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Abstract

The prevailing gender disparities in Science, Technology, Engineering, and Mathematics (STEM) education continue to undermine equity and national development in Uganda. Despite progressive policies on compulsory science subjects and differentiated active learning, female enrolment has remained disproportionately low. This study was guided by the Expectancy-Value Theory to examine teachers' perspectives on the factors hindering girls' entry into STEM with a focus on the mindset change, gender-responsive curricula, and supportive programs. A cross-sectional correlational design was used with 191 secondary school teachers who were pursuing either bachelor's or master's programs at Makerere and Kyambogo Universities. Data was collected and analysed using a self-administered questionnaire and Pearson correlation coefficient respectively. Results revealed significant positive correlations for all the variables. Mindset change with a moderate correlation ($r = 0.350$, $p < 0.01$), highlighting the role of societal and teacher attitudes in increasing females' confidence and aspiration for success. Gender-responsive curricula showed ($r = 0.566$, $p < 0.05$), stressing the need for inclusive pedagogy to enhance girls perceived value of STEM subjects. Finally, it was found that gender supportive programs can play a transformative role in mentorship, and advocacy to reduce

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barriers that impede students' interest in STEM. The study concludes that addressing gender disparities in STEM requires multi-faceted strategies that target the educational supportive programs, pedagogy, and mindset orientation. The study recommends the need for rolling out gender supportive initiatives, institutionalization of gender-responsive practices that can empower girls to embrace scientific and technological advancement.

Keywords: *Gender-responsive curriculum, Gender disparities and Supportive programs, Expectancy-Value Theory, Mindset change and STEM education*

1.0 Introduction

Science, Technology, Engineering, and Mathematics (STEM) has been documented as a catalyst for sustainable development, innovation, and economic transformation world over (Onoshakpokaiye & Avwiri, 2025; Megawati et al., 2025). This connects with the African Union's Agenda 2063, and that of Uganda 2030, both of which advocate for inclusive and gender-supportive involvement in science education. A report by UNESCO (2024) on gender disparities revealed that in Sub-Saharan Africa alone, women account for less than 30% of tertiary enrolment in STEM specialities. In Uganda, this disparity is more pronounced with female involvement significantly lower in core science subjects of Mathematics, Science, and Physics compared to arts and humanities (UPSTU, 2024). The research further indicates that female students encounter discrimination, harassment, and systemic barriers within and outside school environment, which constrain their path into STEM fields (Nweje et al., 2025; IDRC, 2024; Mattheis et al., 2022).

Uganda has responded to the global agenda by implementing science-tailored policies aimed at strengthening STEM education by focusing on compulsory science subjects at Ordinary Level, differentiated salary structures for scientists, and targeted support programs (Baraire & Kahyana, 2025; Muhumuza & Mwesigwa, 2025; Ampeire, 2023; Milliam & Dominic, 2022). These efforts align with the country's national development plan on technological advancement, infrastructure development, and industrialization. Despite these interventions, gender imbalance exists at various levels of education where subject specialization happens (MOES, 2023). This portrays a picture where girls who perform comparably to boys at earlier stages are gradually demotivated from pursuing STEM courses as they progress higher in education (UNESCO, 2022).

The presence of such experiences can be attributed to the socio-cultural norms and gender stereotypes that end up shaping perceptions about girls' interests, abilities and aspirations for education and career pathways (Ampaire, 2022). For instance, beliefs that associate scientific competence with males, together with limited exposure to female role models and gender-insensitive programs, tend to undermine students' confidence and interest in certain fields. As a result, many females opt out of STEM despite demonstrated capability in early years of school (Tandrayen-Ragoobur & Gokulsing, 2022). In addition, this trend does not only reinforce gender inequality but limits our ability as a nation to harness human capital in sectors of energy, engineering, and technology (Tizikara, 2019).

The study was guided by the Expectancy-Value Theory (EVT) (Eccles et al., 1983; Eccles, 2005), which argues that students' academic choices can be influenced by the expectations of success and the value attached. Accordingly, the learning environment and teachers in particular shape students' perceptions through instructional practices, attitudes, and career support systems (El-Annan & Hassoun, 2025; Singh et al., 2023). It is against this background that the study examined barriers that hinder the girl-child enrolment in STEM fields in Uganda from the teachers' perspectives. Specifically, the study sought to examine the relationship

between: (i) mindset change and girls' enrolment in STEM; (ii) gender-responsive curricula and girls' enrolment; and (iii) gender-supportive programs and girls' enrolment in STEM. Teachers' experiences provided critical insights into context-specific strategies and practices that contribute towards the underrepresentation of female students in STEM.

2.0 Literature Review

The recent studies in Africa have emphasized the need to address gendered stereotypes and structural barriers in STEM education. For instance, Makarova et al. (2019) and Miller et al. (2018) reported that at the level of kindergarten, children tend to attribute science with men, as demonstrated in the Draw-a-Scientist Test (Ikkatai et al., 2021). This male representation in children's imaginations may reinforce societal beliefs and biases that end up discouraging them from pursuing STEM subjects (Padwick et al., 2022). More so, the cultural expectations and social norms sometimes instil fear and uncertainty at the critical moment when the students are making education and career decisions (James et al., 2021; Trevor-Roberts, 2006).

An Annual Report by IDRC (2024-2025) in Addis Ababa indicated that several African countries cited a number of challenges faced by female students in higher institutions of learning such as academic aggression, sexual harassment, unfavourable time allocation in some programs, poor infrastructural setup, and unequal participation (IDRC, 2024). In Uganda, female admissions in STEM subjects and programs especially as they progress to tertiary and universities, has been faced with systemic barriers of teacher biases, stereotypes, and lack of role models which reinforce gender exclusion (UPSTU, 2024). This is reinforced by the News release on the barriers faced by Ugandan women in education by Afrobarometer (2024) which revealed that 35% of female students have reported discrimination and harassment from teachers which negatively affects their STEM aspirations. These findings emphasise the urgent need for policy frameworks directed towards gender-supportive practices together with recruitment of female teachers as role models that can enhance girls' education in a safe and secure learning environment.

Pedagogical practices can reinforce gender disparities in education. Several studies have indicated that most learning materials often overlook illustrations, examples, and biographies of successful and outstanding women scientists which creates an impression that science is inherently for men (Makarova et al., 2019; Mtemeri, 2019). In this line, a study by Arguto et al. (2021), argued that the absence of female figures as mentors and role models in teaching and learning content and illustrations sometimes creates a feeling of uncertainty and hopelessness that can instil fear for STEM fields. In most schools in Uganda, female teachers are usually assigned to teach lower-level classes whenever it comes to STEM subjects compared to their male counterparts who are easily allocated candidate classes and/or advanced level of education (HSC) (Muweesi et al., 2024; Gweshe & Chiware, 2023). This concurs with the recommendation by UNESCO (2022) on the need for increased awareness among teachers, parents, and communities on the relevance of women in STEM. Similarly, studies by Bai & Tian (2025) and Kolawole (2025) reported that innovative pedagogies, such as experiential and active learning, robotics education, have significantly improved students' computer skills and confidence in science education. The same studies further indicate that such experiences of exposure instill a sense of positive attitude, and motivation towards STEM learning. This implies that such practices can be adapted to promote self-confidence and efficacy among female students towards STEM careers in Uganda.

Different structures of society in families, schools, and traditional settings have continued to propagate gender stereotypes that constrain girls' aspirations for education and career path in STEM (Ojong & Kareem, 2025). These socio-cultural norms, support beliefs that associate scientific aptitude with males while positioning female gender as less capable in technical

domains (Mitmeri, 2019). Such mindset orientation when internalised early affects students' confidence, and attitudes which impairs their choice of subject and career preferences right from primary education. Consequently, these thoughts and beliefs become normalised in career decisions that eventually limit girls' autonomy in decision-making (Ampaire, 2022). Moreover, such experiences of female-teacher role-assignment in class and other added responsibilities, send clear signals that negatively impact on gendered decisions (Solace et al., 2023). Incidentally, administrators, educators and sometimes policymakers that would have corrected such anomalies, often have been formed by similar societal and structural norms and therefore may not address those issues (Obizue, 2025). Subsequently, these intersecting factors form barriers that limits girls' capacity to make independent and informed career choices. This study argues for deliberate policy and institutional attempts to redirect attention on increased female role models and gender-responsive teaching practices in education (UNICEF, 2020).

In Africa, some initiatives have come up to redirect the attention of female students into STEM programs. For instance, Her Initiative in Tanzania and AkiraChix in Kenya, have raised female students' awareness through peer trainings, digital skills, and mentorship (Adesulu-Dahunsi, 2025; Sithole et al., 2017). These strategies align with the Expectancy-Value theory in trying to boost girl-child's confidence and efficacy in STEM subjects. There's need for targeted programs and initiatives in Uganda to educate school-stakeholders on the importance of grooming and promoting girls' meaningful engagement in activities like fairs, exhibitions, and healthy competitions.

In a nut shell, the existing literature on gender disparities in education has remained Western-focused, with limited Afro-centric evidence on specific initiatives and programs that can redirect girl-child's interest, enrolment and stay in STEM domains. The existing policies and initiatives in Uganda are sometimes undermined by the sociocultural norms, misaligned classroom implementation, and unclear agenda on "what to do..., how to do it..., when to do it, and who should do it queries?". While most studies have focused on girls' enrolment than retention and career pathways, a few have used the Expectancy-Value theory lens to interrogate the gendered STEM choices. We have addressed that inconsistency by linking mindset change, gender-responsive curriculum, and supportive programs to female increased enrolment in STEM.

3.0 Methodology

Research Design

The study followed a cross-sectional correlational research design. This was considered suitable for clarity and interpretation of relationships among variables being studied (Ghanad, 2023). This was deemed appropriate to examine the extent to which mindset change, gender-responsive curriculum, and supportive programs relate to girls' enrolment in STEM.

Participants

A total of 191 secondary school teachers participated in the study. These were pursuing either the bachelor's or master's degree programs at Makerere or Kyambogo universities respectively during the period of September and October, for the academic year of 2025/26. The sample was purposively selected because it represented diverse regions of Uganda and provided a national character of teachers. Students were also conveniently targeted because only those found at campus during the data collection were included. This approach increased the response rate to 100% because all the distributed questionnaires were completed and returned.

Data Collection Instrument

Data was collected using a self-administered questionnaire on a five-point Likert scale of responses ranging from 1= Strongly Disagree, 2 = Disagree, 3 = Not Sure, 4 = Agree, and 5 = Strongly Agree.

Validity and Reliability

The instrument was ascertained for content validation by experts in the Department of gender studies and School of education who reviewed items for clarity, and relevance to the study objectives. We adapted tools that had been previously used with alpha values above 0.70 for reliability. Mindset change was measured using the Implicit Theories of Intelligence Scale by Dweck (2006); Gender-Responsive Curriculum was measured using FAWE GRP Tool (2018); Gender-Supportive Programs was measured using the Gender Equity Tool and School Climate Scale by UNICEF (2017); and Girls' Enrolment in STEM was measured using STEM-CIS/S-STEM by Tyler-Wood et al. (2010) and Unfried et al. (2015). To ensure validity and reliability of the questionnaire, pilot testing among secondary school teachers in Wakiso District who were not enrolled in any program of study in the two universities at that time was done. The Data was helpful in the revision and modification of items and this made the instrument adaptable for use. The reliability indicated a Cronbach alpha coefficient above 0.70 in all the sections.

Procedure

Different programs in the two universities were accessed through School Academic Registrars in liaison with lecturers responsible for the core course units to generate a list of participants. This was followed by meetings with specific lecturers who introduced us to the students. This enabled us to schedule appointments, and obtain consent from the students ahead of data collection. We agreed with participants to meet during their study session days at campus. All participants were briefed on the purpose of the study, freedom of participation, and confidentiality was guaranteed. This was followed with the administration of questionnaires which were filled and immediately collected after completion to ensure a high return rate and minimize attrition.

Ethical Considerations

The study adhered to ethical standards in educational research (Head, 2020). Participants were assured of voluntary participation with freedom to withdraw at any point, informed verbal consent was obtained and reassured participants that the research was for academic and scholarly purposes before administering the questionnaires. Those students that participated were guaranteed confidentiality and anonymity. There were no identifying numbers or information involved. The collected Data was stored securely under lock and key. These measures ensured respect for participants' rights and compliance with ethical consideration.

Data Analysis

The Data was edited, coded, and entered into SPSS Version 25 for cleaning and analysis. Pearson's correlation coefficient (r) was used to establish the magnitude of strength and direction among the factors as stated in the hypotheses on the relationships among; mindset change, gender-responsive curriculum, gender-supportive programs, and girls' enrolment in STEM.

4.0 Findings and Discussion

This section presents results on teachers' perspectives on the factors that impeded girls' enrolment in STEM subjects in Uganda. The results are presented in line with study objectives and hypotheses.

4.1 Mindset Change and Girls’ Enrolment in STEM

The first objective examined the relationship between mindset change and girls’ enrolment in STEM. This was analysed in line with the first hypothesis “*There is a significant relationship between mindset change and girls’ enrolment in STEM*”. The results are presented in Table 1.

Table 1: Relationship between Mindset Change and Girls’ Enrolment in STEM

Variable	Girls’ Enrolment in STEM
Mindset Change	
Pearson r	0.350**
Sig. (2-tailed)	0.006
N	191

**Correlation is significant at 0.01 level (2-tailed).

The results in Table 1 showed a positive significant correlation between mindset change and girls’ enrolment in STEM ($r=0.350, p<0.01$). This means that a positive change in mindset will lead to increased girls’ enrolment in STEM. This implies that addressing gendered norms, myths and misconceptions through mindset strategies can reduce or eliminate the barriers to girls’ enrolment in STEM.

4.2 Gender-Responsive Curriculum and Girls’ Enrolment in STEM

The second objective explored the relationship between gender-responsive curriculum and girls’ enrolment in STEM. The analysis was guided by the second hypothesis “*There is a significant correlation between gender-responsive curriculum and girls’ enrolment in STEM*”. The results are presented in Table 2.

Table 2: Correlation between Gender-Responsive Curriculum and Girls’ Enrolment in STEM

Variable	Girls’ Enrolment in STEM
Gender-Responsive Curriculum	
Pearson r	0.563*
Sig. (2-tailed)	0.031
N	191

*Correlation is significant at 0.05 level (2-tailed).

The results indicated a positive significant correlation between gender-responsive curriculum and girls’ enrolment in STEM ($r=0.563, p<0.05$). This implies that embracing gender-responsive pedagogy and content is likely to increase girls’ enrolment in STEM. This calls for gender-responsive education that can promote girls’ confidence, interest and participation in STEM.

4.3 Gender-Supportive Programs and Girls’ Enrolment in STEM

The third objective examined the relationship between gender-supportive programs and girls’ enrolment in STEM. The analysis was guided by the hypothesis “*There’s a significant relationship between gender-supportive programs and girls’ enrolment in STEM*”. The results are presented in Table 3.

Table 3: Relationship between Gender-Supportive Programs and Girls’ Enrolment in STEM

Variable	Girls’ Enrolment in STEM
Gender-Supportive Programs	
Pearson r	0.647**
Sig. (2-tailed)	0.005
N	191

***Correlation is significant at 0.01 level.*

The results indicated a strong positive significant correlation between gender-supportive programs and girls’ enrolment in STEM ($r=0.647, p< 0.01$). This points to the critical role of deliberate gender-supportive initiatives and practices such as provision of mentorship, scholarships, and exposure to increase female students’ interest and enrolment in STEM fields.

Overall, the results demonstrate that mindset change, gender-responsive curriculum, and gender-supportive programs are all positively and significantly correlated with girls’ enrolment in STEM. This means that multifaceted strategies that address supportive initiatives, societal attitudes, gender tailored curriculum reforms can be essential in fighting the barriers to girls’ enrolment in STEM in Uganda.

4.4 Discussion

The study set out to examine teachers’ perspectives on the barriers impeding girls’ enrolment in STEM in Uganda, with a focus on mindset change, gender-responsive curriculum, and supportive programs. The results revealed significant positive correlations in all the three factors which stress their critical role in STEM education. These results align with the Expectancy-Value Theory (Eccles et al., 1983; Eccles, 2005), which posits that students’ academic choices are shaped by their expectations of success and goal achievement. This implies that mindset change directly influences female students’ expectations, confidence, and efficacy in STEM subjects. In this line, gender-responsive pedagogy increases the value attached to STEM fields. More so, supportive programs say; scholarships and safe learning environments, enhance girls’ confidence, and attitude. This demonstrates how EVT can provide a comprehensive framework to address gender disparities in STEM education in Uganda. The discussion is aligned with the study objectives, theory, and reviewed literature.

Mindset Change and Girls’ Enrolment in STEM

The study findings revealed that mindset change has a significant positive relationship with girls’ enrolment in STEM fields. This implies that improving institutional, societal, and personal beliefs towards females’ abilities in STEM technology is important in limiting increasing gender inequalities in STEM education. Drawing from the Expectancy Value Theory (EVT) advanced by Eccles et al. (1983) and Eccles (2005), girls are more likely to pursue STEM-related subjects when they perceive themselves as capable and when such careers are considered valuable and attainable. In many African contexts, including Uganda, deeply rooted gender stereotypes continue to shape perceptions that science and mathematics are masculine domains, thereby discouraging girls from participating in STEM pathways (Mtemeri, 2019; Tandrayen-Ragoobur & Gokulsing, 2022). The current findings therefore reinforce earlier studies which revealed that children begin forming gender-science stereotypes at an early age, often associating scientists and engineers with men (Makarova et al., 2019; Miller et al., 2018; Ikkatai et al., 2021). Such experiences negatively impact on girls’ efficacy, and aspiration toward STEM careers. In line with Dweck (2006) mindset theory, promoting

growth mindsets among learners can strengthen self-confidence, motivation, and resilience, in dealing with STEM related tasks.

The findings also revealed that changing attitudes toward girls in STEM requires collective efforts to involve different structures of communities, families, schools, and policymakers. Studies have shown that school culture, peer influence, and parental expectations, significantly shape girls' career aspirations and educational choices (Ampaire, 2022; Trevor-Roberts, 2006). In Uganda, although government initiatives such as the compulsory science policy were intended to increase inclusion in science subjects, implementation challenges still constrain girls' intake and success (Milliam & Dominic, 2022; Ampeire, 2023). Moreover, reports by UNESCO (2022, 2024) and UNICEF (2020) indicate that discriminatory beliefs, limited mentorship opportunities, and gender-insensitive learning environments continue to undermine girls' involvement in STEM in Sub-Saharan Africa. Therefore, schools should intentionally inculcate positive STEM identities among girls through career guidance, exposure to female STEM role models, and community involvement. Such interventions can dismantle limiting stereotypes and nurture girls' aspirations to pursue STEM careers that are increasingly vital for national development and economic transformation (Oguru & Amie-Ogan, 2024; Onoshakpokaiye & Awiri, 2025).

Gender-Responsive Curriculum and Girls' Enrolment in STEM

The findings on gender-responsive curriculum and girls' enrolment in STEM showed a significant positive relationship which highlights the importance of relevant content delivery, inclusive pedagogy, and classroom practices in influencing girls' interest in science and technology. According to the Expectancy Value Theory, learners are motivated to engage in academic and career pathways perceived to be supportive, relevant, and meaningful to their future aspirations (Eccles, 2005). A curriculum that challenges socio-cultural and traditional gender norms, encourages active learning, accommodates gender-specific experiences, has the ability to boost girls' interest, and enrolment in STEM. This finding is consistent with Bai and Tian (2025) and Kolawole (2025), who observed that innovative approaches such as robotics, simulations, and learner-centred STEM instruction significantly improve students' attitudes, motivation, and performance in technical subjects. Similarly, FAWE (2018) emphasised that gender-responsive pedagogy creates equitable classroom interactions that encourage girls to actively engage in science and mathematics learning. In Uganda, however, many schools still employ traditional teaching methods and instructional materials that unintentionally reinforce male dominance in STEM disciplines (Muweesi et al., 2024). Consequently, this ends up painting male dominated signals that may shatter girls' confidence and motivation to pursue career in science, technology, and mathematics.

The study further highlights the need for equitable representation and inclusivity in STEM education. The absence of female role models in STEM teaching and learning environments has been identified as a major barrier to girls' representation in science and technology (Arguto et al., 2021; Nweje et al., 2025). Integrating case studies, illustrations, and contributions of female scientists into classroom content and instruction can help girls visualise themselves in STEM programs and challenge the prevailing perceptions that such careers are male domains. Research by Seni (2026) and UNESCO (2024) demonstrated that gender-responsive teaching practices improve females' academic self-efficacy, and attitude towards STEM subjects. Despite Uganda's progressive education policies and growing recognition of STEM as a driver of socioeconomic transformation (MOES, 2023; Oguru & Amie-Ogan, 2024), the implementation still remains inconsistent due to limited school and family related structural concerns. There is therefore a need to strengthen professional teacher training in gender-responsive methodologies to create supportive learning environments that promote girls in

STEM education (Manchenko et al., 2022; El-Annan & Hassoun, 2025). Such practices help to narrow the gender gap in STEM enrolment.

Gender-Supportive Programs and Girls' Enrolment in STEM

The findings of this study revealed a strong and positive relationship between gender-supportive programs and girls' enrolment in STEM education. This suggests that deliberate and transformative interventions aimed at addressing gender disparities can significantly enhance girls' participation in science, technology, engineering, and mathematics subjects. Gender-supportive programs such as mentorship initiatives, career guidance, science camps, female role-model engagement, scholarships, and teacher sensitization have been widely recognized as effective mechanisms for motivating girls to pursue STEM-related pathways (Mlama et al., 2021). In many African contexts, including Uganda, girls often encounter socio-cultural stereotypes, limited exposure to female STEM professionals, and inadequate institutional support, which negatively affect their confidence and interest in STEM disciplines (UNESCO, 2024). Therefore, school-based interventions that create inclusive learning environments and intentionally empower girls are essential in promoting equitable STEM participation.

The study findings are consistent with existing literature which indicates that gender-responsive educational programs improve girls' self-efficacy, academic engagement, and retention in STEM fields. Different studies by Chiphambo (2025) and Msambwa et al., (2024), have revealed that targeted interventions that contest gender stereotypes and provide academic and psychosocial support increase girls' enrolment and persistence in science-related subjects. The same findings argue that gender-sensitive methods and practices have a positive influence on girls' interest in STEM learning in Sub-Saharan Africa. In Uganda, initiatives that promote girls' active learning in science through competitions, exposure camps, science clubs, and community sensitization have been associated with improved enrolment and completion in STEM (Ojong & Kareem, 2025; Node, 2024; (MoES), 2023). These findings support the need to strengthen gender-inclusive policies and frameworks in the education system to attract female students in STEM education. There's need to integrate STEM principles within the Competence Based Curriculum (CBC) as a gender-responsive initiative that can promote active learning competences among learners. In Uganda, this will promote STEM inclusivity to benefit female students at all levels of education.

5.0 Conclusion

The study explored teachers' perspectives on the barriers that impeded girls' enrolment in STEM fields in Uganda with a focus on mindset change, gender-responsive curriculum, and supportive programs. The results revealed that all the three domains were significantly correlated with girls' enrolment in STEM. In line with the Expectancy-Value Theory, the study demonstrated that girls' enrolment in STEM can be shaped by their confidence and aspiration to succeed, their perceived STEM educational prospects, and curtailing barriers through supportive strategies. These results emphasise the need for multifaceted approaches and engagements to address the factors that lead to female underrepresentation in science, engineering and mathematics.

6.0 Recommendations

From the study findings and in line with the objectives, the following recommendations were made;

Teachers, parents, and communities should be empowered to challenge the perceptions and attitudes that portray STEM as a male domain. This will raise the self-efficacy and boost the confidence of female students to belong in STEM space.

The curriculum developers and implementers should mount deliberate efforts to integrate profiles and contributions of female scientists in STEM content to motivate and attract young female involvement in STEM activities.

There is great need for intentional mentorship initiatives, career guidance, and advocacy programs to target girls in STEM.

Community, educational, and family institutions should continuously provide female support structures to create safe, and secure learning environments that will strengthen both educational and career pathways for girls' progression in STEM education.

Practical Implications

1. Policymakers should prioritise mindset change policies and campaigns that target teachers, parents, and communities to support girls' enrolment and progression in STEM up to classroom level.
2. Teachers should do continuous professional development trainings to enhance their capacity in knowledge and skills to support girls' aspirations in STEM education.
3. Institutions of learning should integrate gender-tailored support campaigns that will encourage female students to venture and harness the opportunities presented STEM education programs.
4. Curriculum developers should integrate gender-responsive learning materials, content and pedagogy to enhance the relevance and engagement of STEM among girls in schools for gender inclusive learning.
5. Communities should be sensitised to reorient their thoughts, attitudes, and behaviour to address the negative perceptions and myths surrounding girls in STEM careers.

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