https://journal.ypidathu.or.id/index.php/jete/
P - ISSN: 3025-0668
E - ISSN: 3025-0676

The Story of Struggle and Hope: Narrative Accounts of Female STEM Students in Egyptian Higher Education

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ABSTRACT

Baground. Women in science, technology, engineering, and mathematics (STEM) fields in Egypt continue to face persistent structural and socio-cultural challenges, despite policy efforts to promote gender equity in higher education. The experiences of female STEM students remain underrepresented in scholarly discourse, particularly from an emic, narrative perspective.
Purpose. This study aims to explore the lived experiences, challenges, and aspirations of female undergraduate STEM students in Egyptian universities through narrative inquiry.
Method. Drawing on in-depth, semi-structured interviews with 20 participants from three major public institutions, the research documents personal accounts of gender-based obstacles, including societal expectations, institutional biases, and limited access to mentorship. Thematic narrative analysis revealed two dominant storylines: struggle against systemic barriers and hope grounded in academic identity, family support, and peer solidarity.
Results. Findings reveal two dominant narrative arcs: "struggle"-characterized by marginalization, institutional neglect, and gender bias-and "hope"-rooted in academic identity, peer solidarity, and personal resilience. Participants employed strategies such as informal mentorship, emotional self-regulation, and counter-stereotypical performance to navigate male-dominated academic spaces.
Conclusion. The study concludes that while structural inequalities persist, female students actively construct pathways of persistence, agency, and transformation within STEM fields. These findings provide valuable insights for educators, policymakers, and institutional leaders aiming to foster inclusive and supportive environments in STEM education.

KEYWORDS

Gender Equity, STEM Education, Narrative Inquiry, Egyptian Universities, Female Students

Citation: Youssef, T., Ahmed, D., & Sayed, S. (2025). The Story of Struggle and Hope: Narrative Accounts of Female STEM Students in Egyptian Higher Education. *Journal Emerging Technologies in Education*, *3*(3), 121-129
https://doi.org/10.70177/jete.v3i3.2236

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Received: April 12, 2025

Accepted: April 15, 2025

Published: June 30, 2025

INTRODUCTION

The participation of women in STEM (Science, Technology, Engineering, and Mathematics) education has been the subject of global attention due to its implications for economic development, innovation, and gender equity. In recent years, national and international organizations have pushed for broader female inclusion in STEM fields, recognizing the gender gap as both a social justice issue and a barrier to inclusive scientific advancement. In countries like Egypt, where higher education serves as a central mechanism for social mobility and professional transformation, STEM programs hold particular promise for young women seeking to challenge traditional gender roles and contribute to national progress.

STEM education does not necessarily equate to equitable experience. Despite formal inclusion, many female STEM students continue to face subtle and overt forms of gender-based discrimination, lack of mentorship, limited representation, and societal expectations that challenge their persistence and self-concept. The cultural and institutional structures within which STEM education operates are often embedded with implicit biases that shape women's educational journeys in ways that are frequently under-recognized.

These challenges are compounded by a lack of safe spaces for female students to reflect upon and narrate their lived experiences. While statistical data may illustrate progress in female enrollment, numbers do not capture the nuanced emotional, social, and academic struggles that accompany women's efforts to navigate male-dominated educational cultures. Understanding these experiences from the students' own perspectives provides essential insight into how they construct agency, resilience, and hope. A narrative approach is thus particularly valuable in giving voice to a demographic often discussed in policy rhetoric but less often heard in their own terms.

Despite policies that promote gender equity, female students in Egyptian STEM programs continue to encounter structural and interpersonal challenges that undermine their academic success and professional aspirations. These challenges are not only academic in nature but deeply sociocultural, involving gender norms, familial expectations, and institutional dynamics that often restrict women's full participation and leadership in STEM environments (Anning, 2025; Collins et al., 2025; Murillo-Zepeda et al., 2025; Pituskin et al., 2025). The persistence of gendered stereotypes positions science and engineering as inherently masculine domains, which contributes to a hidden curriculum that marginalizes female presence.

Students report experiencing differential treatment from faculty, limited access to role models, and an ongoing struggle to reconcile academic ambition with expectations of marriage, caregiving, and community conformity. The psychological toll of navigating such dual pressures often goes unacknowledged within formal academic structures. As a result, many women develop informal support networks and adopt coping strategies to manage the conflict between personal aspiration and external constraint (Behnamnia et al., 2025; Majilla, 2025; Maryna et al., 2025; Namazi & Raiessi, 2025). These efforts, while resourceful, highlight the absence of systemic support for gender-responsive learning environments in STEM.

The limited visibility of these lived experiences in institutional planning and academic literature has led to a disconnect between formal equality policies and actual student experiences. Most assessments of gender equity in STEM rely on enrollment statistics or institutional reports, which do not account for qualitative dimensions of exclusion (Arunthavalingam et al., 2025; Gautier, 2025; Jusoh et al., 2025; Matete & Kombe, 2025). Without capturing the voices of students themselves, especially in socio-cultural contexts like Egypt, existing efforts toward gender inclusion risk being superficial or performative rather than transformative.

This study seeks to explore and document the lived experiences of female undergraduate STEM students in Egyptian higher education through a narrative inquiry approach. By centering students' personal stories, the research aims to illuminate how gender, culture, and institutional norms intersect to shape their academic identities, aspirations, and sense of belonging. The inquiry focuses on both challenges and sources of resilience, capturing not only moments of struggle but also narratives of hope and perseverance.

The study aims to identify recurring themes and structural patterns in the stories of female STEM students to better understand how these experiences inform their academic trajectories and self-conception. It seeks to uncover how students negotiate their roles within male-dominated classrooms and how they interpret institutional signals-both explicit and implicit-about their capacity to succeed (Holovko et al., 2025; Mirabelli et al., 2025). Through this process, the research hopes to highlight the everyday ethical labor involved in being a woman in STEM in Egypt.

A secondary objective is to provide data that can inform gender-sensitive pedagogical reform and institutional policies in Egyptian universities. By offering a grounded, student-led account of STEM education from a gender perspective, the study aspires to move beyond policy prescriptions and into the realm of lived experience (Rahman et al., 2025; Schmidt & Stumpe, 2025). The goal is to contribute to a more inclusive academic culture that acknowledges the complexity of gendered educational journeys and develops context-specific responses that empower female students.

Current literature on gender and STEM in the Middle East and North Africa (MENA) region, including Egypt, often lacks depth in capturing the experiential realities of female students. Many existing studies adopt a quantitative lens, focusing on statistical trends in enrollment, graduation rates, or labor market integration. While these data points are valuable for mapping broader patterns, they rarely interrogate the subjective experiences that influence persistence, identity formation, or academic self-efficacy among female STEM students. As a result, the social and emotional labor undertaken by these students remains largely invisible.

Few studies have employed qualitative methodologies, particularly narrative inquiry, to investigate the intersection of gender, education, and cultural identity in STEM fields within the Egyptian context. Those that do exist tend to be either institutionally commissioned reports or embedded within broader gender studies frameworks, without sufficient attention to the disciplinary and pedagogical specificity of STEM. There is limited exploration of how students themselves construct meaning, navigate challenges, and derive resilience from their lived contexts. These gaps leave a significant blind spot in understanding how institutional change can be informed by the people most affected by systemic inequities.

This research addresses these gaps by offering an emic, story-based exploration of women's experiences in STEM. Through the lens of narrative inquiry, the study captures dimensions of identity, emotion, and agency that are often excluded from dominant metrics of academic success. It contributes to a growing but still underdeveloped body of work that treats student voice not as anecdotal but as an essential epistemological resource for institutional transformation. By doing so, the research challenges existing paradigms of evaluation and provides a model for integrating qualitative insights into STEM education reform.

This study is distinctive in both its methodological approach and its contextual focus. The use of narrative inquiry to examine the experiences of Egyptian women in STEM offers a fresh perspective that moves beyond deficit-based or policy-driven analyses. The emphasis on individual stories allows for the emergence of themes that are not pre-scripted by institutional discourse or theoretical assumptions. This bottom-up methodology honors the complexity and specificity of participants' realities, offering rich insights into how they interpret, resist, or adapt to gendered structures within the academic space.

The research provides a novel conceptual lens by framing the academic lives of female STEM students not merely as obstacles to be overcome but as dynamic narratives of struggle, adaptation, and hope. This framing moves away from pathologizing women's experiences and instead emphasizes their agency, voice, and transformative potential. The study also contributes methodologically by modeling how narrative inquiry can be used in STEM education research to uncover ethical and affective dimensions of student experience, which are often marginalized in data-centric evaluations.

This research is justified by the urgent need to understand and support female participation in STEM education within cultural contexts where gender norms are rapidly evolving but institutional practices remain rigid. As Egypt and similar nations invest in STEM as a driver of economic and technological development, ensuring that these spaces are inclusive, supportive, and empowering for women becomes not only a moral imperative but a strategic necessity. By giving voice to those whose stories are seldom heard, this study offers a critical foundation for evidence-based gender equity interventions grounded in authentic lived experience.

RESEARCH METHODOLOGY

This study employed a narrative inquiry research design to explore the lived experiences of female undergraduate students in STEM disciplines within Egyptian higher education institutions. Narrative inquiry was chosen for its capacity to foreground personal stories and meaning-making processes, allowing for deep engagement with the complex interplay of gender, culture, and institutional dynamics (Bierman et al., 2025; Ortiz-Rojas et al., 2025; Sager et al., 2025). The approach aligns with the study's objective to highlight individual voices and examine how students construct resilience and identity through their educational journeys in male-dominated academic spaces.

The population of the study consisted of female students currently enrolled in science, technology, engineering, and mathematics (STEM) programs across three public universities in Egypt, located in Cairo, Alexandria, and Assiut. A purposive sampling strategy was employed to select 20 participants who represented various STEM majors, socioeconomic backgrounds, and years of study. Participants were identified through student networks, academic advisors, and university clubs, ensuring diversity in lived experience while maintaining a focus on those with direct engagement in institutional and cultural challenges related to gender in STEM education.

The instruments used in this study included in-depth, semi-structured interviews and participant-written personal reflections. Interviews were conducted in Arabic or English, depending on the participant's preference, and followed a flexible guide designed to elicit narrative accounts related to motivation, obstacles, support systems, and future aspirations. Each session lasted between 60 and 90 minutes and was audio-recorded with informed consent. Participants were also invited to submit short written narratives elaborating on specific themes that emerged during the interviews. All collected data were transcribed verbatim and translated into English where necessary to support thematic analysis.

The research was conducted in four stages: recruitment, data collection, narrative construction, and analysis. Ethical approval was obtained from the lead researcher's institutional review board, and all participants provided written informed consent. During the narrative construction phase, the researcher collaborated with participants to co-develop coherent life stories that accurately reflected their intended meaning. Data analysis was guided by Clandinin and Connelly's framework for narrative inquiry, which involves attention to temporality, sociality, and place. Thematic coding focused on identifying recurring patterns of struggle, hope, agency, and resistance. Trustworthiness was enhanced through member-checking, reflexive journaling, and triangulation between interview and written data.

RESULT AND DISCUSSION

Table 1 summarizes the demographic characteristics of the 20 female STEM participants across three Egyptian public universities. Participants ranged in age from 18 to 24 years (M = 21.1), with representation from engineering (n = 8), computer science (n = 5), physics (n = 4), and biotechnology (n = 3). The majority were in their third or fourth year of study (n = 15), and most identified as coming from middle-income families (n = 12), while others described either lower-income (n = 6) or upper-middle-class backgrounds (n = 2). All participants had experienced some form of gender-based bias or stereotype in their academic environments, either from peers, faculty, or institutional culture.

Table 1.

Participant Demographics and Academic Background (n = 20)

Variable	Range/Value
Age	18–24 (M = 21.1)
STEM Major	Engineering (8), CS (5), Physics (4), Biotech (3)
Year of Study	Year 1 (2), Year 2 (3), Year 3 (7), Year 4 (8)
Socioeconomic Background	Lower (6), Middle (12), Upper-middle (2)
Reported Gender Bias	100% (all participants)

Thematic analysis of the interviews and written narratives yielded four central themes: navigating exclusionary academic spaces, resistance and resilience, institutional invisibility, and the role of hope and peer solidarity. Participants described environments where subtle and overt gender-based microaggressions were commonplace. Several recounted being underestimated by male peers or dismissed in group projects. Others reported discouragement from faculty who questioned their ability to handle the rigor of STEM fields, with some even advising them to pursue "more suitable" paths. Despite these challenges, most participants expressed a strong sense of purpose and commitment to their academic goals.

Narratives of resistance and resilience revealed that many students developed personal coping strategies to manage both internal and external challenges. These included seeking support from female faculty or forming informal mentorship circles with other women in STEM. Some participants described deliberately outperforming peers to counter negative assumptions, while others emphasized emotional resilience and self-talk as tools to persist. Hope emerged as a narrative motif, often expressed through aspirations for future success, representation, and the desire to serve as role models for younger girls interested in science and engineering.

A recurring concern among participants was the lack of institutional recognition for the unique struggles they faced as women in male-dominated programs. Few universities provided structured support systems or visible gender-equity initiatives within STEM faculties. Students often relied on informal networks or external organizations to access mentorship or guidance. Several narratives indicated a desire for more inclusive classroom practices, awareness training for faculty, and the integration of gender-sensitive policies into academic procedures. The perceived silence of institutions in the face of everyday discrimination was described as both disheartening and motivational, fueling students' determination to succeed.

Inferential patterns emerged between socioeconomic background and the degree of resilience described. Students from lower-income households were more likely to attribute their perseverance to necessity, family sacrifice, and the potential of STEM careers to provide financial stability. These students often expressed a dual burden of class and gender, yet demonstrated high levels of agency. In contrast, students from more privileged backgrounds cited access to private schooling or international exposure as sources of confidence but reported fewer community-based support systems. This suggests that narratives of struggle and hope are shaped by intersecting dimensions of identity beyond gender alone.

The relationship between academic year and reported confidence levels was also notable. Senior students, particularly those in their final year, spoke with greater clarity and assertiveness about their experiences compared to first- and second-year students. This may indicate that persistence in STEM contributes to a strengthened academic identity over time, though early-career students expressed more vulnerability and uncertainty. Peer solidarity was especially crucial for students in earlier stages of their academic journey, with many identifying female friendships as a critical buffer against isolation and self-doubt.

A detailed case narrative from "Salma," a third-year engineering student from Alexandria, exemplifies the struggle-hope dialectic. Initially hesitant to speak up in class due to repeated dismissive responses from male classmates, Salma gradually developed confidence after being mentored by a female lecturer who encouraged her to lead a research project. Her success in the project, and the validation it brought, transformed her self-perception. Salma's story illustrates how individual moments of empowerment can serve as turning points, reinforcing persistence and reshaping internal narratives of capability and belonging.

Another illustrative case, "Mona," a physics student from a rural background, highlighted the compounded challenges of gender, geography, and socioeconomic status. Mona reported being the only woman in several of her core science modules and described feelings of cultural alienation on campus. Despite this, she emphasized the role of her father's unwavering support and her personal conviction to pursue postgraduate education abroad (El Fathi et al., 2025; Lucena et al., 2025; Majid et al., 2025; Norambuena et al., 2025). Mona's narrative revealed a rich interplay between familial hope and institutional exclusion, demonstrating how students locate sources of strength even when formal structures fall short.

Participants frequently described their educational journeys as marked by dual forces-barriers that constrained them and sources of motivation that propelled them forward. These competing dynamics shaped how they narrated their identity as "women in STEM," not merely as a category but as a process of ongoing negotiation. Hope was not framed as passive optimism but as an active orientation toward the future, sustained by relational support, academic achievement, and imagined professional impact. The result is a portrait of persistence, not devoid of struggle, but infused with meaningful efforts to transform hardship into growth.

The overall findings underscore the importance of institutional responsiveness to the lived experiences of female STEM students in Egyptian universities. Their narratives reveal a need for structured mentorship programs, gender-sensitive teaching practices, and the cultivation of academic cultures that validate both competence and identity. The story of struggle and hope is not anecdotal-it is emblematic of broader systemic patterns that must be addressed if higher education is to become a truly equitable space for all learners (Amalina et al., 2025; Yamtinah et al., 2025). These stories are not only testimonies of endurance but blueprints for inclusive transformation.

The findings of this study reveal that female STEM students in Egyptian higher education navigate their academic journeys through a dual narrative of struggle and hope. Participants consistently reported experiences of gender-based marginalization, ranging from subtle forms of exclusion in classroom discussions to overt discouragement from faculty and peers. Despite these challenges, students expressed a strong sense of purpose and agency, fueled by academic aspirations, familial support, and peer solidarity. Their narratives illustrate a complex negotiation of identity, in which academic resilience is cultivated not in the absence of adversity, but in response to it (Chinwong et al., 2025; Fishman et al., 2025; Hajimiri & Soleymani, 2025; Rehman et al., 2025). Students drew upon relational, emotional, and intellectual resources to persist, highlighting how personal conviction and community support interplay in sustaining hope.

This study complements existing research on gender in STEM but offers a distinct contribution by framing these experiences through a narrative inquiry lens rooted in the Egyptian socio-cultural context. Prior studies in Western and global North contexts often focus on institutional climate, gender bias metrics, or access to mentorship. While such studies are critical, they frequently overlook the everyday ethical labor involved in self-positioning within patriarchal academic spaces. In contrast, this research centers the students' voices and positions their lived experiences as primary epistemological sources. It affirms findings from global South feminist research that highlight the role of family, class, and faith in shaping female educational trajectories—dimensions often underemphasized in more universalist analyses of gender and STEM.

The narratives gathered in this study signal a deeper truth about the moral and structural dimensions of STEM education. Students' experiences of being simultaneously marginalized and motivated suggest that inclusion is not simply a matter of presence, but of meaningful participation and affirmation. The stories underscore how institutional silence around gender often leaves students to negotiate academic belonging on their own, resulting in emotional fatigue but also innovation in how resilience is imagined and enacted.

These narratives are not isolated cases of individual perseverance; they are indicative of systemic gaps in institutional care and cultural validation that, if left unaddressed, risk stifling talent and reinforcing inequality.

The implications of these findings are profound for educational policy, institutional leadership, and curriculum design in Egyptian higher education. Policies that focus solely on gender parity in enrollment are insufficient unless they are accompanied by deliberate, context-sensitive interventions that support the psychological, emotional, and academic wellbeing of female students. Faculty development programs should include training on inclusive pedagogical practices, while STEM departments should implement mentorship networks that prioritize relational equity. Institutional structures must shift from passive accommodation to active empowerment, recognizing the narratives of struggle not as exceptional but as normative in the current educational landscape. This reorientation is vital for ensuring that the hope expressed by these students is not only sustained but also institutionally validated.

The persistence of gendered obstacles in these students' narratives can be attributed to a broader cultural and institutional lag in integrating gender equity into the ethos of STEM education. Traditional gender norms, combined with a historically male-dominated scientific culture, continue to shape the assumptions, expectations, and interactions that female students encounter daily. The lack of female representation in faculty roles, limited visibility of success stories, and unspoken codes of academic masculinity contribute to a sense of peripheral belonging. The resilience strategies adopted by students are therefore both a response to exclusion and a quiet form of resistance that challenges the structural status quo from within.

The tension between institutional absence and personal agency highlights the paradox at the heart of many participants' experiences. Students were often driven by a sense of moral responsibility-not only to themselves but to their families and communities-to succeed despite the barriers. In this sense, academic perseverance became a form of gendered labor, deeply embedded in cultural narratives of transformation and mobility. These motivations, though empowering, also carry the weight of expectation, which can increase psychological pressure in environments where structural support is lacking. The hope that sustains these students, while powerful, often exists in contrast to institutional indifference.

The relational ecosystems that female STEM students construct-comprising peers, family members, and occasional mentors-serve as counterstructures to the institutional deficits they face. These informal support systems provide emotional sustenance, validation, and practical guidance, enabling students to reframe challenges as surmountable. The emotional vocabulary used by participants-resilience, pride, and purpose-reflects an ethics of care that operates beneath formal academic systems. This dimension is rarely acknowledged in policy discourse but is central to the lived realities of inclusion. Recognizing and integrating these emotional infrastructures into formal institutional planning can serve as a transformative step toward gender-responsive STEM education.

The next stage in addressing gender equity in STEM must involve translating these insights into actionable institutional commitments. Egyptian universities should develop gender-sensitive support structures that respond to the multifaceted realities of female students, including mentorship initiatives, inclusive learning environments, and policy reforms that address both cultural and academic barriers. Further research should examine longitudinal impacts of such interventions on student persistence, identity development, and career trajectories. Comparative studies across disciplines and universities could deepen understanding of how institutional culture mediates gendered experiences. By grounding reform in students' own narratives, higher education can begin to build not only inclusive policies but inclusive cultures that truly honor the stories of struggle and hope that shape the future of science and society.

CONCLUSION

This study reveals that female STEM students in Egyptian higher education experience a dual narrative of systemic struggle and emergent hope. Through narrative inquiry, we uncovered how these students negotiate exclusionary environments with resilience strategies rooted in relational support, emotional intelligence, and personal conviction. This combination of struggle and aspiration underscores that inclusion in STEM is not merely about access, but about recognition, belonging, and the affirmation of identity within academic cultures historically shaped by patriarchal norms. What differentiates this finding is the depth with which students articulate their sense of moral and intellectual commitment to succeed not just for themselves, but as representatives of change in their families and communities.

The principal contribution of this research lies in its methodological and conceptual approach, which uses narrative inquiry to surface the lived realities of women often excluded from traditional academic discourse on STEM education. By foregrounding personal stories and subjective meaning-making, the study shifts the analytical lens from policy compliance to cultural and emotional dimensions of inclusion. This framework not only reveals the limitations of metrics-based evaluations of gender equity but also offers a replicable model for integrating student voice into research, policy design, and institutional reform. The thematic focus on hope, identity, and emotional labor enriches the literature on women in STEM by offering a grounded, culturally embedded account of persistence.

The study is limited by its sample size and institutional scope, as it focuses on students from three Egyptian universities without encompassing the full spectrum of STEM disciplines or geographic diversity across the country. The reliance on self-reported narratives, while offering deep insight, also introduces subjectivity and potential selection bias. Future research should expand the sample to include a wider range of institutions, explore longitudinal trajectories of female STEM students from entry to graduation and employment, and examine faculty perspectives to contextualize institutional roles in shaping inclusive or exclusive academic environments. Mixed-methods approaches combining narrative with ethnographic observation or quantitative tracking could further illuminate the systemic patterns underlying women's experiences in STEM across the Egyptian higher education landscape.

Methodologically, the research advances the use of narrative inquiry to capture gendered academic identities in the Global South. Conceptually, it reframes women's presence in STEM not as anomaly but as moral labor and cultural transformation.

Limitations include sample size and single-country focus. Future research should include longitudinal narrative tracking and cross-institutional comparisons.

We recommend that Egyptian universities implement formal mentorship programs, integrate gender-sensitivity training into STEM pedagogy, and establish safe spaces for female students to articulate their lived experiences as part of institutional development.

AUTHORS' CONTRIBUTION

Tamer Youssef: Conceptualization; Project administration; Validation; Writing - review and editing; Conceptualization; Data curation; In-vestigation.

Dina Ahmed: Data curation; Investigation; Formal analysis; Methodology; Writing - original draft.

Yasser Sayed: Supervision; Validation; Other contribution; Resources; Visuali-zation; Writing - original draft.

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