

GENDER DIFFERENCES IN ACADEMIC SELF-EFFICACY IN TECHNOLOGY AND ENGINEERING COURSES AMONG STUDENTS AT USMANU DANFODIYO UNIVERSITY SOKOTO

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Abstract

Academic self-efficacy is a key determinant of students' engagement, persistence, and achievement in Science, Technology, and Engineering (STEM), particularly in traditionally male-dominated fields such as Technology and Engineering. This study examined gender differences in academic self-efficacy and the role of socio-cultural factors among technology and engineering students at Usmanu Danfodiyo University, Sokoto, Nigeria. A quantitative cross-sectional survey design was employed, with data collected from 225 undergraduate students selected through simple random sampling. Academic self-efficacy was measured using the Self-Efficacy subscale of the Motivated Strategies for Learning Questionnaire (MSLQ), whereas socio-cultural influences were assessed using a context-specific socio-cultural influence questionnaire. Data were analyzed using descriptive statistics, independent sample t-tests, and Pearson product-moment correlation. The results revealed a statistically significant gender difference in academic self-efficacy, with male students reporting higher levels than female students. Additionally, a weak but statistically significant positive relationship was found between socio-cultural factors and academic self-efficacy. The findings underscore the persistence of gender-based disparities in self-efficacy within technology and engineering disciplines and highlight the influence of socio-cultural context in shaping students' academic confidence. This study contributes context-specific empirical evidence from Northern Nigeria and recommends gender-responsive pedagogical practices and mentorship interventions to promote equity in STEM education.

Keywords: Academic self-efficacy, gender differences, socio-cultural factors, STEM education; Nigeria.

Introduction

Academic self-efficacy, defined as an individual's belief in their ability to succeed in academic tasks, plays a crucial role in students' motivation, persistence, and overall performance in higher education (Bandura, 1997). In science, technology, engineering, and mathematics (STEM) fields, self-efficacy is particularly significant as it influences students' engagement, career aspirations, and resilience in overcoming academic challenges (Zeldin & Pajares, 2000). In STEM disciplines, self-efficacy is a strong predictor of persistence, as students with higher confidence are more likely to engage in challenging coursework and pursue related careers (Lent et al., 2018). Conversely, low self-efficacy leads to avoidance behaviors, increased anxiety, and dropout tendencies (Betz & Hackett, 2021). Olabamiji, (2024) reported that gender did not significantly predict self-efficacy.

Self-efficacy theory (Bandura, 1997) posits that individuals' confidence in their abilities is shaped by four primary sources: mastery experiences, vicarious experiences, social persuasion, and physiological states. In academic settings, male students in STEM often benefit from more positive reinforcement, role models, and hands-on experiences, which enhance their self-efficacy (Sax et al., 2017). Conversely, female students may encounter stereotype threat, fewer female mentors, and

implicit biases that undermine their confidence (Stout et al., 2011). However, research suggests that gender differences in self-efficacy persist, especially in male-dominated fields such as Technology and Engineering (T & E), where female students often report lower confidence in their academic capabilities (Cheryan et al., 2017).

Globally, women remain underrepresented in STEM fields, particularly in Engineering and Technology, where cultural stereotypes, societal expectations, and institutional barriers contribute to lower female enrollment and retention (UNESCO, 2019). In Nigeria, gender disparities in STEM education are influenced by socio-cultural norms that often discourage women from pursuing technical careers (Okeke, 2020). Despite efforts to promote gender equity in education, female students in Northern Nigeria face additional challenges due to deeply rooted patriarchal values that prioritize male education in scientific and technical domains (Ezeudu et al., 2021).

In Nigerian tertiary contexts, disparity in self-efficacy may also be influenced by gendered expectations. Research in Nigerian universities indicates that female students in engineering programs experience lower self-efficacy due to societal perceptions that these fields are "masculine," leading to reduced participation and higher attrition rates (Aina-Pelemo et al., 2023). However, some studies find no significant differences among senior secondary students in Niger State, where girls marginally outranked boys in self-efficacy, albeit with lower academic outcomes (Baji, 2020). Previous studies in Nigeria have focused broadly on STEM enrollment trends (Ojukwu & Oluwatayo, 2022), but few have examined self-efficacy differences within specific universities, particularly in Northern Nigeria, where cultural norms significantly impact educational choices. Despite extensive research on gender and self-efficacy in Nigerian STEM education, there is a marked void at Usmanu Dan Fodiyo University, particularly on T & E courses.

Therefore, this study examines gender differences in academic self-efficacy among students enrolled in T & E courses at Usmanu Danfodiyo University (UDUS), Sokoto, Nigeria. The findings of this study will be beneficial to university administrators, curriculum developers, and gender advocacy groups seeking to implement mentorship programs, confidence-building workshops, and awareness campaigns to bridge the gender gap in STEM. Additionally, the study will provide empirical data that can inform national policies on STEM education in Nigeria, particularly in regions with pronounced gender disparities.

Research questions

This study seeks to answer the following research questions:

1. What are the differences in academic self-efficacy between male and female students in Technology and Engineering courses at UDUS?
2. How do socio-cultural factors influence gender disparities in self-efficacy within T & E disciplines?
3. What is the relationship between self-efficacy socio-cultural factors?

Research Hypotheses

Based on the study's questions, the following hypotheses were formulated:

1. There is no significant difference in academic self-efficacy between male and female students in Technology and Engineering courses at UDUS.
2. Socio-cultural factors have no significant influence on gender disparities in self-efficacy within T & E disciplines.
3. There is no significant relationship between self-efficacy and socio-cultural factors among T & E students at UDUS.

Relationship between Socio-Cultural Factors and Academic Self-Efficacy among T & E Students at UDUS

Methodology

This study employed a quantitative research design, using a structured survey questionnaire to assess academic self-efficacy among male and female students in the Technology and Engineering (T & E) departments at Usmanu Danfodiyo University, Sokoto (UDUS), in which 225 T & E students at UDUS were selected using simple random sampling. The data were collected using two questionnaires. The primary instrument was adapted from the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich and De Groot (1990), supplemented with additional items reflecting socio-cultural influences based on McCabe (2001). Data were analyzed using descriptive and inferential statistics to examine gender-based differences in academic self-efficacy.

Two instruments were used for data collection:

Motivated Strategies for Learning Questionnaire (MSLQ): The MSLQ is a widely recognized self-report instrument designed to measure college students' motivational orientations and learning strategies. This study specifically utilized the Self-Efficacy Subscale, which assesses students' beliefs in their capacity to successfully complete academic tasks. The subscale comprises 9 items, that are measured through a 5-point Likert scale, which is widely employed in more recent studies (14, 18). The reliability of this scale was acceptable.

Sociocultural Influence Questionnaire (SIQ): The SIQ is a context-specific instrument developed from existing literature on gender and STEM education (e.g., McCabe, 2001). It is designed to measure the influence of socio-cultural factors on students' academic self-efficacy, career choices, and persistence in Technology and Engineering (T&E) fields. Unlike standardized instruments, the SIQ allows flexibility in addressing contextually relevant factors in Nigerian universities.

Results and Discussion

Hypothesis Testing

The null hypotheses were tested at the 0.5 level of significance using the T-test (t) and Pearson product-moment correlation coefficient (r) for hypothesis one and the T-test for hypothesis three. The results are presented below.

H₀₁: There is no significant difference in academic self-efficacy between male and female students in Technology and Engineering courses at UDUS.

Table 1: Difference between Students' Academic Self-Efficacy and Gender

Variable	N	Mean	Std Dev.	t-Cal	p-Value	Decision
Male	180	66.00	12.68	7.134	.010	H ₀
Female	170	59.04	11.81			Rejected

From table 1, an independent t- test indicated that scores were significantly higher for the male (M=66.00, SD=12.68) than for the female (M=59.04, SD=11.81), t= 7.124, p<.010. This indicates that there is a significant gender difference in the Students' Academic Self-efficacy. Therefore, H₀₁ which stated that there is no significant gender difference in students' academic Self-efficacy among students in Usmanu Danfodiyo University Sokoto was rejected.

H₀₂: Socio-cultural factors have no significant influence on gender disparities in self-efficacy within T & E disciplines.

Table 2: Relationship between Students' Social Adjustment and Academic Performance

Variable	Mean	Std Dev.	r-Cal	p-Value	Decision
Socio-cultural factors	66.00	12.76			
Self-efficacy	59.04	11.55	.068	.031	H ₀₂ Rejected

From table 2, it can be seen that the relationship between student's social adjustment and academic performance was positive, Pearsons $r = .068$, $p = 031$. This indicates a significantly low positive relationship between Socio-cultural factors and Self-efficacy of the students. Therefore, H₀₂ which stated that there is no significant relationship between socio-cultural factor and self-efficacy among students of Usmanu Danfodiyo University Sokoto, was rejected is rejected.

H₀₃: There is no significant relationship between academic self-efficacy and socio-cultural factors among T & E students at UDUS.

Table 3: Pearson Correlation between Academic Self-Efficacy and Socio-Cultural Factors among T & E Students at UDUS

Variables	N	Mean	Std. Dev	r -Cal	p-Value	Decision
Academic Self-Efficacy	180	59.04	11.55	0.069	0.032	H ₀₃ Rejected
Socio-Cultural Factors	170	67.00	12.87			

Table 3 presents the Pearson product–moment correlation analysis between academic self-efficacy and socio-cultural factors among Technology and Engineering students at Usmanu Danfodiyo University, Sokoto. The result shows a weak but statistically significant positive correlation between academic self-efficacy and socio-cultural factors ($r = 0.069$, $p = 0.032$). Since the p-value is less than the 0.05 level of significance, the null hypothesis (H₀₃) is rejected. This implies that socio-cultural factors are significantly related to students' academic self-efficacy, although the strength of the relationship is low.

Summary of the Findings

This study investigated gender differences in academic self-efficacy in Technology and Engineering (T & E) courses among students of Usmanu Danfodiyo University, Sokoto, as well as the influence of socio-cultural factors on self-efficacy. Based on the analysis of data collected from 225 students using validated instruments, the major findings are summarized as follows:

1. Gender Difference in Academic Self-Efficacy:

The study found a statistically significant difference in academic self-efficacy between male and female students in T & E courses. Male students recorded higher mean self-efficacy scores than their female counterparts. This indicates that gender plays a significant role in shaping students' confidence in their academic abilities within Technology and Engineering disciplines.

2. Influence of Socio-Cultural Factors:

The findings revealed that socio-cultural factors significantly influence students' academic self-efficacy. Although the relationship was weak, it was statistically significant, indicating that cultural expectations, gender norms, and societal perceptions still affect students' confidence levels, particularly within male-dominated academic fields.

3. Relationship between Socio-Cultural Factors and Academic Self-Efficacy:

A weak but positive and statistically significant relationship was found between socio-cultural factors and academic self-efficacy. This suggests that while socio-cultural influences may not be the strongest predictors of self-efficacy, they nonetheless play a meaningful role in shaping students' academic beliefs and attitudes.

Discussion of the Findings

The result of the independent t-test showed a significant difference in academic self-efficacy between male and female students, with male students exhibiting higher levels of self-efficacy. Consequently, the null hypothesis was rejected.

This finding aligns with Bandura's self-efficacy theory, which emphasizes the role of mastery experiences and social reinforcement in shaping confidence. Male students in Technology and Engineering are often more exposed to hands-on activities, encouragement, and positive feedback, which may enhance their self-belief. The result also supports earlier studies (e.g., Sax et al., 2017; Cheryan et al., 2017), which reported that males in STEM fields tend to demonstrate higher self-efficacy than females.

Within the Nigerian context, especially in Northern Nigeria, deeply entrenched socio-cultural norms often portray Engineering and Technology as masculine fields. This may discourage female students from fully engaging or believing in their academic capabilities, thereby lowering their self-efficacy. However, this finding contradicts Olabamiji (2024), who reported no significant gender differences in self-efficacy, suggesting that institutional and cultural contexts may moderate gender effects.

The second hypothesis also indicated a statistically significant, though weak, relationship between socio-cultural factors and academic self-efficacy. Thus, the null hypothesis was rejected.

This finding suggests that socio-cultural factors such as family expectations, gender stereotypes, peer influence, and societal attitudes toward female participation in technical fields, contribute to differences in self-efficacy among students. The weak magnitude of the relationship implies that while these factors are influential, other variables such as institutional support, teaching methods, and individual motivation may exert stronger effects.

This outcome supports previous Nigerian studies (Aina-Pelemo et al., 2023; Ezeudu et al., 2021), which found that socio-cultural norms significantly shape female students' confidence and persistence in sEngineering-related disciplines. It also reflects the reality in Northern Nigeria, where patriarchal values may subtly undermine female students' self-belief despite increasing access to higher education.

The third hypothesis also indicated that the Pearson correlation analysis revealed a weak but statistically significant positive relationship between academic self-efficacy and socio-cultural factors. The null hypothesis was therefore rejected.

This finding indicates that favorable socio-cultural conditions such as family encouragement, acceptance of women in STEM, and positive societal perceptions, are associated with higher levels of academic self-efficacy among students. Although the correlation is low, it highlights that the socio-cultural context cannot be ignored when examining students' confidence and academic behavior.

The result is consistent with social cognitive theory, which posits that environmental factors interact with personal beliefs to influence behavior. It also aligns with UNESCO (2019), which emphasized

that cultural support systems are essential for improving women's confidence and retention in STEM fields.

Conclusion

Based on the findings of this study, it can be concluded that gender differences exist in academic self-efficacy among Technology and Engineering students at Usmanu Danfodiyo University, Sokoto, with male students demonstrating significantly higher self-efficacy than female students. Additionally, socio-cultural factors were found to have a statistically significant influence on students' academic self-efficacy, although the strength of this influence was weak.

The study further established that socio-cultural factors are significantly related to academic self-efficacy, reinforcing the view that students' academic confidence is shaped not only by individual abilities but also by societal norms and cultural expectations. These findings highlight the need for context-specific interventions aimed at strengthening female students' confidence and reducing gender disparities in Technology and Engineering disciplines, particularly within Northern Nigerian universities.

Recommendations

Based on the conclusions drawn from this study, the following recommendations are made:

1. Targeted Mentorship Programs: The University should establish mentorship programs that pair female Technology and Engineering students with successful female academics and professionals to enhance role modeling and boost self-efficacy.
2. Gender-Sensitive Teaching Practices: Lecturers in T & E departments should adopt inclusive and gender-sensitive pedagogical approaches that encourage equal participation, reduce stereotype threat, and promote confidence among female students.
3. Socio-Cultural Awareness Campaigns:
University management and gender advocacy groups should organize awareness campaigns to challenge negative socio-cultural stereotypes surrounding female participation in engineering and technology fields.
4. Confidence-Building Workshops: Regular workshops focusing on academic confidence, resilience, and self-efficacy should be organized, particularly targeting female students in male-dominated disciplines.
5. Policy and Curriculum Support: Policymakers and curriculum developers should integrate gender equity considerations into STEM education policies to ensure sustained support for female students, especially in Northern Nigerian universities.
6. Further Research: Future studies should adopt mixed-method approaches to explore other factors influencing academic self-efficacy, such as institutional climate, teaching quality, and peer support, across multiple universities for broader generalization.

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