

Influence of psychosocial predictors and school counseling interventions on female secondary school students' learning outcomes in science

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Abstract: Efforts to address gender disparities in Science, Technology, Engineering, and Mathematics (STEM) education remain limited in many developing countries, particularly where psychosocial barriers and inadequate school counseling systems intersect. This study examined the combined influence of psychosocial predictors and school counseling interventions on female secondary school students' learning outcomes in science. A quantitative correlational survey design was employed involving 360 female senior secondary school students and 30 school counselors drawn from 30 public schools with functional counseling units. Data were collected using standardized instruments measuring psychosocial factors, counseling access, and science achievement records. Findings of the study indicate that psychosocial factors significantly predict science learning outcomes, with self-efficacy emerging as the strongest positive predictor, while internalized gender stereotypes exert a significant negative influence. Furthermore, higher levels of counseling access were associated with greater science self-efficacy, interest, and achievement among students. Among counseling strategies, self-efficacy enhancement workshops were rated as the most effective intervention. The results provide evidence for the integrated influence of psychosocial factors and school counseling interventions in explaining gender disparities in science education. It indicates that strengthening gender-responsive counseling systems may support improved confidence, engagement, and achievement among female students in science.

Keywords: STEM education; gender equity; psychosocial factors; school counseling; self-efficacy; female students

1. Introduction

Despite decades of global advocacy for inclusive education, gender disparities in science learning persist across educational and sociocultural contexts and remain a major concern in STEM education research. Large-scale assessments, including the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS), consistently show lower persistence and underrepresentation of girls in science-related pathways, particularly at post-basic education levels [1]. These persistent gaps suggest that access alone has not resolved gender inequality in science education, indicating deeper psychosocial and institutional influences. These disparities are not the result of differences in cognitive ability; rather, they reflect systemic inequities, cultural stereotypes, and psychosocial barriers that shape girls' science identity, motivation,

and access to support systems [2–4]. Consequently, many female students face limitations in pursuing advanced science courses and STEM careers, even when their academic competence matches or exceeds that of their male peers [5,6].

Research increasingly emphasizes that girls' engagement in science is shaped by the interaction of psychological dispositions and contextual influences rather than ability alone. Self-efficacy, emotional regulation, peer influence, parental expectations, and teacher attitudes all play critical roles in shaping persistence and performance in science learning [7, 8]. Among these, self-efficacy and stereotype-related beliefs consistently emerge as central explanatory constructs in predicting science engagement. However, internalized gender schemas and the experience of stereotype threat can undermine science self-concept even among high-achieving female students [9, 10]. While teachers, peers, and families significantly influence science trajectories, less attention has been given to how school-based institutional support systems, particularly counseling services, interact with these psychosocial variables to shape learning outcomes.

This gap becomes more critical when considering that school counselors occupy a strategic position in supporting both academic development and psychosocial adjustment. Despite this role, gender-equity-focused counseling practices remain limited, especially in under-resourced secondary schools [11, 12]. Interventions such as mentoring programmes, emotional intelligence training, and digital counseling platforms have demonstrated potential in improving girls' academic resilience and motivation in science [13, 14]. However, existing studies are fragmented, often examining these interventions in isolation rather than as part of an integrated counseling framework capable of addressing multiple psychosocial barriers simultaneously.

The persistence of gender disparity in science further reflects a complex interaction between early socialization processes and structural constraints. From early childhood, girls are exposed to gendered expectations regarding appropriate academic domains, which gradually shape their science identity, confidence, and achievement orientation. Internalized stereotypes weaken self-efficacy and belonging in science, particularly in male-dominated STEM fields [3, 15]. Stereotype threat theory further explains how awareness of negative expectations can impair performance and reduce persistence in science, even among capable learners [16]. In Sub-Saharan Africa, particularly in Nigeria, Kenya, Tanzania, and Ghana, these psychosocial challenges are intensified by sociocultural norms, patriarchal systems, and educational resource constraints [17, 18]. Girls in rural and low-income settings additionally face structural barriers such as early marriage, gender-based violence, inadequate infrastructure, and limited family support, all of which constrain sustained engagement in science learning [19, 20].

1.1. Conceptual framework

The conceptual framework integrates Social Cognitive Career Theory (SCCT) and Gender Schema Theory to explain how psychosocial and institutional factors influence female students' science learning outcomes [21–23]. From SCCT, science-related outcomes are driven by self-efficacy, outcome expectations, and goal formation [22]. In this study, science self-efficacy is treated as a proximal predictor of engagement,

interest, academic performance, and career intention, while school counseling functions as an external support system that strengthens these beliefs through guidance, encouragement, and exposure to STEM experiences [23]. Accordingly, counseling access and counseling strategies are expected to positively influence science outcomes by enhancing motivational and cognitive processes.

Gender Schema Theory complements SCCT by explaining how internalized gender beliefs shape interpretation of science experiences [24]. Gender stereotypes operate as cognitive filters that may weaken science identity and self-efficacy by reinforcing perceptions that science is male-typed. Counseling interventions that include role modeling and gender-responsive practices are expected to reduce these stereotypes and promote more adaptive science beliefs [2, 25]. Thus, psychosocial variables (self-efficacy, stereotypes, teacher attitudes, parental support, and peer influence) and counseling variables (access and strategies) jointly predict science outcomes. The framework positions counseling as both a direct predictor and an indirect modifier of psychosocial processes influencing female students' science achievement and aspirations. **Figure 1** illustrates these relationships.

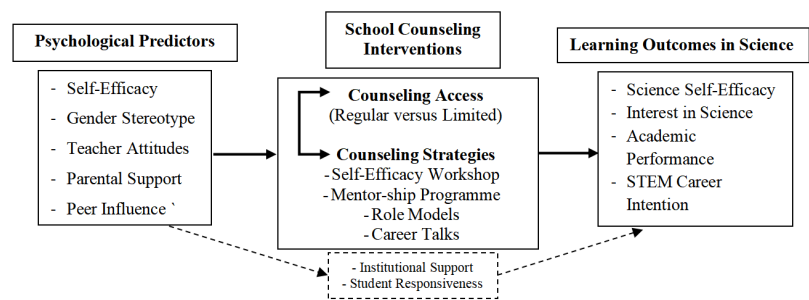


Figure 1. Conceptual framework of psychosocial and counseling influences on female students' science outcomes.

Source: Authors' own elaboration, 2026.

1.2. Theoretical framework

This study is anchored in Social Cognitive Career Theory (SCCT) and Gender Schema Theory, which jointly inform the selection of variables and the analytical model tested in this study. SCCT posits that self-efficacy, outcome expectations, and goal setting are central determinants of academic and career-related behaviour [21,22]. In this study, science self-efficacy is operationalized as a key independent variable predicting female students' science interest, academic performance, and STEM career intention, while counseling access and counseling strategies are conceptualized as contextual inputs that strengthen these SCCT pathways through guidance, feedback, and exposure to STEM opportunities [23]. These constructs are directly tested in the regression and inferential models as predictors of science outcomes.

Bem [24] explains how internalized gender beliefs influence interpretation and engagement in academic domains. In this study, internalized gender stereotypes are treated as a measurable psychosocial predictor that negatively relates to science self-efficacy and performance outcomes. Counseling interventions that incorporate role modeling, anti-bias practices, and gender-responsive support are theorized to weaken these schemas and improve science-related attitudes [2, 25]. Accordingly,

stereotype perception and counseling access are included as variables in the statistical model to examine their direct effects on outcomes. These theories provide the explanatory foundation for the regression framework, where psychosocial variables (self-efficacy, stereotypes) and institutional variables (counseling access and strategies) are simultaneously tested as predictors of female students' science learning outcomes.

1.3. Psychosocial predictors of learning outcomes in science

Psychosocial factors play a decisive role in shaping female students' engagement, persistence, and achievement in science. Central among these is science self-efficacy, which refers to students' beliefs in their capability to successfully perform science-related tasks. According to Social Cognitive Career Theory, such beliefs strongly determine academic choices and persistence [22]. However, empirical evidence shows that female students often report lower science self-efficacy despite comparable academic ability [26, 27], indicating that gendered perceptions rather than competence drive engagement patterns. Science-related anxiety further compounds these disparities by reducing persistence and cognitive engagement in complex tasks [28]. Similarly, stereotype threat, where awareness of negative societal expectations undermines performance, continues to affect female learners in STEM [16]. These factors operate alongside teacher expectations, peer dynamics, and parental influence, forming a complex psychosocial environment that shapes science identity [7,8]. These psychosocial variables do not function independently but interact to reinforce or weaken students' motivation and academic resilience in science learning contexts.

1.4. Socio-cultural and structural determinants

Cultural and peer influences significantly shape girls' engagement and persistence in science. Rather than functioning as isolated influences, these factors operate as reinforcing systems that collectively shape gendered academic identity formation. Girls are often exposed to sociocultural messages suggesting that science is inconsistent with traditional femininity, which can suppress curiosity, confidence, and sustained interest in technical subjects [15,29]. Peer interactions may further reinforce these dynamics, as girls expressing interest in science may experience social exclusion or reduced peer acceptance [15]. In many developing countries, including Nigeria, family expectations also contribute to the gendered structuring of subject choices, with girls often guided toward arts or vocational pathways, while boys are encouraged toward science-related disciplines [17]. This early academic channeling creates structural path dependency that limits later STEM participation. More so, system-level mechanisms such as early subject tracking intensify inequality, as students are required to make science-related decisions at junior secondary level with strong influence from parents, teachers, and peers [30].

Beyond social expectations, classroom and instructional environments also shape gender outcomes in science. Teacher-centered pedagogical approaches, rigid curricula, and high-stakes assessments have been shown to increase science anxiety, particularly among girls with lower confidence [31,32]. In contrast, student-centered

and inquiry-based pedagogies enhance engagement and reduce gender gaps by promoting active participation and conceptual understanding [14,33,34]. Technological innovations such as virtual laboratories and gamified simulations further enhance engagement; however, their effectiveness is maximized only when embedded within gender-responsive pedagogical and counseling support systems rather than used in isolation [20,34].

1.5. Role of school counseling

School counseling has emerged as an important institutional mechanism for addressing gender inequities in science education. Unlike classroom-based interventions that primarily target cognitive learning, counseling interventions address both academic decision-making and underlying psychosocial constraints influencing science identity formation. Counselors function as advocates, mentors, and emotional support providers, shaping students' academic pathways and self-concept in science. Egbule [35] showed that counselor-led interventions significantly increase female enrollment in physics and chemistry, particularly when programmes are individualized and culturally responsive. These outcomes suggest that counseling effectiveness depends not only on content but also on contextual alignment with students' sociocultural realities. Furthermore, counselors play a transformative role by challenging gendered narratives, coordinating exposure programmes, and facilitating mentorship opportunities that collectively disrupt stereotype internalization and strengthen science identity [19,36].

Effective counseling strategies are multidimensional rather than singular. Role modeling through culturally relatable female STEM professionals enhances identification and engagement in science [18, 37]. Similarly, interdisciplinary programmes integrating arts and science broaden students' perception of scientific creativity and reduce disciplinary anxiety [37]. Emotional intelligence (EI)-based counseling strengthens resilience, persistence, and adaptive coping strategies in science learning, while growth-oriented feedback promotes mastery orientation and long-term academic motivation [13, 29]. Furthermore, digital counseling tools such as virtual labs, animations, and culturally contextualized content enhance science engagement by providing interactive learning experiences [14, 20, 38]. Group counseling, science clubs, and peer mentorship further contribute to collective efficacy and normalize female participation in STEM fields [18,39,40]. These findings suggest that counseling is most effective when implemented as an integrated ecosystem of academic, emotional, and experiential support rather than isolated interventions.

1.6. Empirical evidence on school counseling and gender equity

Empirical studies across diverse contexts consistently demonstrate the positive influence of counseling interventions on female students' engagement and achievement in science. Ngozi and Kalu-Uche [17] showed that structured counselor-led programmes increase girls' enrollment in biology and chemistry in Nigeria. Similarly, Amoadu et al. [19] found that the integration of counseling with parental engagement enhances both academic performance and persistence in science in Ghana. In Tanzania

and Kenya, technology-enhanced mentorship programmes improve engagement and achievement among female students [18, 20]. Evidence from high-income countries also reflects comparable patterns. Evidence from high-income countries also reflects comparable patterns. Bachmann and Hertweck [41] reported that the integration of STEM-focused modules within counseling frameworks increases female participation in engineering pathways in Germany, while Sergent [42] showed that cross-sector STEM exposure programmes in Australia enhance sustained interest and career aspirations among female learners. Across these studies, a consistent pattern emerges, that counseling interventions are more effective when they combine informational support, mentorship, and contextual exposure to science careers rather than relying on a single strategy. However, despite this convergence of evidence, most existing studies remain context-specific and methodologically fragmented, focusing on isolated interventions such as mentorship or digital tools rather than comparative evaluations of multiple counseling strategies.

Furthermore, there is limited empirical attention to how psychosocial predictors (such as self-efficacy and stereotype threat) interact with counseling access to influence science outcomes. This gap is particularly evident in low-resource contexts, where structural constraints and limited counseling infrastructure may alter intervention effectiveness. These limitations emphasize the need for integrated research that simultaneously examines psychosocial and institutional factors shaping female students' science learning outcomes.

1.7. Research gap

Growing evidence on psychosocial predictors and counseling interventions highlights several important gaps in the literature. Limited research has examined the combined influence of psychosocial factors and school counseling on female students' science outcomes. In addition, few studies have systematically compared the effectiveness of different counseling strategies within a unified analytical framework. Research in Sub-Saharan Africa also remains underrepresented, despite its distinct structural and cultural constraints. Existing studies have not sufficiently integrated theoretical frameworks such as Social Cognitive Career Theory and Gender Schema Theory into empirical modeling, resulting in fragmented interpretations of findings. These gaps underscore the need for a comprehensive study that simultaneously examines both psychosocial and institutional determinants of female students' science learning outcomes.

1.8. Research objectives

The main objective of this study is to investigate the influence of psychosocial predictors and school counseling interventions on female secondary school students' learning outcomes in science. Specific objectives are to:

1. Identify psychosocial factors influencing gender disparities in science learning.
2. Examine the role of school counseling in addressing gender equity in science education.

3. Compare the effectiveness of different counseling strategies in supporting female students' science outcomes.
4. Determine the impact of counseling access on science self-efficacy, interest, and performance.

1.9. Hypotheses

To statistically test the research objectives, the following null hypotheses are formulated:

H0₁. *Psychosocial predictors do not significantly influence female students' science performance.*

H0₂. *School counseling does not significantly address gender equity in science.*

H0₃. *Counseling strategies do not differ significantly in effectiveness.*

H0₄. *Counseling access does not significantly affect science self-efficacy, interest, or performance.*

2. Materials and methods

2.1. Research design

This study employed a quantitative correlational survey design to examine relationships between psychosocial predictors, school counseling interventions, and female students' science learning outcomes. Correlational designs assess the strength and direction of naturally occurring relationships without experimental manipulation [43]. Multiple predictors comprising science self-efficacy, gender stereotypes, teacher and peer attitudes, parental support and counseling access were analyzed in relation to outcomes including science interest, academic performance, and STEM career intention. Given the cross-sectional design, findings are interpreted as associations rather than causal effects.

2.2. Research setting

The study was conducted in public senior secondary schools within the Zaria Educational Zone under the Kaduna State Ministry of Education, Nigeria. The zone comprises both urban and semi-urban communities and is characterized by sociocultural diversity alongside persistent gender disparities in science education. Female students in this setting frequently encounter structural and psychosocial barriers, including entrenched gender stereotypes, limited access to professional counseling services, and a scarcity of female STEM role models [1]. This setting therefore provides a relevant background for examining how psychosocial and institutional factors interact to shape science learning outcomes.

2.3. Participants

A total of 360 female Senior Secondary School II (SSS II) students and 30 school counselors participated. A multistage sampling approach was used: thirty schools with functional counseling units were purposively selected, and female science students within each school were chosen through stratified random sampling. Counselors

possessed at least a bachelor’s degree in guidance and counseling and a minimum of three years of experience. All students had been on the science track for at least one academic session and had prior exposure to counseling services. While this ensured relevance, it introduces potential selection bias and limits generalizability. A pilot study involving 50 students and 5 counselors, who were excluded from the main sample, was conducted to refine the instruments. The pilot test conducted confirmed clarity, usability, and initial reliability and informed minor revisions to item wording.

2.4. Instrumentation

Data were collected using three instruments, namely; the Female Science Participation Scale (FSPS), the Gender-Equity Counseling Evaluation Form (GECEF), and students’ academic performance records. Both FSPS and GECEF were adapted from validated instruments in social cognitive and counseling literature [21, 25, 39], and were modified to reflect the Nigerian secondary school setting and gender-specific science learning environment.

2.4.1. Female science participation scale (FSPS)

The FSPS comprised 38 items across six subscales: Science Self-Efficacy, Internalized Gender Stereotypes, Teacher and Peer Attitudes, Parental Support, Access to Counseling Services, and STEM Career Intention. Responses were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Sample items of FSPS are: “I feel confident solving science problems even when they are difficult,” “Girls are less suited for science careers” (reverse-coded), and “My teachers encourage me to pursue science subjects.” Subscale scores were computed using mean aggregation, and composite Likert responses were treated as continuous variables consistent with established psychometric practice for multi-item scales. Content validity was established through expert review, while internal consistency reliability was confirmed with Cronbach’s alpha coefficients exceeding 0.70 for all subscales. Construct validity was assessed using exploratory factor analysis (EFA) with principal component extraction and varimax rotation. The KMO value exceeded 0.80 and Bartlett’s test was significant ($p < 0.001$), confirming sampling adequacy and factorability, with items loading appropriately on their respective constructs. The structure and reliability of the FSPS are presented in **Table 1**, while factorability statistics are summarized in **Table 2**.

Table 1. Subscale composition and reliability of the FSPS.

Subscale	Number of items	Cronbach’s alpha (α)
Science Self-Efficacy	8	0.88
Internalized Gender Stereotypes	6	0.81
Teacher and Peer Attitudes	7	0.84
Parental Support	5	0.78
Access to Counseling Services	6	0.80
STEM Career Intention	6	0.83

Table 2. Factorability statistics for FSPS.

Statistic	Value
KMO Measure	>0.80
Bartlett's Test	$p < 0.001$
Extraction Method	Principal Component Analysis
Rotation Method	Varimax

2.4.2. Gender-equity counseling evaluation form (GECEF)

The GECEF was designed to capture counselors' perspectives on the types, frequency, and perceived effectiveness of gender-responsive counseling strategies. The instrument comprised 16 items covering counseling strategies, session frequency, and student responsiveness, measured on a 5-point Likert scale. Some of the sample items are: "I use female STEM role models during counseling sessions," "I conduct gender-sensitive career guidance discussions," and "I organize self-efficacy enhancement activities for female students in science." Content and face validity were established through expert review, and pilot testing confirmed clarity and usability. Composite indices were generated using mean scores for each dimension, allowing integration into correlation and regression analyses.

2.4.3. Academic performance records

Students' academic performance was assessed using official school records. This comprised recent term examination scores in Biology, Chemistry, and Physics. Scores were standardized as percentages (0–100%) and served as objective indicators of academic achievement.

2.5. Data collection procedure

Ethical review and approval were waived because the study involved a minimal-risk, non-invasive educational survey using anonymized data collected with informed consent. Informed consent was secured from all participants. The FSPS was administered to students during supervised classroom sessions to ensure standardized conditions, while counselors independently completed the GECEF. Data collection was conducted over a four-week period during the third term of the 2024/2025 academic session.

2.6. Data analysis

Descriptive statistics were used to summarize variables, and assumptions of normality, linearity, and homoscedasticity were met. Pearson correlation was used to examine relationships among psychosocial factors, counseling access, and learning outcomes. H_{01} was tested using multiple regression analysis, H_{02} using correlation and regression analyses, H_{03} using one-way ANOVA with Tukey post hoc tests, and H_{04} using independent samples t -tests. Regression models used the enter method, with multicollinearity assessed via VIF (< 5). Effect sizes (η^2 and Cohen's d) and post hoc comparisons were used to address potential Type I error. Statistical significance was set at $p < 0.05$. Findings were interpreted as associations rather than causal effects. Data were analyzed using SPSS version 27.

3. Results

3.1. H0₁: Psychosocial predictors of science performance

Descriptive statistics were first computed to summarize psychosocial variables influencing science performance.

Table 3 shows variability in psychosocial factors among respondents. Gender stereotypes recorded the highest mean score, while science self-efficacy recorded the lowest, indicating comparatively low confidence in science among participants. Teacher attitudes and peer influence were moderately rated, while parental support fell slightly below the midpoint.

Table 3. Descriptive statistics of predictors of science performance.

Factor	Mean	SD
Gender Stereotypes	4.23	0.58
Parental Support	2.75	0.79
Teacher Attitudes	3.57	0.61
Peer Influence	3.34	0.73
Self-Efficacy in Science	2.41	0.88

Note: N = 360 female students.

A multiple regression analysis was conducted to test H0₁.

Results in Table 4 indicate that the regression model was statistically significant, $F_{(5,354)} = 155.73, p < 0.001$, explaining 69% of the variance in science performance ($R^2 = 0.69$, Adjusted $R^2 = 0.686$). All predictors made significant unique contributions. Self-efficacy emerged as the strongest predictor of science performance ($\beta = 0.44, p < 0.001$), indicating its relatively higher contribution within the model compared to other psychosocial factors. This was followed by teacher attitudes ($\beta = 0.28, p < 0.001$), parental support ($\beta = 0.15, p < 0.001$), and peer influence ($\beta = 0.12, p = 0.001$). Gender stereotypes showed a significant negative relationship with science performance ($\beta = -0.37, p < 0.001$). Although all predictors were significant, the pattern suggests partial shared explanatory variance among psychosocial factors. H0₁ was rejected. These findings indicate that psychosocial determinants operate as an integrated system, with self-efficacy emerging as the most influential component in explaining science performance.

Table 4. Multiple regression coefficients predicting science performance.

Predictor	β	SE β	t	p	95% confidence interval		Part r^2
					Lower bound	Upper bound	
Self-Efficacy	+0.44	0.041	10.68	<0.001	0.36	0.52	0.23
Gender Stereotypes	-0.37	0.041	-9.12	<0.001	-0.45	-0.28	0.19
Teacher Attitudes	+0.28	0.041	6.89	<0.001	0.20	0.36	0.11
Parental Support	+0.15	0.036	4.21	<0.001	0.08	0.23	0.05
Peer Influence	+0.12	0.035	3.47	0.001	0.05	0.20	0.03

Note: Model statistics: $R = 0.831, R^2 = 0.69, \text{Adjusted } R^2 = 0.686, F_{(5,354)} = 155.73, p < 0.001, \text{Std. Error of Estimate} = 2.14$.

3.2. H0₂: School counseling and gender equity

Descriptive statistics were computed for gender-equity counseling practices.

Results in **Table 5** indicate generally low implementation of gender-equity counseling strategies across schools, with most mean scores below the scale midpoint.

Table 5. Descriptive statistics of gender-equity counseling practices.

Counseling practice	M	SD	% reporting adequacy
Frequency of Equity Sessions	1.60	0.90	40%
Integration in Career Counseling	2.40	1.10	55%
Gender-Sensitive Materials Used	1.20	0.70	30%
Collaboration with Science Teachers	2.10	0.80	50%
Perceived Programme Effectiveness	2.70	0.90	60%

Note: N = 30 Counselors.

A one-sample *t*-test was conducted to test H0₂.

Table 6 shows that counseling access was significantly below the benchmark value, $t_{(29)} = -9.47, p < 0.001$, with a large effect size ($d = -1.73$). This implies limited implementation of structured gender-equity counseling activities. To examine the relationship between counselor experience and perceived programme effectiveness, Pearson correlations were also computed (see **Table 7**).

Table 6. One-sample *t*-test on frequency of equity sessions.

Variable	M	SD	$t_{(29)}$	<i>p</i>	95% confidence interval		Cohen's <i>d</i>
					Lower bound	Upper bound	
Equity Counseling access	1.60	0.90	-9.47	<0.001	-1.72	-1.12	-1.73

Table 7. Correlation between counselor experience and programme effectiveness.

Variable pair	<i>r</i>	<i>p</i>	95% confidence interval	
			Lower bound	Upper bound
Experience × Effectiveness	+0.62	0.0003	0.35	0.79

A significant positive relationship was observed in **Table 7** between counselor experience and perceived programme effectiveness ($r = 0.62, p < 0.001$), indicating that more experienced counselors reported higher effectiveness in delivering gender-focused interventions. H0₂ was rejected. This suggests that institutional counseling structures remain underdeveloped, limiting systematic support for gender-equity interventions.

3.3. H0₃: Effectiveness of counseling strategies

Descriptive results for counseling strategies are presented in **Table 8**.

Table 8. Effectiveness ratings of counseling strategies.

Strategy	M	SD
Self-Efficacy Enhancement Workshops (SEEW)	4.58	0.54
Career Role Model Sessions (CRMS)	4.32	0.61
Peer Mentoring Programmes (PMP)	3.97	0.73
Parental Engagement Counseling (PEC)	3.45	0.82

Results in **Table 8** indicate that Self-Efficacy Enhancement Workshops recorded the highest effectiveness rating, followed by Career Role Model Sessions, Peer Mentoring Programmes, and Parental Engagement Counseling.

A one-way ANOVA was conducted to test H_0_3 .

The ANOVA results in **Table 9** show that there was a statistically significant difference among counseling strategies, $F_{(3,246)} = 45.23, p < 0.001, \eta^2 = 0.35$, indicating a large effect of strategy type on perceived effectiveness. The magnitude of effect suggests that intervention design is more influential than general counseling access in shaping perceived effectiveness.

Table 9. ANOVA summary table for counseling strategy effectiveness.

Source	SS	df	MS	F	p	η^2
Between Groups	47.82	3	15.94	45.23	<0.001	0.35
Within Groups	82.36	246	0.33			

Post hoc comparisons were performed to identify which specific group differences accounted for the significant ANOVA result (see **Table 10**).

Table 10. Tukey HSD Post Hoc comparisons.

Comparison	Mean difference	p
SEEW–CRMS	+0.26	0.042
SEEW–PMP	+0.61	<0.0001
SEEW–PEC	+1.13	<0.0001
CRMS–PMP	+0.35	0.018
CRMS–PEC	+0.87	<0.0001
PMP–PEC	+0.52	0.001

Post hoc analysis in **Table 10** showed that Self-Efficacy Enhancement Workshops significantly outperformed all other strategies ($p < 0.05$). Career Role Model Sessions also performed significantly better than Peer Mentoring and Parental Engagement Counseling. H_0_3 was rejected. These results imply that self-efficacy–focused interventions represent the most impactful counseling strategy, with substantially higher effectiveness ratings compared to other approaches. This suggests that interventions targeting confidence and belief systems may yield stronger outcomes than indirect or support-based strategies.

3.4. H_0_4 : Counseling access and learning outcomes

Descriptive comparisons between counseling groups are presented in **Table 11**.

Table 11. Regular and limited counseling access.

Outcome	Regular access	Limited access
Self-Efficacy	4.12 ± 0.62	3.35 ± 0.75
Interest in Science	4.25 ± 0.57	3.48 ± 0.79
Science Performance (%)	78.6 ± 8.4	65.3 ± 10.2

As **Table 11** shows, students with regular counseling access consistently recorded

higher means in self-efficacy, interest in science, and academic performance compared to those with limited access.

Independent samples *t*-tests were conducted to test H0₄.

Table 12 shows statistically significant differences between groups across all outcomes ($p < 0.001$), with large effect sizes ($d = 0.98$ to 1.13). Students with regular counseling access demonstrated higher self-efficacy, greater interest in science, and better academic performance. H0₄ was rejected. Pearson correlations were also computed to assess the association between counseling access and students' learning outcomes (see **Table 13**). This may indicate that counseling access functions as a strong enabling condition for both motivational and academic outcomes in science.

Table 12. *t*-test results for counseling access.

Outcome	<i>t</i> ₍₂₉₈₎	<i>p</i>	Cohen's <i>d</i>	95% confidence interval	
				Lower bound	Upper bound
Self-Efficacy	9.12	<0.001	1.06	0.61	0.93
Interest	8.57	<0.001	0.98	0.59	0.94
Performance	9.84	<0.001	1.13	10.61	15.73

Table 13. Correlation between counseling access and learning outcomes.

Variable pair	<i>r</i>	<i>p</i>	95% confidence interval	
			Lower bound	Lower bound
Frequency × Self-Efficacy	+0.68	<0.001	0.55	0.78
Frequency × Interest	+0.63	<0.001	0.49	0.74
Frequency × Performance	+0.59	<0.001	0.44	0.71

The results in **Table 13** show that significant positive relationships were found between counseling access and all outcome variables, with the strongest association observed for self-efficacy ($r = 0.68$). All correlations were statistically significant at $p < 0.001$. Taken together, these findings establish that regular access to counseling is strongly associated with improved psychosocial and academic outcomes, with the largest effects observed in science performance. This stresses the practical significance of consistent counseling engagement in supporting female students' science learning.

3.5. Summary of the major findings

The results indicate that psychosocial factors significantly predicted science performance (H0₁), with self-efficacy showing a positive association and gender stereotypes a negative association. Collectively, self-efficacy emerged as the strongest predictor of science performance. Gender-equity counseling practices were found to be significantly limited (H0₂). Counseling strategies differed significantly in effectiveness (H0₃), with self-efficacy focused interventions yielding the highest ratings. Counseling access was significantly associated with improvements in students' self-efficacy, interest, and academic performance (H0₄).

4. Discussion

4.1. Psychosocial predictors and female students' science performance

The findings indicate that psychosocial factors, particularly self-efficacy and internalized gender stereotypes, are strongly associated with variation in female students' science performance. The magnitude of the regression coefficients suggests that self-efficacy is not only statistically significant but also a substantively important predictor, reflecting the role of confidence-driven engagement in academic tasks. This aligns with Social Cognitive Career Theory, which posits that self-efficacy beliefs shape individuals' choices, persistence, and performance outcomes. The strong positive association observed may reflect reciprocal processes, where higher performance reinforces self-efficacy over time, rather than a strictly unidirectional relationship [21, 22, 44]. Conversely, the negative association between gender stereotypes and science performance supports propositions of Gender Schema Theory, where internalized societal beliefs shape cognitive processing and self-concept in domain-specific contexts. In this study, the relatively large negative effect suggests that stereotypes may operate as cognitive constraints, limiting engagement and persistence in science-related tasks.

This finding is consistent with prior studies by Cheryan et al. [2] and McGuire et al. [15], although the strength of the association observed here may reflect context-specific sociocultural expectations in Nigerian educational settings, where STEM fields are often perceived as gendered domains. While teacher support, peer influence, and parental involvement were also significant, their smaller effect sizes indicate overlapping contributions, suggesting shared variance among psychosocial predictors. This points to the importance of considering these variables as interrelated rather than independent influences.

The pattern of shared variance among psychosocial predictors suggests that these variables may reflect a higher-order latent construct of "science learning psychosocial environment," rather than functioning as fully independent predictors. Within this structure, SCCT constructs particularly self-efficacy, appear to dominate the explanatory model, indicating that cognitive-motivational beliefs may serve as the central mechanism through which other contextual influences operate. This supports the theoretical parsimony of SCCT in explaining female students' science outcomes compared to fragmented predictor interpretations.

The relatively high explanatory power of the regression model ($R^2 = 0.69$) suggests remarkable overlap among the psychosocial predictors. This may indicate that variables such as self-efficacy, teacher attitudes, and parental support may reflect interconnected aspects of students' learning environments rather than fully independent influences. As such, the regression coefficients should be interpreted as partial effects, representing the unique contribution of each predictor while controlling for others. This overlap may also explain the strong role of self-efficacy, which appears to integrate both personal beliefs and contextual support factors. The findings suggest that these predictors operate as a system of interacting influences rather than as isolated determinants of science performance.

Extending the interpretation of these psychosocial patterns, prior studies have also emphasized contextual differences in gender-related STEM outcomes. For example, Lindberg et al. [5] reported narrowing gender gaps in STEM confidence; however, the present findings suggest that such improvements may not be consistent across contexts, highlighting the importance of localized interpretation of gender disparities in science education.

4.2. Extent of school counseling in addressing gender equity

The findings suggest that gender-equity-focused counseling practices are limited in scope and frequency, with statistically significant deviations from expected implementation levels. The large effect size observed in counseling access indicates a substantial gap between recommended and actual practice. This supports the study of Egbule [35] and Harsani et al. [45] that structural constraints such as inadequate training, limited institutional support, and resource shortages restrict effective delivery of gender-responsive counseling programmes.

The positive association between counselor experience and programme effectiveness further indicates that professional expertise may enhance the quality of intervention delivery. This is consistent with studies by Hilts et al. [36] and Cole et al. [25], although it also raises the possibility that less experienced counselors may lack the pedagogical or contextual competence required to address complex gender-related issues. However, this relationship should be interpreted cautiously, as perceived effectiveness may also be influenced by subjective evaluation rather than objective programme outcomes.

In contrast to settings where counseling is systematically embedded within school systems, the observed inconsistencies align with findings of UNESCO [1] and Goos and Kelly [4] indicating that underdeveloped frameworks can limit programme impact. These results suggest that the effectiveness of counseling interventions is contingent not only on their presence but also on their quality, structure, and institutional support.

4.3. Comparative effectiveness of counseling strategies

The results demonstrate significant differences in the effectiveness of counseling strategies, with a large effect size ($\eta^2 = 0.35$) indicating that strategy type explains a substantial proportion of variance in perceived effectiveness. Interventions emphasizing self-efficacy enhancement and role modeling were rated most effective, suggesting that psychologically oriented and exposure-based approaches may be more salient for female students.

This pattern is consistent with Stout et al. [39] and O'Brien et al. [46], showing that interventions targeting identity formation and confidence development are critical in STEM engagement. The strong performance of role-model-based strategies also supports findings of Cyr et al. [47] and Martín-Peciña et al. [48], which stress the importance of visibility and relatability in shaping career aspirations. However, the comparatively lower effectiveness of parental engagement counseling contrasts with some studies by Wang et al. [10] and Archer et al. [49]. This discrepancy may reflect contextual differences, including variations in parental STEM literacy, socio-cultural

expectations, or levels of parental involvement in academic decision-making. It is also possible that indirect interventions (e.g., parental counseling) have less immediate impact on students compared to direct, student-centered approaches. These findings stress the need for context-sensitive intervention design, rather than assuming uniform effectiveness across settings.

4.4. Counseling access and student learning outcomes in science

The findings indicate that regular access to counseling is strongly associated with higher self-efficacy, interest, and academic performance, with large effect sizes (Cohen's $d > 0.8$) suggesting substantial practical significance. These magnitudes imply that differences between students with regular and limited counseling access are not only statistically significant but also educationally meaningful. These results are consistent with prior studies by Psaki et al. [40], Shahin et al. [34], and Osuoha [44], which suggest that sustained counseling engagement can support students in navigating psychosocial barriers. However, given the correlational and cross-sectional nature of the study, these relationships may also reflect selection effects, where students who are more motivated or supported are more likely to access counseling services. This introduces the possibility of endogeneity, particularly between self-efficacy and performance.

The positive correlations between counseling access and learning outcomes further reinforce the role of sustained engagement, although these associations do not establish causality. In line with previous research by Silverman et al. [37] and UNESCO [50], the findings suggest that access to structured guidance and mentoring is an important component of equitable STEM participation, but should be interpreted as part of a broader system of interacting influences rather than a singular determining factor.

5. Conclusion

This study examined the influence of psychosocial predictors and school counseling interventions on female secondary school students' learning outcomes in science. The findings revealed that psychosocial variables, particularly self-efficacy and internalized gender stereotypes, significantly shaped students' science performance, interest, and engagement. Self-efficacy emerged as the most influential predictor, while gender stereotypes negatively affected science outcomes. The study also found that access to counseling and gender-responsive counseling strategies were positively associated with improved self-efficacy, academic performance, and interest in science subjects among female students. Among the counseling approaches examined, self-efficacy enhancement workshops and role-model-based interventions proved to have the highest effectiveness. The findings stress the importance of integrating psychosocial support and structured counseling within science education to address gender disparities. Strengthening counseling services in schools, promoting positive science identity, and reducing stereotype-related barriers may contribute to more equitable participation and achievement of female students in science subjects.

5.1. Significance of the study

This study contributes to existing literature by integrating psychosocial and institutional perspectives in explaining gender disparities in science education. By simultaneously examining self-efficacy, gender stereotypes, and counseling access, the study provides a more comprehensive understanding of how internal and external factors interact within specific educational contexts. The findings also extend theoretical applications of Social Cognitive Career Theory and Gender Schema Theory by demonstrating how these constructs operate within a Nigerian secondary school setting.

5.2. Limitations

The cross-sectional correlational design limits causal inference and does not establish temporal relationships among variables. The use of purposive sampling and inclusion of only students with prior counseling access introduces potential selection bias, limiting generalizability. Reliance on self-reported Likert-scale measures may be subject to social desirability bias and common method variance [51]. The relatively high R^2 observed in the regression model may reflect shared variance among predictors, despite acceptable multicollinearity diagnostics. Contextual specificity to the Zaria Educational Zone means findings may not generalize to other regions with different socio-cultural or institutional conditions. Another limitation is the use of multiple statistical tests without a global correction (e.g., Bonferroni adjustment), which may slightly increase the risk of Type I error. Consistent findings across analyses and reported effect sizes provide support for the robustness of the results. However, findings should still be interpreted with caution given the use of multiple related tests.

5.3. Implications for practice

The findings suggest that interventions targeting self-efficacy and stereotype reduction should be prioritized, given their strong associations with learning outcomes. The observed differences in strategy effectiveness indicate that self-efficacy enhancement workshops and role-model-based interventions may be more impactful than indirect approaches such as parental engagement counseling. More so, the association between counseling access and student outcomes highlights the need for equitable and consistent provision of counseling services. These implications should be interpreted in light of effect sizes and contextual realities, emphasizing targeted and evidence-informed implementation.

5.4. Suggestions for further research

Future studies should employ longitudinal or experimental designs to clarify causal relationships among psychosocial variables and learning outcomes. Further research should also examine variability in counseling programme quality, include more diverse samples, and explore contextual moderators such as school resources and cultural norms.

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References

1. United Nations Educational, Scientific and Cultural Organization (UNESCO). *Cracking the Code: Girls' and Women's Education in Science, Technology, Engineering, and Mathematics (STEM)*. UNESCO; 2017.
2. Cheryan S, Master A, Meltzoff AN. Cultural stereotypes as gatekeepers: increasing girls' interest in computer science and engineering by diversifying stereotypes. *Frontiers in Psychology*. 2015; 6. doi: 10.3389/fpsyg.2015.00049
3. Master A, Cheryan S, Meltzoff AN. Computing whether she belongs: Stereotypes undermine girls' interest and sense of belonging in computer science. *Journal of Educational Psychology*. 2016; 108(3): 424–437. doi: 10.1037/edu0000061
4. Goos M, Kelly R. Addressing the gender gap in science: Lessons from examining international initiatives. *Pure and Applied Chemistry*. 2021; 93(8): 949–954. doi: 10.1515/pac-2021-0102
5. Lindberg SM, Hyde JS, Petersen JL, et al. New trends in gender and mathematics performance: A meta-analysis. *Psychological Bulletin*. 2010; 136(6): 1123–1135. doi: 10.1037/a0021276
6. Tucker-Drob EM, Cheung AK, Briley DA. Gross Domestic Product, Science Interest, and Science Achievement: A Person \times Nation Interaction. *Psychological Science*. 2014; 25(11): 2047–2057. doi: 10.1177/0956797614548726
7. Hu X, Jiang Y, Bi H. Measuring science self-efficacy with a focus on the perceived competence dimension: Using mixed methods to develop an instrument and explore changes through cross-sectional and longitudinal analyses in high school. *International Journal of STEM Education*. 2022; 9(1): 47. doi: 10.1186/s40594-022-00363-x
8. Yang H, Xiang J. Peer support and academic engagement: The moderated mediation model for college students. *Psychology in the Schools*. 2025; 62(1): 281–295. doi: 10.1002/pits.23324
9. Robinson KA, Perez T, White-Levatich A, et al. Gender differences and roles of two science self-efficacy beliefs in predicting post-college outcomes. *The Journal of Experimental Education*. 2022; 90(2): 344–363. doi: 10.1080/00220973.2020.1808944
10. Wang MT, Ye F, Degol JL. Who Chooses STEM Careers? Using A Relative Cognitive Strength and Interest Model to Predict Careers in Science, Technology, Engineering, and Mathematics. *Journal of Youth and Adolescence*. 2017; 46(8): 1805–1820. doi: 10.1007/s10964-016-0618-8
11. Abrha M, Kelkay AD, Seifu A. Gender responsive pedagogy practices: Secondary school science teachers in Ethiopia.

- Journal of International Women's Studies. 2023; 25(1): 20. Available online: <https://vc.bridgew.edu/jiws/vol25/iss1/20/>
12. Kanga BM. Gender Comparison in the Effectiveness of Guidance and Counselling Services in Enhancing Students' Adjustment to School Environment in Boarding Secondary Schools in Kenya. *International Journal of Advanced Engineering Research and Science*. 2017; 4(3): 1–14. doi: 10.22161/ijaers.4.3.1
 13. Ayeni OO, Chisom ON, Hamad NMA, et al. Enhancing STEM education through emotional intelligence and counseling techniques. *World Journal of Advanced Research and Reviews*. 2024; 21(2): 903–916. doi: 10.30574/wjarr.2024.21.2.0503
 14. Ribeirinha T, Baptista M, Correia M. Investigating the Impact of STEM Inquiry-Based Learning Activities on Secondary School Student's STEM Career Interests: A Gender-Based Analysis Using the Social Cognitive Career Framework. *Education Sciences*. 2024; 14(10): 1037. doi: 10.3390/educsci14101037
 15. McGuire L, Hoffman AJ, Mulvey KL, et al. Gender Stereotypes and Peer Selection in STEM Domains Among Children and Adolescents. *Sex Roles*. 2022; 87(9–10): 455–470. doi: 10.1007/s11199-022-01327-9
 16. Steele CM. A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*. 1997; 52(6): 613–629. doi: 10.1037/0003-066X.52.6.613
 17. Ngozi EG, Kalu-Uche N. Strategies for Closing the Gender Gap in Science & Technology (S&T) Classrooms in Nigeria Secondary Schools: Teachers' Perception of Gender Mainstreaming. *Journal of Educational and Social Research*. 2013; doi: 10.5901/jesr.2013.v3n8p9
 18. Isma'il A, Abbas M, Ibrahim A. Enrollment Trends, Motivations, and Future Aspirations of Female Undergraduate Students in STEM Courses at Federal University Gusau—Nigeria. *Global Academic Journal of Humanities and Social Sciences*. 2023; 5(3): 142–150. doi: 10.36348/gajhss.2023.v05i03.001
 19. Amoadu M, Agormedah EK, Obeng P, et al. Gender Differences in Academic Resilience and Well-Being among Senior High School Students in Ghana: A Cross-Sectional Analysis. *Children*. 2024; 11(5): 512. doi: 10.3390/children11050512
 20. Manyilizu MC. Effectiveness of virtual laboratory vs. paper-based experiences to the hands-on chemistry practical in Tanzanian secondary schools. *Education and Information Technologies*. 2023; 28(5): 4831–4848. doi: 10.1007/s10639-022-11327-7
 21. Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Prentice-Hall; 1986.
 22. Bandura A. *Self-Efficacy: The Exercise of Control*. W.H. Freeman; 1997.
 23. Li Y, Singh C. Impact of perceived recognition by physics instructors on women's self-efficacy and interest. *Physical Review Physics Education Research*. 2023; 19(2): 020125. doi: 10.1103/PhysRevPhysEducRes.19.020125
 24. Bem SL. Gender schema theory: A cognitive account of sex typing. *Psychological Review*. 1981; 88(4): 354–364. doi: 10.1037/0033-295X.88.4.354
 25. Cole S, McCarthy-Curvin A, Thompson C, et al. Investigating guidance counselors' perceived sense of preparedness and support in carrying out their job. *Global Journal of Guidance and Counseling in Schools: Current Perspectives*. 2023; 13(2): 65–80. doi: 10.18844/gjgc.v13i2.9094
 26. Cotner S, Jenö LM, Walker JD, et al. Gender gaps in the performance of Norwegian biology students: the roles of test anxiety and science confidence. *International Journal of STEM Education*. 2020; 7(1): 55. doi: 10.1186/s40594-020-00252-1
 27. Pennington CR, Kaye LK, Qureshi AW, et al. Do gender differences in academic attainment correspond with scholastic attitudes? An exploratory study in a UK secondary school. *Journal of Applied Social Psychology*. 2021; 51(1): 3–16. doi: 10.1111/jasp.12711
 28. Joseph Owan V. Effects of Gender, Test Anxiety and Test Items Scrambling on Students Performance in Mathematics: A Quasi-Experimental Study. *World Journal of Vocational Education and Training*. 2020; 2(2): 56–75. doi: 10.18488/journal.119.2020.22.56.75
 29. Paechter M, Luttenberger S, Ertl B. Distributing Feedback Wisely to Empower Girls in STEM. *Frontiers in Education*. 2020; 5: 141. doi: 10.3389/educ.2020.00141
 30. Jacob M, Iannelli C, Duta A, et al. Secondary school subjects and gendered STEM enrollment in higher education in Germany, Ireland, and Scotland. *International Journal of Comparative Sociology*. 2020; 61(1): 59–78. doi: 10.1177/0020715220913043
 31. Happe L, Buhnova B, Koziolok A, et al. Effective measures to foster girls' interest in secondary computer science education: A Literature Review. *Education and Information Technologies*. 2021; 26(3): 2811–2829. doi: 10.1007/s10639-020-10379-x

32. Kang J. Gendered Science Practice at Secondary School and its Effects on Science Motivations. *International Journal of Science and Mathematics Education*. 2023; 21(6): 1725–1747. doi: 10.1007/s10763-022-10325-y
33. Chen C, Sonnert G, Sadler PM. The effect of first high school science teacher’s gender and gender matching on students’ science identity in college. *Science Education*. 2020; 104(1): 75–99. doi: 10.1002/sce.21551
34. Shahin M, Ilic O, Gonsalvez C, et al. The Impact of a STEM-based Entrepreneurship Program on the Entrepreneurial Intention of Secondary School Female Students. *arXiv preprint*. 2020; doi: 10.48550/ARXIV.2012.03746
35. Egbule EO. Senior secondary school students’ preferences by gender for counseling in Delta State, Nigeria. *GPH–International Journal of Educational Research*. 2023; 6(4): 45–53. doi: 10.5281/zenodo.7903813
36. Hilts D, Liu Y, Guo X. Student-To-School-Counselor Ratios, School-Level Factors, and Leadership Practices of School Counselors: A National Investigation. *Professional School Counseling*. 2023; 27(1). doi: 10.1177/2156759X231182135
37. Silverman M, Shields AL, Howard JN, et al. Rising Stargirls: Benefits of a Creative Arts-Based Approach to Astronomy Education for Middle-School Girls from Underrepresented Groups. *arXiv preprint*. 2025; doi: 10.48550/ARXIV.2501.11682
38. Sáinz M, Fàbregues S, Romano MJ, et al. Interventions to increase young people’s interest in STEM. A scoping review. *Frontiers in Psychology*. 2022; 13: 954996. doi: 10.3389/fpsyg.2022.954996
39. Stout JG, Dasgupta N, Hunsinger M, et al. STEMing the tide: Using ingroup experts to inoculate women’s self-concept in science, technology, engineering, and mathematics (STEM). *Journal of Personality and Social Psychology*. 2011; 100(2): 255–270. doi: 10.1037/a0021385
40. Psaki S, Haberland N, Mensch B, et al. Policies and interventions to remove gender-related barriers to girls’ school participation and learning in low- and middle-income countries: A systematic review of the evidence. *Campbell Systematic Reviews*. 2022; 18(1): e1207. doi: 10.1002/cl2.1207
41. Bachmann R, Hertweck F. The gender gap in digital literacy: A cohort analysis for Germany. *Applied Economics Letters*. 2025; 32(5): 608–613. doi: 10.1080/13504851.2023.2277685
42. ‘Invisible’: Australian girls facing big school problem. Available online: <https://www.news.com.au/lifestyle/parenting/school-life/invisible-australian-girls-facing-big-school-problem/news-story/72d7188fe85ae4e5895c791cbf8f5f9a> (accessed on 14 December 2025).
43. Creswell JW, Creswell JD. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. SAGE; 2018.
44. Osoha J. Assessment of the Impact of Guidance and Counselling on Academic Performance and Discipline among Junior Secondary School Students (A Study of Federal Capital Territory in Abuja). *Global Academic Journal of Humanities and Social Sciences*. 2024; 6(02): 85–97. doi: 10.36348/gajhss.2024.v06i02.006
45. Harsani P, Erniyati E, Kurnia D. Strengthening School Counseling Guidance Activities through e-counseling. *International Journal of Ethno-Sciences and Education Research*. 2022; 2(1): 43–48. doi: 10.46336/ijeer.v2i1.241
46. O’Brien LT, Hitti A, Shaffer E, et al. Improving Girls’ Sense of Fit in Science: Increasing the Impact of Role Models. *Social Psychological and Personality Science*. 2017; 8(3): 301–309. doi: 10.1177/1948550616671997
47. Cyr EN, Spencer SJ, Wright SC, et al. Seeing women who fit: Girls’ forecasted fit in STEM fosters career interest. *Social Psychology of Education*. 2025; 28(1): 112. doi: 10.1007/s11218-025-10056-2
48. Martín-Peciña M, Quesada A, Abril AM, et al. Breaking Barriers to Unleash STEM Futures by Empowering Girls Through Mentorship in Summer Camps. *Education Sciences*. 2025; 15(2): 242. doi: 10.3390/educsci15020242
49. Archer L, Moote J, Francis B, et al. The “Exceptional” Physics Girl: A Sociological Analysis of Multimethod Data From Young Women Aged 10–16 to Explore Gendered Patterns of Post-16 Participation. *American Educational Research Journal*. 2017; 54(1): 88–126. doi: 10.3102/0002831216678379
50. United Nations Educational, Scientific and Cultural Organization (UNESCO). *From Access to Empowerment: UNESCO Strategy for Gender Equality In and Through Education 2019–2025*. UNESCO; 2019. doi: 10.54675/IJGQ3826
51. Podsakoff PM, MacKenzie SB, Lee JY, et al. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*. 2003; 88(5): 879–903. doi: 10.1037/0021-9010.88.5.879