enrol in engineering studies. Previous literature has shown concern about the low academic persistence of female students in STEM environments and analysed the factors that threaten their attrition in technological careers (Beasley & Fischer, 2012; Casad et al., 2019; Moè et al., 2021; Rosenthal et al., 2016), such as the perceived discrimination (Beasley & Fischer, 2012; Leaper & Starr, 2019), academic satisfaction (R. Lent et al., 2016; Navarro et al., 2014) and students' self-esteem (Casad et al., 2019; Major et al., 2003; Sommer & Baumeister, 2002). However, fewer studies compared the retention of STEM and non-STEM students to understand if the observations hold in other domains or if there are discrepancies across different fields of study. Moreover, the few who have studied the differences between academic fields showed conflicting results. For instance, Gansemer-Topf et al. (2017) found that the retention rate was higher for STEM students than non-STEM students, while in Xu's (2015) study, students in STEM fields reported significantly stronger intention to abandon before degree completion than non-STEM students. Shedding light on this issue would be valuable to identify the specific challenges faced by female STEM students compared to those in non-STEM degrees and take specific measures to support their continued participation in technical fields.

In addition, while STEM studies have a strong male stereotype, non-STEM studies have a strong female stereotype. Comparing minority groups in both fields can help us understand how the environment affects academic persistence. Female students have been found to feel more threatened and discriminated against in STEM or predominantly male environments (Dresden et al., 2018; Ganley et al., 2018) than male students in non-STEM degrees. Moreover, in Fernández et al.'s (2006) study, male and female students enrolled in technical degrees reported the most sexist attitudes within their studies than non-technical ones. However, these results are inconsistent with those reported by other studies, such as Morris & Daniel's (2008), which concluded that female students and students in traditionally female-dominated degrees perceived the campus as less safe than male students and students in traditionally male-dominated degrees. This inconsistency underlines the need for further research to determine if STEM environments are particularly challenging for female students and to identify the impact of such challenges on their attrition rates. In order to fill this research void, the current study examined the results for male and female students enrolled in STEM and non-STEM programs. By comparing these variables across fields of study, the study aimed to provide insights into differences in academic persistence and the factors that threaten retention in each domain.

Finally, numerous studies have found that vocational interest in a university degree plays a crucial role in student retention (Allen & Robbins, 2008; Kim & Beier, 2020; Nye et al., 2012). One of the most influential theories in the field of career development is Holland's Theory of Vocational Choice (1997), which states that individuals tend to gravitate toward careers where they can work alongside individuals with similar interests and abilities. Additionally, Holland's theory notes that the greater the degree of alignment between an individual's interests and career choice, the more likely they are to experience positive career outcomes, such as job satisfaction, persistence, and achievement. On this basis, the present study explores the relationship between vocational interest and the intention to drop out of university. The goal is to deepen the understanding of the impact of vocational interest on university student retention and to explore whether the association between vocation and dropout intentions persists across different academic domains.

In summary, the current study aims to analyse the factors influencing career choices for STEM and non-STEM enrolled students, with a particular focus on encouraging more female students to pursue STEM degrees. Additionally, the study will compare the intentions to drop out of STEM and non-STEM students to determine if factors affecting female academic persistence in STEM fields are similar across other disciplines or vary by field of study. By offering a more comprehensive understanding of the factors that influence career choices and student retention, this study will significantly benefit educational institutions, policymakers, and career counsellors who seek to promote equity and diversity in academic fields. Additionally, the study's findings may help inform the development of evidence-based policies and programs that promote academic and professional success, not just for female students but for all students in STEM and non-STEM studies.

1.2. The present study

Against this background, the present study compares different groups of students based on sex and academic field:

a) STEM female students vs. non-STEM female students: Analyse differences between female students enrolled in STEM degrees where they are in the numerical minority and where there is a male stereotype and female students enrolled in non-STEM degrees where they are in the numerical majority and where there is no male stereotype.

b) STEM female students vs. non-STEM male students: Analyse differences between the two minority groups and compare the experience between female students in a predominantly male environment and male students in a predominantly female environment.

c) STEM male students vs. non-STEM male students: Finally, to analyse whether the differences

observed are specific to female students, this study compares male students in STEM studies to male students in non-STEM studies.

Based on these comparisons, this study explores the following research questions:

1) Do career choice factors differ by students' sex and academic field? It is expected that the factors that motivate the career choice of STEM female students will differ from those of male and female students in non-STEM degrees (Fernández et al., 2006; Garibay, 2015; Gottfredson, 2002; Moote et al., 2020; Yang & Barth, 2015).

2) Do the intentions to drop out and related factors (academic satisfaction, perceived discrimination, students' self-esteem) differ among students by students' sex and academic field? Female STEM students are expected to report higher dropout intentions and perceptions of discrimination and lower self-esteem and academic satisfaction than non-STEM students (Beasley & Fischer, 2012; Dresden et al., 2018; Fernández et al., 2006; Ganley et al., 2018; Xu, 2015),

3) What factors are associated with students' intentions to drop out by students' sex and academic field? The intention of dropping out of STEM female students is expected to be associated with academic satisfaction, perceived discrimination, and self-esteem. However, the association between perceived discrimination and dropout intentions is not expected to be found in non-STEM studies under the assumption that these are safer environments (Dresden et al., 2018; Fernández et al., 2006; Ganley et al., 2018).

4) Does vocation relate to students' dropout intentions based on sex and academic field? It is expected to find a significant association between vocation and persistence in male and female students and in STEM and non-STEM degrees (Allen & Robbins, 2008; Kim & Beier, 2020; Nye et al., 2012).

2 Method

2.1 Participants

The current study was conducted at two Spanish public universities. It was based on a cross-sectional survey of a non-probabilistic voluntary sample of students enrolled in university degrees. With a response rate of 54%, a total of 402 students answered the questionnaire, with a confidence level of 95% and a margin of error of 5%, of which 226 students were enrolled in STEM degrees and 176 students were enrolled in non-STEM. Table 1 shows the academic characteristics of the students. Respondents were self-selected, and no incentive was offered to participate in the study. Participants received an informed consent form explaining the goals of the study and data protection procedures. The authors ensured that all respondents agreed to receive communications and understood the purpose of the study. Data collection was anonymous and exclusively used for the purposes stated in the informed consent form.

2.2 Measures

A questionnaire was designed for this study, including measures from previous literature and adapted to the research context.

First, sociodemographic data were asked to characterize the sample, such as sex or students' degree. To assess the factors that motivated the career choice, the FIT-Choice (Factors Influencing Teaching Choice) Scale (Watt & Richardson, 2007) was used, a widely known and validated measure for assessing career choice factors. The measure comprised a multiple-choice question with eleven motivational factors for choosing the career (e.g., "It is my vocation"). Academic satisfaction was measured based on Ramsden's (1991) measurement, consisting of a single question on how satisfied they were with their studies on a 4-point scale (1 = Not satisfied to 4 = Very satisfied). To measure students' dropout intentions, students were asked to indicate if they had thought about changing or leaving their studies on a 4-point scale (1 = Never

to 4 = Very often), based on Bunker et al.'s (2013) study. Students' self-esteem was measured with the Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965) adapted for the purpose of this study, consisting of a set of four items (e.g., "I am generally satisfied with myself") scored on a 4-point scale (1 = Strongly disagree to 4 = Strongly agree). The Cronbach's alpha for the scale was computed, obtaining reasonably strong reliability ($\alpha = 0.82$). Finally, perceived discrimination was measured with 5 items adapted from Pachter et al. (2010). Six experiences of discrimination were presented (e.g., "I have not been treated with the respect I deserved"), and participants had to indicate if any of the situations had happened to them on a 4-point scale (1 = Never to 4 = Very often). The Cronbach's alpha for the scale was computed, yielding acceptable reliability ($\alpha = 0.66$).

2.3 Procedure

The questionnaire was designed using Google Forms© and sent to the participants by email during the second semester of 2019/2020 and the first semester of 2020/2021 by the authors of this research and other faculty members explaining the study's purpose. Participants were encouraged to answer all the questions sincerely according to their opinions. Before the distribution, the questionnaire underwent a validation process by experts to identify whether it omitted some important and relevant question topics, determine the questions' clarity and accuracy, and unveil potential flaws in its design.

The data underwent preliminary analysis, including identifying missing values and outliers, characterizing the sample, and defining/classifying variables. Table 2 shows the labels designated for each of the variables and factors studied. The sample was described using descriptive statistics and frequency analysis. Next, a comparative analysis was carried out according to students' sex and field of studies, dividing the sample into female students enrolled in STEM and non-STEM degrees and male students enrolled in STEM and non-STEM degrees. The Chi-Square test for independence was employed to explore the differences between the defined groups regarding students' career choice factors and assess the relationship between vocation and dropout intentions. The Mann–Whitney U test was applied to analyse the differences regarding students' academic satisfaction, self-esteem, perceived discrimination, and dropout intentions. Finally, Spearman's correlation analysis was executed to examine the association between students' dropout intentions and the other variables. Results yielding a *p*-value less than 0.05 was considered statistically significant, and Cohen's d (1988) criteria was used to assess the effect size of the correlations.

3 Results

The initial data set of 402 participants was evaluated for missing data and outliers. After the deletions of 5 extreme outliers, the final data set consisted of 397 participants. No missing values were found due to the compulsory completion of questions.

Regarding students' choice factors (Table 3), non-STEM female students were more likely to choose their studies because of their vocation, having a positive impact on society, and having a job that made them feel fulfilled than those enrolled in STEM studies. In contrast, female students enrolled in STEM degrees were likelier to choose their careers to get a high salary and find a job easily. However, contrary to expectations, no significant differences were found regarding the motivation received from family, friends, and teachers and regarding their skills in the area as a motivating factor for career choice. When comparing minority groups, male students in non-STEM studies chose vocation as the most relevant factor of career choice and were significantly more likely than female students in STEM studies to choose studies because of their vocation, even though male students are in the minority in non-STEM studies and these fields have strong female stereotype (Table 4). In contrast, female STEM students chose ease of finding a job significantly more often than non-STEM male students. As shown in Table 5, the comparison results between male students were similar to that of female students. Non-STEM male students were more likely to choose their studies because of their vocation and the possibility of positively impacting society. In

contrast, male students in STEM studies were more likely to choose their studies because of the ease of finding a job and earning a high salary.

Female students enrolled in STEM degrees had significantly lower self-esteem and higher intentions to drop out from their studies than female students in non-STEM degrees (Table 6). In addition, female STEM students reported lower academic satisfaction and a higher perception of discrimination, although the differences were not statistically significant. Female students in STEM degrees showed significantly lower self-esteem and higher dropout intentions than male students in non-STEM degrees. While differences were observed between female groups, no significant differences were found between male students enrolled in STEM degrees and male students in non-STEM degrees.

As regards the factors associated with students' dropout intentions, female STEM students' intentions to drop out were related to their academic satisfaction, self-esteem, and perceived discrimination, while for female students in non-STEM degrees, their intentions to drop out were only associated with academic satisfaction (Table 7). Similar results were found in the case of men since, for those in STEM degrees, perceived discrimination and self-esteem were correlated with dropout intentions, while for non-STEM male students, they were not related (Table 8).

Finally, a significant relationship was found between vocation as a factor of career choice and students' dropout intentions, so those with a greater vocation had fewer intentions to leave their studies. This relationship was found in the case of female students (X^2 (3, n = 209) = 37.65, p = .000) and also male students (X^2 (3, n = 188) = 12.35, p = .006). Moreover, the association was also significant for both STEM students (X^2 (3, n = 224) = 9.14, p = .027) and non-STEM students (X^2 (3, n = 173) = 33.43, p = .000).

4 Discussion

Despite decades of interventions and research, the participation of female students across university degrees is heterogeneous. While some fields, such as social or healthcare, manage to attract females' interest, others, such as engineering, remain worryingly under-represented. This study brings new insights into the differences in the factors that intervene in choosing a career and dropping out from studies between STEM and non-STEM degree students.

The results showed that vocation was the first factor that motivated female and male students enrolled in non-STEM studies, while it was a significantly less relevant factor for female and male students enrolled in STEM. This suggests that non-STEM students are more likely to choose their field of study based on their interests and passion, while STEM students are more likely to be influenced by other factors. Another interesting finding was that having a job that made them feel fulfilled and positively impact society were more relevant reasons for non-STEM students than for STEM students. This implies that non-STEM students place a greater emphasis on finding work that is meaningful and fulfilling, while STEM students may prioritize job security and earning potential, even above vocation.

The findings of this study concur with previous research on career choice motivations which indicate that students pursuing STEM degrees or fields with a male-dominant presence tend to prioritize tangible and status-oriented goals, while non-STEM students prioritize making a positive impact on society and helping others (Fernández et al., 2006; Garibay, 2015; Yang & Barth, 2015). Women's tendency towards collectivist interests and group-oriented goals (Diekman et al., 2010; Fernández et al., 2006; Zeffane, 2017) may conflict with engineering with individualistic and professional status goals (Yang & Barth, 2015), potentially leading to lower female participation in STEM fields. Contrary, studies that promote more collectivist or altruistic aspirations, such as those in non-STEM fields, may be more likely to attract female students. Therefore, fostering a more socially-oriented view of STEM careers could encourage the participation of female students and other under-represented groups in these fields (Diekman et al., 2010; Garibay, 2015) and help challenge the longstanding association of STEM and engineering with masculinity and individuality.

The results showed that male and female STEM students identified vocation and impact on society as less significant motivating factors than their counterparts in non-STEM fields. This suggests that a lack of vocation or interest in the positive impact on society is not limited to a particular sex but affects all STEM students. Despite recognition by governments and institutions such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) that STEM careers hold the potential to drive social change (UNESCO, 2021), this is not reflected in the motivations of those who pursue these careers. To address this issue, it is crucial to increase the visibility of the social impact of STEM careers, which will have positive consequences for the entire student body, regardless of students' sex. This will increase student engagement in social problems, foster their transformative potential to rectify structural inequalities, and enhance essential outcomes such as social responsibility and civic engagement, which are critical for a more democratic society.

The results showed that female students in STEM fields reported significantly higher intentions to drop out than non-STEM female and male students. Conversely, no significant differences between STEM and non-STEM male students were found regarding students' dropout intentions. Aligned with previous studies (Casad et al., 2019; Leaper & Starr, 2019; Rosenthal et al., 2016), these findings suggest that predominantly male academic settings pose a greater threat to female students' retention compared to predominantly female settings for male and female students' retention. In addition, female students in STEM studies reported less self-esteem than female and male students in non-STEM degrees. Meanwhile, no significant differences were observed in self-esteem between male students in STEM and non-STEM fields. Previous literature stated that females tend to have lower self-esteem than males (Helwig & Ruprecht, 2017; McMullin & Cairney, 2004), so it could be expected that the two groups of female students, regardless of the academic setting, showed low self-esteem. However, the results of the present study imply that the field of the studies can affect female students' self-esteem, weakening it in the case of STEM studies.

To create a more inclusive and supportive environment in STEM fields, institutions should increase the representation and visibility of women in STEM fields, offer mentorship and support networks, address gender biases and stereotypes through unconscious bias training, and increase the representation of women in STEM leadership roles. Institutions can also provide counselling and support services to address issues such as impostor syndrome and self-doubt faced by female students in STEM degrees. Creating more welcoming and supportive environments in STEM fields can encourage female students to pursue their academic and professional interests and increase retention of female students in STEM fields, leading to a more diverse and talented student body and a diversification in the STEM workforce. Encouraging female students and other ethnic minorities to participate in STEM studies may help create a more comfortable space for all students. These results show the need for a more supportive and inclusive environment in STEM fields. This can be achieved through initiatives like increasing the representation and visibility of women, offering mentorship and support networks, and addressing gender biases through unconscious bias training. Institutions can also provide counselling and support services to address specific challenges faced by female students, such as impostor syndrome and self-doubt (Diekman et al., 2010; Olmedo-Torre et al., 2019). Creating welcoming and supportive environments can encourage female students to pursue their interests and boost their confidence and self-esteem. Increased retention of female students can lead to a more diverse and talented student body and workforce. Therefore, encouraging female students and other ethnic minorities to participate in STEM studies can help create a more comfortable space for all students and balance the values established in academic STEM campuses.

Furthermore, this study sheds light on the complex relationship between self-esteem, perceived discrimination, and dropout intentions among students in different academic fields. While previous research has shown the significance of these factors in predicting student dropout rates (Casad et al., 2019; Morris & Daniel, 2008; Sommer & Baumeister, 2002), this study highlights the importance of considering the academic environment. In male-dominated academic fields, self-esteem, perceived discrimination, and academic satisfaction were associated with dropout intentions among male and female students, with lower self-esteem, lower academic satisfaction, and higher perceived discrimination leading to higher dropout

intentions. However, these associations do not hold in predominantly female academic fields, indicating that the influence of these factors may be context-dependent. One possible explanation aligned with previous research is that the predominantly male environment and associated values such as competitiveness (Johnson, 2007; Riegle-Crumb et al., 2019) can create a threatening environment for all students, not just female STEM students (Fernández et al., 2006). By showing that the relationship between self-esteem, perceived discrimination, and dropout intentions is not universal, the study underscores the need for a nuanced and context-specific approach to addressing these issues and developing targeted interventions to support student success in STEM degrees. In male-dominated academic settings, addressing students' perceived discrimination and self-esteem may be especially important in reducing the risk of dropout compared to non-STEM settings, where other factors should be explored. STEM institutions can take various actions to foster inclusivity, such as incorporating diverse perspectives into course materials and teaching practices; addressing implicit biases through education and training, including workshops, seminars, and online resources; providing student support services and encouraging open communication and transparency; encourage students to believe in their ability to grow and develop their skills within the university help to increase their confidence; and increasing diversity in STEM fields through outreach programs and scholarships (Braxton & Mundy, 2001; Cronin et al., 2021; Gairín et al., 2010; Massey et al., 2022).

Additionally, the study found a significant correlation between vocation and students' likelihood of dropping out for both male and female students in all academic fields. This result reinforces the importance of encouraging the vocation of STEM careers, especially in female STEM students, which are under-represented. This will not only encourage them to become more interested in these degrees but also reduce the chances of dropping out once they enrol. Governments and educational institutions can promote STEM vocations among female students through talks, workshops, and STEM-related activities led by women in STEM fields for primary and secondary school girls, creating mentorship programs, and including the role of women in STEM into the academic material throughout the educational process (Olmedo-Torre et al., 2019; Peña et al., 2021; Whitehead & Alves, 2022).

4.1 Limitations

Several limitations should be considered when interpreting the results of this study. The study focuses on male and female students, which may exclude the perspectives of non-binary or gender-nonconforming students. Future research could include a broader range of gender identities. Also, not all degrees within these fields were included, cautioning generalizations to other fields, such as healthcare, biology, or humanities. Future studies could validate the results of this investigation for other majors within the fields studied. Finally, it is important to keep in mind that the measures are based on self-reported data and that the study explores complex human processes such as career choice and the decision to drop out of college, so other elements could also influence these decisions. For instance, students' academic performance, perceived difficulty level, the effort required to pass the courses, or the perceived quality of their classes could also play a role (Xu, 2015). While this research provides valuable insights into the academic experience of female students in engineering majors, future research could address these limitations for a more comprehensive understanding of the experiences of underrepresented students.

5 Conclusion

This study sheds light on the factors influencing female students' career choices and persistence in STEM and non-STEM fields. The findings highlight differences in the factors students value when choosing a career, with STEM students prioritizing job security and earning potential, while non-STEM students value meaningful work and social impact. There are also significant differences in how minority students fare in the academic environment, with female STEM students reporting lower self-esteem and higher intentions

to drop out. To address these disparities and create a more balanced and welcoming environment, institutions need to promote the social impact of STEM careers, challenge biases, and adopt a more socially-oriented view of STEM careers. By taking these actions, STEM fields can enhance the participation and success of female students, leading to a more diverse and inclusive academic environment that fosters essential outcomes like social responsibility and civic engagement.

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Table 1. Demographic Characteristics of the Participants

Baseline characteristic	*n*	*%*
Sex		
Male	190	47.3
Female	212	52.7
STEM degrees		
Mechanical Engineering	72	17.9
Electrical Engineering	23	5.7
Energy Engineering	23	5.7
Materials Engineering	11	2.7
Industrial Electronics and Automation Engineering	37	9.2
Chemical Engineering	43	10.7
Biomedical Engineering	17	4.2
non-STEM degrees		
Pedagogy	22	5.5
Psychology	21	5.2
Primary Education	47	11.7
Early Childhood Education	41	10.2
Social Education	34	8.5
Double Degree in Early Childhood and Primary Education	11	2.7

Note. $N = 402$.

Table 2. Variables Related to Career Choice Factors and Interaction and Perceived Discrimination Situations

Measure	Survey item	Variable
Students' career choice factors	My family	Family
	My friends	Friends
	My teachers	Teachers
	It is my vocation	Vocation
	My skills in the area	Skills
	To get a high salary	Salary
	Ease of finding a job	Find_job
	Having a positive impact on society	Impact_society
	To have a job that makes me feel fulfilled	Feel_fulfilled
	Having a job that makes it easy for me to raise a family	Start_family
	The possibility of working as part of a team	Teamwork
Students' perceived discrimination		Perceived_discrimination
Students' academic satisfaction		Academic_satisfaction
Students' self-esteem		Self-esteem
Students' intentions to drop out		Dropout_intentions

Table 3. Frequencies and Chi-Square Results for Female Students Choice Factors by Field of Degree

Variable	STEM female[a]		non-STEM female[b]		$X^2(1)$	*p*
	n	%	*n*	%		
Family	21	27.6	30	22.6	0.43	.513
Friends	3	3.9	11	8.3	0.84	.360
Teachers	8	10.5	11	8.3	0.09	.768
Vocation	21	27.6	96	72.2	37.16	.000
Skills	29	38.2	47	35.3	0.07	.796
Salary	15	19.7	5	3.8	12.48	.000
Find_job	24	31.6	7	5.3	24.47	.000
Impact_society	29	38.2	77	57.9	6.77	.009
Feel_fulfilled	39	51.3	99	74.4	10.52	.001
Start_family	5	6.6	8	6.0	0.00	1.000
Teamwork	13	17.1	33	24.8	1.26	.263

Note. $n = 209$.
[a]$n = 76$. [b]$n = 133$.

Table 4. Frequencies and Chi-Square Results for Minority Students Choice Factors by Field of Degree

Variable	STEM female[a]		non-STEM male[b]		$X^2(1)$	*p*
	n	%	*n*	%		
Family	21	27.6	6	15.0	1.69	.194
Friends	3	3.9	1	2.5	0.00	1.000
Teachers	8	10.5	6	15.0	0.16	.687
Vocation	21	27.6	29	72.5	19.72	.000
Skills	29	38.2	15	37.5	0.00	1.000
Salary	15	19.7	3	7.5	2.13	.144
Find_job	24	31.6	4	10.0	5.54	.019
Impact_society	29	38.2	21	52.5	1.65	.199
Feel_fulfilled	39	51.3	22	55.0	0.03	.855
Start_family	5	6.6	3	7.5	0.00	1.000
Teamwork	13	17.1	10	25.0	0.59	.442

Note. $n = 116$.
[a]$n = 76$. [b]$n = 40$.

Table 5. Frequencies and Chi-Square Results for Male Students Choice Factors by Field of Degree

Variable	STEM male[a]		non-STEM male[b]		$X^2(1)$	*p*
	n	%	*n*	%		
Family	55	37.2	6	15.0	6.08	.014
Friends	15	10.1	1	2.5	1.48	.224
Teachers	24	16.2	6	15.0	0.00	1.000
Vocation	62	41.9	29	72.5	10.62	.001
Skills	70	47.3	15	37.5	0.86	.355
Salary	62	41.9	3	7.5	14.98	.000
Find_job	73	49.3	4	10.0	18.54	.000
Impact_society	45	30.4	21	52.5	4.81	.016
Feel_fulfilled	77	52.0	22	55.0	0.02	.876
Start_family	23	15.5	3	7.5	1.10	.294
Teamwork	28	18.9	10	25.0	.394	.530

Note. $n = 188$.
[a]$n = 148$. [b]$n = 40$.

Table 6. Means, Standard Deviations and Mann-Whitney U test Results for Female Students by Field of Degree

Variable	*M*	*SD*	*M*	SD	*U*	*z*	*p*
	STEM female[a]		non-STEM female[b]				
Academic_satisfaction	2.76	0.61	2.92	0.68	4513	-1.47	.143
Self-esteem	2.84	0.57	3.15	0.52	3433	-3.93	.000
Perceived_discrimination	1.42	0.42	1.39	0.37	5131	-0.19	.852
Dropout_intentions	2.20	0.99	1.70	0.85	3579	-3.75	.000
	STEM female[a]		non-STEM male[c]				
Academic_satisfaction	2.76	0.61	2.80	0.65	1480	-0.28	.783
Self-esteem	2.84	0.57	3.21	0.50	938	-3.42	.000
Perceived_discrimination	1.42	0.42	1.48	0.51	1483	-0.22	.826
Dropout_intentions	2.20	0.99	1.83	0.90	1841	-1.99	0.47
	STEM male[d]		non-STEM male[c]				
Academic_satisfaction	2.76	0.64	2.80	0.65	2845	-0.43	.664
Self-esteem	3.06	0.62	3.21	0.50	2534	-1.41	.159
Perceived_discrimination	1.35	0.42	1.48	0.51	2566	-1.33	.183
Dropout_intentions	1.95	0.85	1.83	0.90	3242	-0.99	.322

Note. $n = 397$. Range = 1-4 for each variable.
[a]$n = 76$. [b]$n = 133$. [c]$n = 40$. [d]$n = 148$.

Table 7. Intercorrelations for Study Variables for Female Students by Field of Degree

Variable	1	2	3	4
1. Academic_satisfaction	-	.171	-.123	-.261*
2. Self-esteem	.190*	-	-.152	-.602***
3. Perceived_discrimination	-.125	-.090	-	.234*
4. Dropout_intentions	-.282**	-.003	.127	-

Note. The results for female students in STEM degrees ($n = 76$) are shown above the diagonal. The results for female students in non-STEM degrees ($n = 133$) are shown below the diagonal.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 8. Intercorrelations for Study Variables for Male Students by Field of Degree

Variable	1	2	3	4
1. Academic_satisfaction	-	.380***	-.276***	-.381***
2. Self-esteem	.233	-	-.218**	-.338***
3. Perceived_discrimination	-.214	-.643***	-	.321***
4. Dropout_intentions	-.474**	-.266	.224	-

Note. The results for male students in STEM degrees (n = 148) are shown above the diagonal. The results for male students in non-STEM degrees (n = 40) are shown below the diagonal.

*p < .05. **p < .01. ***p < .001.

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