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Women's Technology Empowerment Centre

BRIDGING THE STEM DIVIDE:

18 YEARS OF IMPACT, INSIGHTS AND STAKEHOLDER ACTION FOR GENDER EQUITY IN NIGERIA (2008–2026)

TRACING PROGRESS, NARRATIVES AND FUTURE DIRECTIONS IN STEM INCLUSION

BRIDGING THE STEM DIVIDE: 18 YEARS OF IMPACT, INSIGHTS AND STAKEHOLDER ACTION FOR GENDER EQUITY IN NIGERIA (2008–2026)

Tracing Progress, Narratives and Future Directions in STEM Inclusion

Author: Monsurat Oshinfisan ***(MER Officer)***

ABSTRACT

This conceptual journal examines the evolving landscape of gender equity in Science, Technology, Engineering and Mathematics in Nigeria between 2008 and 2026 through the lens of communication, education, policy and stakeholder engagement. It explores how advocacy efforts, institutional reforms, media representation, digital innovation and community-based interventions have influenced participation and visibility for girls and women across STEM spaces. The journal reflects on shifts in public narratives surrounding science and technology, highlighting the growing role of communication in shaping awareness, aspiration and inclusion. It also documents the contributions of government institutions, educational organisations, civil society groups, development partners, private-sector actors, and technology communities in advancing access to STEM learning and innovation opportunities. While notable progress has been made through digital literacy programmes, mentorship initiatives and policy reforms, persistent barriers linked to infrastructure, social stereotypes, uneven regional access and weak implementation continue to affect long-term participation. Drawing on research evidence, policy frameworks, and communication perspectives, the journal identifies lessons learned and emerging priorities related to inclusive innovation, youth engagement, and future workforce development. Ultimately, the publication presents gender equity in STEM as both a development priority and a collective social responsibility requiring sustained collaboration, inclusive communication and long-term institutional commitment.

Keywords: Gender equity, STEM education, digital inclusion, science communication, women in STEM, Nigeria

INTRODUCTION

Over the past eighteen years, gender inclusion in Science, Technology, Engineering and Mathematics (STEM) has gained increasing attention in Nigeria's education, development and policy conversations. The demand for digital skills, scientific innovation and technological advancement has expanded rapidly, yet women and girls continue to face unequal access to opportunities within many STEM fields. Reports from UNESCO (2017) and the World Bank (2020) show that structural barriers, social expectations and unequal access to resources continue to shape participation patterns globally and within developing countries.

This conceptual journal examines the changing landscape of gender equity in STEM in Nigeria between 2008 and 2026. It documents major developments, policy shifts, advocacy efforts and public conversations that have influenced access, participation and visibility for girls and women across STEM education and related industries. Beyond statistics and institutional reports, the journal also reflects on the social narratives that shape how science and technology are understood within families, schools, workplaces and media spaces.

The journal adopts a communication perspective by exploring how public messaging, media representation, storytelling and advocacy campaigns influence attitudes towards women in STEM. Public perceptions often determine who feels welcomed, valued or excluded within science and technology spaces. As Steinke (2017) argues, media images and cultural narratives play a significant role in shaping STEM identity formation among young girls. In Nigeria, these perceptions are further shaped by economic realities, regional inequalities and cultural expectations surrounding gender roles.

Over the years, several organisations have contributed to changing these narratives through advocacy, mentorship and digital empowerment initiatives. One notable example is the Women's Technology Empowerment Centre (W.TEC), a Nigerian non-profit organisation established to encourage girls and women to engage confidently with technology and digital innovation. Through initiatives such as *She Creates Camp*, technology literacy programmes and community-based digital skills training, W.TEC has supported thousands of girls and young women across Nigeria by improving access to coding, digital safety education, technology leadership and mentorship opportunities (Women's Technology Empowerment Centre, 2024). The organisation's work reflects the growing recognition that digital inclusion

is not only about access to technology, but also about confidence, representation and long-term participation within innovation spaces.

This publication, therefore, seeks to provide a concise but grounded reflection on progress made between 2008 and 2026 while identifying areas where action remains limited. It highlights the contributions of government institutions, international development agencies, schools, civil society organisations, media practitioners, professional associations and technology communities that have worked to improve gender inclusion across the STEM ecosystem.

Focus

The journal focuses on documenting shifts in gender inclusion within STEM across education, policy, communication and workforce participation. Since 2008, Nigeria has witnessed growing investment in digital education, innovation hubs, coding initiatives and technology-driven entrepreneurship. Government policies such as the National Policy on Gender in Education and the National Digital Literacy Framework have also increased attention on inclusive learning and skills development (Federal Ministry of Education, 2021; National Information Technology Development Agency, 2023).

Particular attention is given to how communication shapes public understanding of STEM careers. Research shows that stereotypes about science and technology continue to discourage many girls from pursuing technical disciplines (Cheryan et al., 2017). Media visibility and representation, therefore, matter. Campaigns highlighting female scientists, engineers and innovators have helped challenge assumptions about who belongs in STEM. Social media campaigns, online storytelling and digital advocacy platforms have also created new spaces where girls can encounter relatable role models and alternative narratives around science and technology careers.

The journal also examines stakeholder contributions across sectors. International agencies such as UNICEF, UNESCO, UN Women and the World Bank have supported initiatives focused on girls' education, digital inclusion and STEM participation. At the national level, organisations such as W.TEC, the Association of Professional Women Engineers of Nigeria (APWEN), and various state education programmes have created mentorship opportunities, advocacy campaigns, and digital learning interventions aimed at improving participation by girls and young women. W.TEC's annual reports further highlight efforts around technology training, safe digital participation, coding education and gender-responsive digital literacy

initiatives designed to support girls from underserved communities (Women's Technology Empowerment Centre, 2024).

Regional differences remain an important part of the discussion. While urban centres continue to benefit from expanding digital opportunities, many rural communities still face barriers linked to poverty, insecurity, limited infrastructure and unequal access to quality science education. Understanding these differences is necessary for building more inclusive and realistic interventions.

Objectives

The main objective is to examine the progress, challenges and stakeholder contributions shaping gender equity in STEM in Nigeria between 2008 and 2026 through the lens of education, communication, advocacy and inclusion.

The specific objectives include:

1. To document key policies, programmes and interventions that have influenced girls' and women's participation in STEM across Nigeria.
2. To explore how communication, media representation and advocacy efforts have shaped public attitudes towards gender inclusion in STEM fields.
3. To identify emerging gaps, lessons and opportunities for strengthening collaboration, access and long-term participation for women and girls in STEM.

HISTORICAL AND SOCIAL CONTEXT

STEM in Nigeria

The growth of STEM education in Nigeria has been closely connected to the country's broader economic and technological ambitions. Since the late 2000s, there has been increased emphasis on science, technology and innovation as drivers of national development, digital transformation and employment creation. The expansion of telecommunications, financial technology and digital entrepreneurship has further increased demand for STEM-related skills.

Government reforms and policy frameworks have contributed to this shift. The Federal Ministry of Education introduced strategic plans to improve science education and digital learning, while the National Science, Technology and Innovation Policy strengthened the focus on research and innovation (Federal Ministry of Science, Technology and Innovation, 2022). In addition, the rapid growth of Nigeria's technology sector has created new pathways into software development, digital communication, robotics and data-driven careers.

Despite this progress, educational inequality remains a significant challenge. Many schools still lack adequate science laboratories, qualified teachers and digital infrastructure. Regional disparities also continue to affect access to quality STEM education, particularly in parts of Northern Nigeria where poverty and insecurity have disrupted school participation. UNICEF Nigeria (2023) reports that girls in several underserved communities continue to face lower educational access compared to boys.

Gender Dimensions

Gender disparities in STEM are rooted in historical and social patterns that have long influenced educational and career opportunities. For decades, the fields of science and technology were largely viewed as male domains, while girls were often encouraged to pursue subjects considered socially suitable for women. These perceptions shaped classroom experiences, confidence levels and career aspirations from an early age.

Research consistently shows that stereotypes and social expectations continue to influence participation in STEM disciplines (Ellemers, 2018). In Nigeria, economic pressures, early marriage, caregiving responsibilities and unequal access to resources have further contributed to gender disparities in education and employment.

Although participation has improved over time, women remain underrepresented in fields such as engineering, information technology and advanced scientific research. However, the period between 2008 and 2026 has also witnessed visible progress. More girls are participating in coding programmes, science competitions and mentorship initiatives. Organisations such as W.TEC and the African Girls Can Code Initiative have contributed to increasing visibility and digital access for girls and young women.

Public conversations around gender inclusion have also become more visible within media and policy spaces. Discussions about representation, equal opportunity and digital access are no longer confined to academic or advocacy circles alone. This shift reflects growing awareness that gender equity in STEM is linked to broader national development goals.

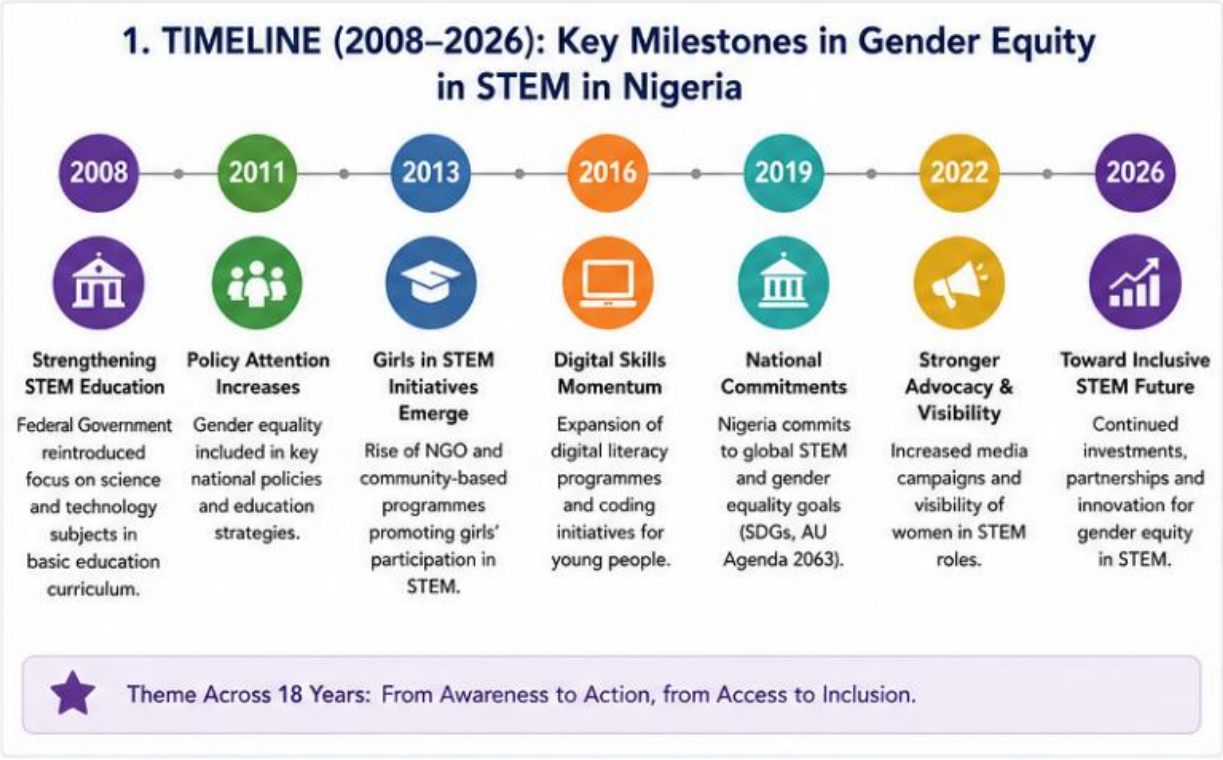
Communication Context

Communication remains central to understanding how public attitudes towards STEM are formed and sustained. Media representation influences how society imagines scientists, innovators and technology professionals. For many years, portrayals of STEM experts in films, news reports and educational materials were dominated by men, reinforcing stereotypes that science and technology were unsuitable for women.

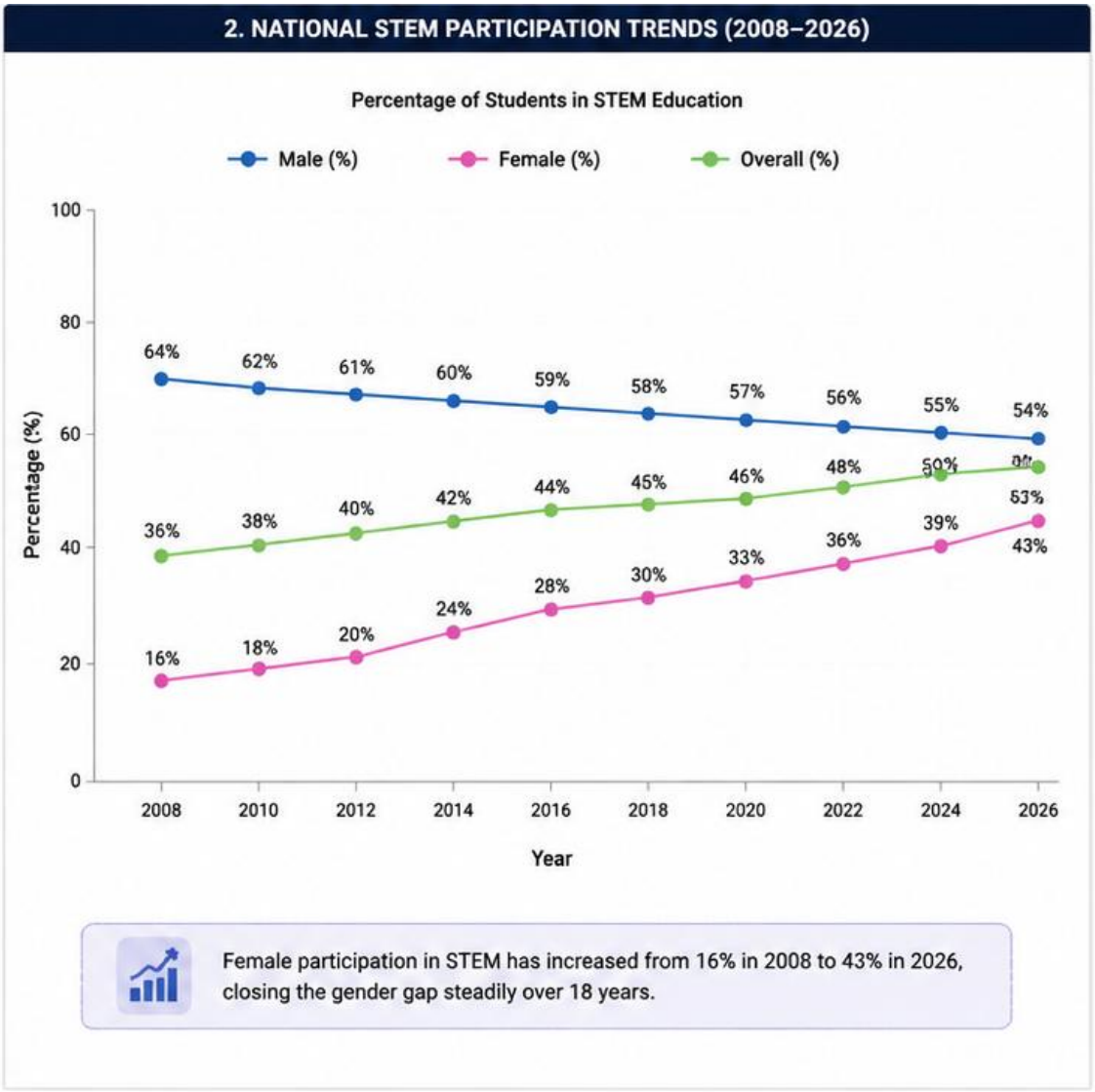
Studies on media representation suggest that visibility and storytelling strongly influence young people's career aspirations (Archer et al., 2013; Steinke et al., 2024). In Nigeria, digital platforms have increasingly created opportunities for women in STEM to share experiences, build communities and challenge stereotypes. Social media campaigns, mentorship webinars, documentaries and online storytelling have helped make female role models more visible to younger audiences.

At the same time, communication challenges remain. Gender stereotypes continue to appear in classrooms, workplaces and media narratives. Women in technical professions are still sometimes portrayed as exceptions rather than part of the norm. Addressing these patterns requires more inclusive communication strategies that present STEM careers as accessible and achievable for everyone.

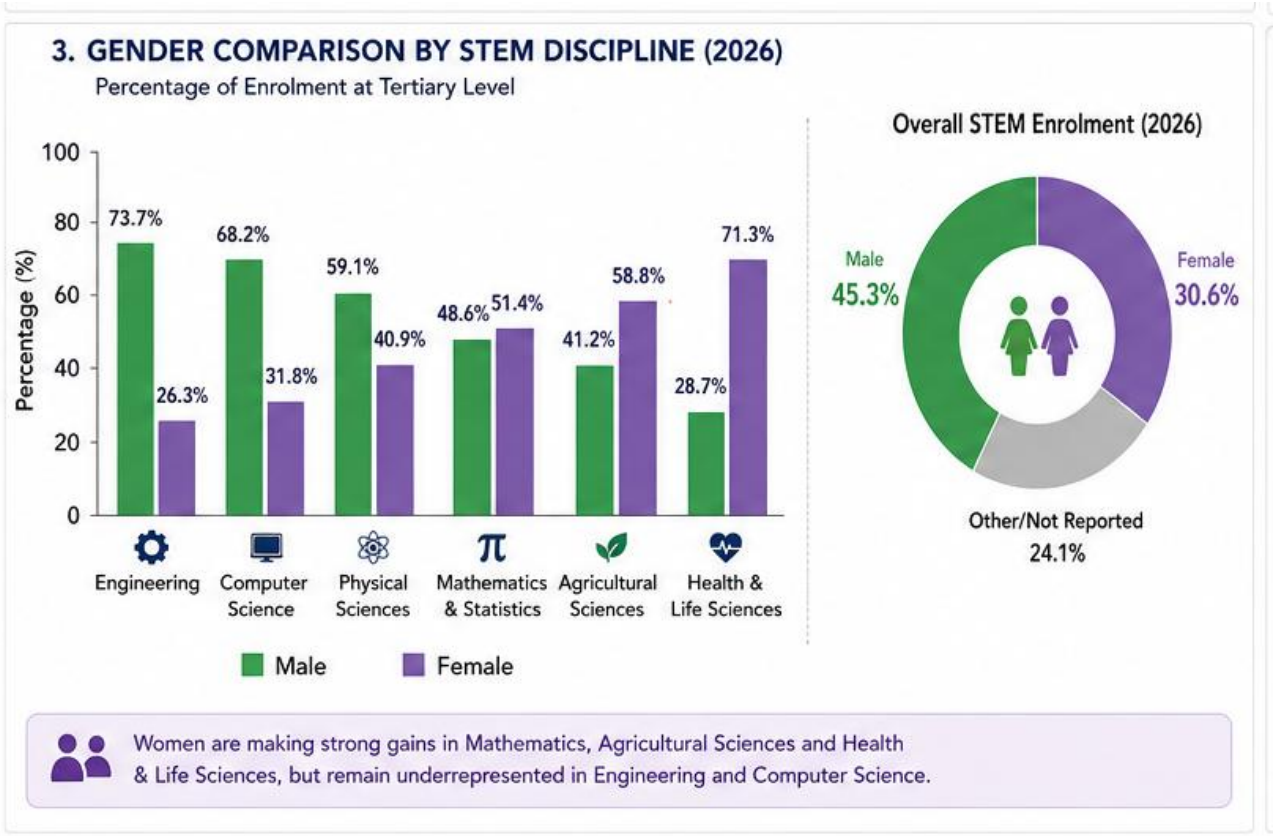
VISUALS



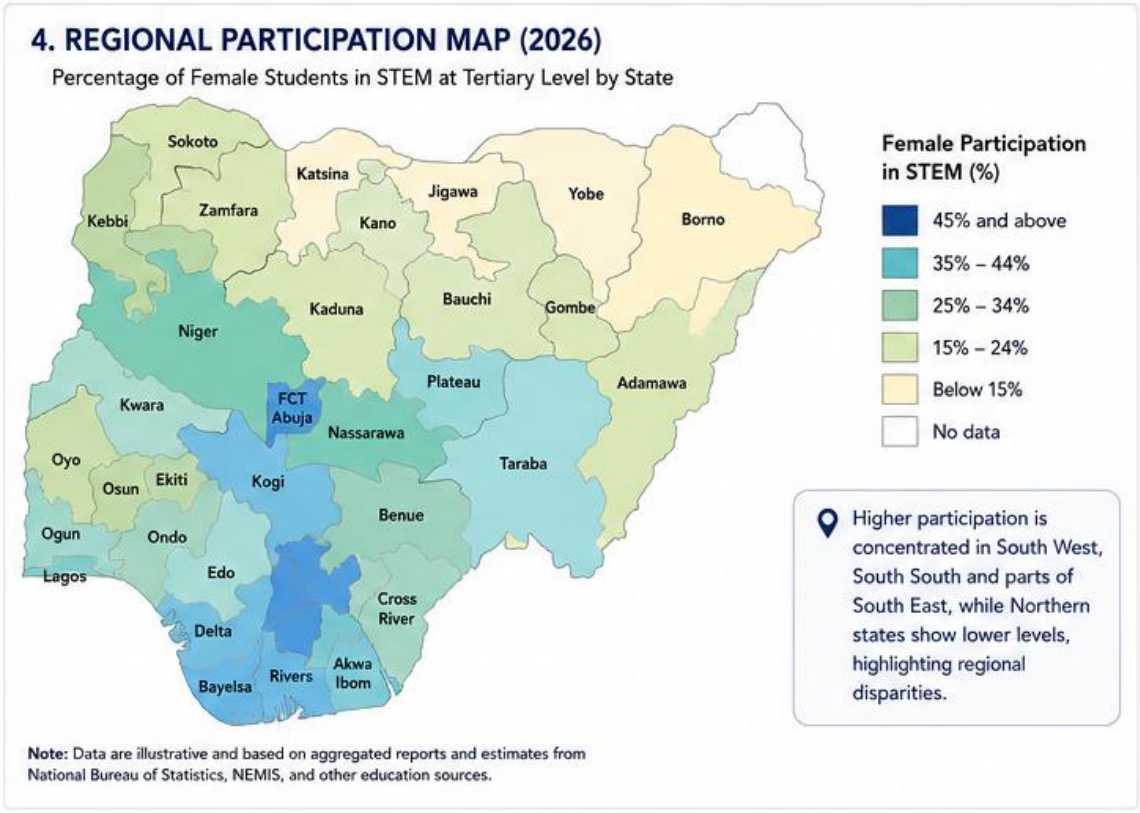
Source: Author's conceptual illustration developed from Federal Ministry of Education policy documents, UNESCO STEM reports, NITDA digital literacy frameworks, and W.TEC advocacy records (2008–2026).



Source: Author's visualisation based on aggregated data from NEMIS, National Universities Commission reports, UNESCO Institute for Statistics, World Bank gender data and related STEM participation studies.



Source: Author's chart developed from tertiary education participation estimates drawn from National Universities Commission statistics, UNESCO STEM reports and Nigerian STEM education studies.



Source: Author's map based on compiled estimates from the National Bureau of Statistics, NEMIS, UNICEF education reports and regional STEM participation assessments.

EVOLUTION OF GENDER EQUITY IN STEM

CHANGING LANDSCAPES

Over the past eighteen years, the conversation around gender equity in STEM in Nigeria has moved from limited advocacy efforts to broader national engagement involving education, technology, policy and innovation ecosystems. While structural inequalities remain visible, the period between 2008 and 2026 reflects gradual but important shifts in participation, representation and public awareness.

Education

One of the most noticeable changes has been the increased enrolment of girls in STEM-related subjects across different levels of education. Government reforms, donor-supported programmes and community advocacy efforts contributed to wider access to science and technology education, particularly for girls in underserved regions. Policies such as the *National Policy on Gender in Education* and interventions supported by UNICEF and the World Bank encouraged stronger attention to inclusive learning and retention strategies (Federal Ministry of Education, 2021; UNICEF Nigeria, 2023).

The expansion of STEM-focused programmes also played a significant role. Science clubs, coding camps, robotics competitions and mentorship initiatives became more common within schools and youth organisations. Groups such as the Women's Technology Empowerment Centre (W.TEC), APWEN and other civil society organisations introduced digital literacy programmes designed to improve confidence and participation among girls and young women in technology spaces (Women's Technology Empowerment Centre, 2024).

Digital learning further changed access to STEM education. The growth of mobile technology, online training platforms and virtual learning environments created opportunities beyond the traditional classroom. During and after the COVID-19 period, digital education became more visible within policy and public discussions, although unequal internet access and infrastructure limitations continued to affect many communities. UNICEF (2022) noted that digital learning initiatives improved educational continuity for girls, but also exposed existing inequalities linked to affordability, connectivity and device access.

Technology and Innovation

Nigeria's expanding technology ecosystem influenced public interest in STEM careers, especially among young people. Between 2013 and 2026, technology hubs, start-up communities and digital entrepreneurship networks grew rapidly in cities such as Lagos, Abuja and Port Harcourt. This expansion increased the visibility of women participating in innovation spaces that were previously dominated by men.

Women-led technology initiatives and digital advocacy campaigns also contributed to changing public perceptions. Female software developers, engineers, data analysts and digital entrepreneurs became more visible through conferences, media platforms and online communities. Campaigns promoting women in coding, artificial intelligence and digital entrepreneurship challenged long-standing stereotypes about who belongs in technology spaces.

The broader digital transformation of Nigeria's economy created new opportunities for participation. Programmes linked to digital literacy, financial technology and innovation training exposed more girls and young women to STEM pathways connected to employment and entrepreneurship. According to the National Information Technology Development Agency (2023), digital inclusion remains central to Nigeria's long-term economic and workforce development strategy.

Leadership

The period under review also witnessed the emergence of more female STEM leaders across academia, research, policy and industry. Women increasingly occupied visible positions within universities, innovation hubs, engineering associations and development organisations. Although representation remains uneven, there has been a gradual improvement in the visibility of women within research and leadership spaces.

Public communication played an important role in this transition. Media interviews, digital campaigns and professional networking platforms helped amplify the voices of female scientists, educators and innovators. Research suggests that visibility and representation contribute significantly to STEM identity formation and career aspiration among young girls (Steinke, 2017). Increased representation, therefore, became both symbolic and practical,

offering younger generations more relatable role models within the science and technology sectors.

At the policy level, conversations about gender also became more prominent. Discussions around digital inclusion, innovation, education reform and workforce participation increasingly acknowledged the importance of women's representation in STEM-related decision-making processes.

KEY PHASES (2008–2026)

Phase 1: Awareness and Access (2008–2012)

The early years of this period focused largely on awareness creation and basic access. Advocacy campaigns during this phase concentrated on encouraging girls to remain in school and participate in science subjects. Community mobilisation efforts by schools, non-governmental organisations and development partners sought to challenge cultural assumptions that limited girls' participation in technical fields.

Initial interventions were often small-scale and community-based, with emphasis placed on awareness rather than long-term systems change. Public conversations around gender equity in STEM were still emerging, and visibility for women in science and technology remained limited within mainstream media and public discourse.

Phase 2: Expansion and Participation (2013–2017)

Between 2013 and 2017, participation-focused initiatives expanded significantly. STEM clubs, coding competitions, mentorship programmes and scholarship opportunities became more visible across secondary and tertiary institutions. Technology organisations and development agencies increased investment in girls' digital learning and innovation programmes.

Media visibility also improved during this period. Social media platforms created new opportunities for storytelling and public engagement around women in STEM. Campaigns featuring female engineers, developers and innovators helped challenge stereotypes and broaden public conversations about gender and science careers.

The period also witnessed stronger engagement from organisations such as W.TEC and APWEN, which introduced practical technology training and mentorship opportunities for girls and young women.

Phase 3: Advocacy and Systems Engagement (2018–2022)

This phase reflected stronger policy engagement and institutional collaboration. Gender inclusion in STEM became more connected to national development discussions, digital economy planning and workforce readiness strategies. Public and private sector actors increasingly recognised that inclusive STEM participation was linked to economic growth and innovation.

Research-driven interventions became more common during this period. Reports from UNESCO, UNICEF, the World Bank, and local education agencies provided stronger evidence of participation gaps, digital inequality, and barriers affecting girls' access to STEM education (UNESCO, 2021; World Bank, 2020).

Public-private collaborations also expanded. Technology companies, educational institutions and development organisations partnered on digital skills training, innovation competitions and STEM outreach programmes aimed at increasing female participation.

Phase 4: Innovation and Future Readiness (2023–2026)

The most recent phase has been shaped by conversations around artificial intelligence, digital transformation and future workforce readiness. Emerging technologies created renewed urgency around digital skills and inclusive innovation ecosystems.

Girls' participation in coding, robotics, artificial intelligence and entrepreneurship programmes increased through both formal and informal learning platforms. Digital advocacy efforts also became more sophisticated, with greater use of social media storytelling, online mentorship and community-driven campaigns.

At the same time, discussions around inclusion became more intersectional. Stakeholders increasingly acknowledged that gender disparities in STEM are influenced by geography, disability, economic inequality and digital access. As Nigeria continues to position itself within the global digital economy, inclusive participation remains central to long-term innovation and development goals.

COMMUNICATION, MEDIA AND PUBLIC NARRATIVES

THE ROLE OF COMMUNICATION

Communication has remained central to conversations around gender equity in Science, Technology, Engineering and Mathematics in Nigeria. Between 2008 and 2026, awareness efforts expanded from small educational campaigns to broader public discussions connected to digital inclusion, innovation, employability and national development. While policy reforms and institutional programmes contributed to increased participation, communication shaped how STEM itself was understood, who was represented within those spaces and how girls imagined their future possibilities.

Public Awareness

Public awareness campaigns helped reposition STEM as a social development issue rather than a specialised academic field reserved for a select group of learners. Government agencies, development organisations and advocacy groups increasingly link participation in science and technology to economic growth, digital transformation and workforce inclusion. UNESCO (2017) noted that unequal participation of girls and women in STEM limits innovation capacity and broader development outcomes across countries.

In Nigeria, awareness campaigns also sought to improve public understanding of gender disparities in education and technology. In many communities, science and technical careers were traditionally associated with men, while girls were often encouraged towards professions considered socially safer or more acceptable. Advocacy messages, therefore, focused on challenging assumptions surrounding intelligence, technical competence and leadership.

Organisations such as the Women's Technology Empowerment Centre (W.TEC), APWEN, and UNICEF-supported education initiatives introduced school outreach programmes, coding camps, and digital literacy workshops to improve access to and confidence in STEM spaces for girls. W.TEC's technology camps and digital skills programmes exposed girls to coding, online safety, robotics and leadership opportunities, particularly within underserved communities (Women's Technology Empowerment Centre, 2024).

Narrative Framing

The framing of women's participation in science and technology changed significantly during the eighteen-year period covered by this journal. Earlier media narratives often portrayed women in STEM as exceptions rather than contributors within mainstream innovation spaces. Over time, advocacy organisations and digital communities worked to normalise women's presence in science, engineering and technology-related careers.

Research by Cheryan et al. (2017) shows that stereotypes surrounding STEM careers continue to influence participation and belonging. Girls are less likely to pursue technical disciplines when science is framed as masculine, socially isolated or incompatible with communal values. Communication strategies, therefore, increasingly emphasised collaboration, creativity, social impact and leadership rather than technical exclusivity alone.

Aspirational storytelling became one of the most visible communication approaches between 2015 and 2026. Media campaigns, digital interviews and mentorship platforms increasingly highlighted stories of female scientists, software developers, engineers and innovators whose experiences reflected resilience, achievement and social contribution. These narratives helped create more relatable role models for younger audiences.

Social media further strengthened this shift. Platforms such as Instagram, TikTok and YouTube enabled women in STEM to share their experiences directly with wider audiences. Steinke et al. (2024) found that digital platforms have become important spaces for identity expression and visibility among women in science and technology.

Behaviour Change Communication

Communication efforts also focused on changing attitudes within families, schools and communities. In many parts of Nigeria, educational and career decisions remain strongly influenced by parents, teachers and social expectations. Girls interested in science and technology frequently encounter subtle discouragement linked to cultural perceptions about gender roles and technical competence.

Behaviour change communication strategies, therefore, targeted not only students, but also parents, educators and community leaders. Mentorship programmes, school campaigns and community dialogues encouraged families to support girls pursuing STEM-related careers. Archer et al. (2013) argue that family environments and social perceptions significantly shape science aspirations among children and adolescents.

Digital communities also contributed to confidence-building and belonging. Online mentorship groups, virtual coding sessions and women-led technology networks created supportive environments where girls could interact with role models and access opportunities outside their immediate communities.

Campaign Timeline

Year	Communication Milestone
2008–2012	Early STEM awareness campaigns focused on girls' education and science participation
2013–2017	Expansion of STEM clubs, coding initiatives and mentorship storytelling
2018–2020	Increased digital advocacy and public conversations around gender inclusion
2020–2022	Rise of online STEM learning and virtual mentorship during COVID-19
2023–2026	Increased focus on AI, digital skills and women-led innovation storytelling

MEDIA REPRESENTATION

Traditional Media

Traditional media platforms played a significant role in increasing public awareness around women in STEM, although representation remained inconsistent. Radio and television campaigns frequently focused on girls' education, digital literacy and youth empowerment, especially during national advocacy events and international observances such as the International Day of Women and Girls in Science.

Print journalism also contributed through feature stories, interviews, and public-interest reporting on female scientists, innovators, and entrepreneurs. Newspapers increasingly covered stories linked to digital transformation and technology-driven development, helping broaden public understanding of women's contributions to innovation.

However, representation was often event-based rather than sustained. Women in STEM were sometimes featured symbolically in campaigns, yet remained less visible in mainstream technology and policy reporting throughout the year.

Digital Media

Digital media transformed communication about STEM participation more rapidly than traditional platforms did. Social media advocacy campaigns created accessible spaces for storytelling, mentorship and peer engagement, particularly among younger audiences. Hashtag campaigns connected to coding, innovation and women in technology have helped amplify visibility and participation.

Online communities became important spaces for informal learning and support. Through webinars, virtual boot camps, and digital campaigns, girls from different regions gained access to mentorship opportunities previously unavailable through traditional educational structures.

Digital storytelling also allowed women in STEM to present their experiences in their own voices rather than through institutional framing. Campaigns featuring Nigerian women in coding, artificial intelligence, engineering and entrepreneurship challenged stereotypes while promoting more diverse images of leadership and expertise.

Representation Issues

Despite increased visibility, important representation gaps remain. Women continue to be underrepresented in many technical discussions, leadership panels and mainstream innovation reporting. Visibility gaps affect how girls perceive expertise, leadership and belonging within STEM spaces.

Tokenism remains another challenge. Some campaigns and institutions showcase women symbolically without addressing deeper inequalities linked to access, leadership representation or workplace inclusion. Corsbie-Massay and Wheatly (2022) note that media professionals continue to shape whether stereotypes surrounding women in STEM are reinforced or disrupted.

Gender bias also appears subtly in media narratives. Men are more frequently associated with innovation, expertise, and technical authority, while women are often framed in terms of emotional resilience or inspirational storytelling. These differences influence public perceptions of competence and leadership.

Communication Analysis

Communication campaigns targeting STEM inclusion increasingly adopted audience-focused strategies between 2018 and 2026. Secondary school girls were often targeted with

confidence-building and aspirational messaging, while parents and educators were approached with narratives connected to employability, education, and national development.

Messaging strategies that used relatable storytelling, mentorship and community impact generally produced stronger engagement than campaigns relying solely on policy language or statistics. Interactive communication formats such as social media storytelling, webinars, and online mentorship also led to higher participation among younger audiences.

Communication outcomes over the years included increased visibility for women in STEM, stronger public engagement with digital learning initiatives and broader conversations around inclusion and representation. However, long-term change still depends on sustained representation, accessible opportunities and institutional support beyond awareness campaigns alone.

Media Snapshot

- W.TEC digital literacy campaigns reached thousands of girls and women through coding camps, technology workshops and online mentorship initiatives between 2020 and 2024 (Women's Technology Empowerment Centre, 2024).
- UNICEF-supported digital learning campaigns recorded increased online engagement during post-pandemic education interventions focused on girls' participation and digital access (UNICEF, 2022).
- UNESCO's *Cracking the Code* campaign became one of the most referenced global advocacy initiatives focused on girls' participation in STEM education (UNESCO, 2017).

Social Media Metrics

- UNESCO's STEM advocacy campaigns under *Cracking the Code* generated global digital engagement across educational and policy networks during annual International Day of Women and Girls in Science activities (UNESCO, 2017).
- W.TEC reported continued growth in participation across its digital learning and mentorship programmes through community-based technology initiatives and online engagement platforms between 2020 and 2024 (Women's Technology Empowerment Centre, 2024).

- UNICEF digital education campaigns expanded online visibility around girls' access to technology and STEM-focused learning during COVID-19 recovery interventions (UNICEF, 2022).

STAKEHOLDER PERSPECTIVES AND ACTION

MULTI-STAKEHOLDER CONTRIBUTIONS

Efforts to improve gender equity in Science, Technology, Engineering and Mathematics in Nigeria between 2008 and 2026 were shaped by the combined actions of multiple stakeholders across education, government, civil society, industry and local communities. Progress within STEM inclusion did not emerge from a single institution or policy direction. Instead, it developed through partnerships, advocacy efforts, mentorship initiatives and public engagement activities that gradually expanded opportunities for girls and women.

Education Sector

Schools and universities remained central to efforts to increase girls' participation in STEM. Over the past 18 years, educational institutions have introduced science clubs, coding programmes, robotics competitions, and digital learning initiatives to encourage participation beyond traditional classroom instruction. Universities also expanded opportunities in engineering, computing, and applied sciences, although gender disparities persisted in several technical disciplines.

Teachers and mentors played a particularly important role in shaping confidence and aspiration among girls interested in STEM. Research shows that early encouragement and positive classroom experiences strongly influence long-term participation in science-related careers (Archer et al., 2013). Female educators, researchers and mentors became increasingly visible through outreach programmes and mentorship networks that connected students with role models working within STEM professions.

Curriculum reforms also contributed to changing educational experiences. The Nigerian Educational Research and Development Council introduced revisions to the Basic Science and Technology curricula to improve science engagement and practical learning approaches (Nigerian Educational Research and Development Council, 2012). At the policy level, the *National Policy on Gender in Education* further emphasised inclusive learning and equal access for girls within educational systems (Federal Ministry of Education, 2021).

Government and Policy Actors

Government institutions played a major role in establishing policy frameworks linked to education reform, digital literacy and innovation development. Between 2008 and 2026,

national conversations around technology, skills development and digital transformation increasingly recognised the importance of women's participation in STEM-related sectors.

Policies such as the *National Digital Literacy Framework* and the *National Science, Technology and Innovation Policy* reflected growing institutional interest in workforce readiness, digital inclusion and innovation-led development (National Information Technology Development Agency, 2023; Federal Ministry of Science, Technology and Innovation, 2022).

Government-supported programmes also contributed to increased awareness around girls' education and STEM participation, particularly in underserved regions. Partnerships with development agencies and state governments expanded scholarship schemes, digital training opportunities and girls' education interventions across different parts of Nigeria.

At the same time, policy implementation remained uneven. Infrastructure limitations, funding gaps and regional disparities continued to affect access to quality science education and digital learning opportunities, especially within rural communities.

Civil Society and Advocacy Groups

Civil society organisations and advocacy groups played a visible role in advancing conversations around gender inclusion in STEM. Their contributions often extended beyond awareness campaigns to include mentorship, digital literacy, scholarship support and community engagement.

Organisations such as the Women's Technology Empowerment Centre (W.TEC), APWEN and FAWE created programmes aimed at increasing confidence and participation among girls and young women. W.TEC's technology camps, coding workshops and online safety programmes introduced thousands of girls to digital learning opportunities and leadership development initiatives (Women's Technology Empowerment Centre, 2024).

Advocacy groups also influenced public dialogue by challenging stereotypes surrounding women in science and technology. Through storytelling, media campaigns and mentorship activities, these organisations helped create more visible and relatable representations of women working within STEM-related fields.

Scholarship and mentorship initiatives became particularly important for girls from underserved communities who faced financial and social barriers to participation.

Community-based programmes often combine academic support with confidence-building and career guidance.

Private Sector and Industry

The private sector has increasingly become an important stakeholder in Nigeria's evolving STEM ecosystem. Technology companies, innovation hubs and start-up communities expanded rapidly during the period under review, creating new pathways for skills development and employment.

Innovation hubs and digital entrepreneurship programmes exposed young women to coding, artificial intelligence, software development and technology-driven business opportunities. Several organisations also introduced internship pipelines, mentorship opportunities and digital boot camps to improve female participation in technical industries.

Industry involvement became more visible through public-private partnerships linked to digital literacy, innovation competitions and workforce development programmes. These collaborations reflected growing recognition that inclusive participation strengthens innovation ecosystems and expands economic opportunity.

Communities and Families

Families and local communities remained influential in shaping educational and career decisions for girls. In many parts of Nigeria, parental expectations and cultural attitudes continue to shape perceptions of science and technology careers. Girls interested in technical fields sometimes encounter discouragement linked to stereotypes about gender roles and professional suitability.

Community mobilisation efforts, therefore, became essential to improving participation. Religious leaders, traditional leaders, educators and local organisations often contributed to awareness campaigns focused on girls' education and STEM inclusion.

Parental support also emerged as a strong predictor of confidence and persistence within science education pathways. Advocacy initiatives increasingly recognise that sustainable progress requires changing attitudes not only within schools, but also within homes and communities.

COLLABORATIVE IMPACT

Partnership Models

One of the strongest features of gender equity initiatives between 2008 and 2026 was the growth of partnership-driven approaches. Government agencies, educational institutions, civil society organisations, development partners and private sector actors increasingly worked together to address participation gaps and digital inequality.

Collaborative models often combined resources, expertise and communication networks to improve reach and sustainability. For example, partnerships between schools, technology organisations and development agencies supported coding camps, innovation challenges and digital learning programmes for girls across multiple regions.

Cross-Sector Collaboration

Cross-sector collaboration became increasingly important as STEM inclusion was recognised as both an educational and economic issue. Education stakeholders alone could not address barriers linked to digital access, mentorship, infrastructure and employment opportunities.

Technology companies partnered with advocacy groups to support innovation training and internship opportunities, while development organisations worked with government agencies to strengthen policy implementation and girls' education programmes. UNICEF, UNESCO and the World Bank also supported initiatives focused on digital inclusion and gender-responsive education systems (UNICEF Nigeria, 2023; World Bank, 2020).

Shared Accountability

Stakeholders gradually moved towards shared accountability models that recognised the collective responsibility required to improve gender equity in STEM. Public reporting, monitoring frameworks, and policy evaluations have increased attention to measurable outcomes linked to participation, digital access, and educational inclusion.

This shift also strengthened advocacy efforts by creating clearer expectations around institutional responsibility and long-term investment in inclusive education systems.

Sustainability Mechanisms

Sustainability remained an important concern across many interventions. Several programmes achieved short-term visibility but struggled with continuity due to funding limitations, leadership changes or weak institutional integration.

Long-term sustainability was strongest where interventions combined policy support, community engagement, mentorship structures and local ownership. Programmes linked to schools, community organisations and technology networks often achieved stronger continuity than isolated awareness campaigns.

Communication Perspective

Communication remained central to stakeholder engagement and coalition-building throughout the eighteen years. Public dialogue, storytelling, and media visibility helped create a shared understanding of the importance of gender inclusion in STEM.

Stakeholders increasingly used digital campaigns, community outreach and public engagement strategies to mobilise support and encourage participation. Coalition-building efforts also relied heavily on communication networks connecting educators, advocates, policymakers, and technology communities around common goals.

By 2026, communication had become more than a supporting tool within STEM advocacy. It had become part of the broader infrastructure that shapes representation, visibility, participation, and institutional accountability within Nigeria's evolving STEM ecosystem.

RESEARCH, DATA AND EVIDENCE

DATA INSIGHTS

Research and data have played an increasingly important role in shaping conversations around gender equity in Science, Technology, Engineering and Mathematics in Nigeria. Between 2008 and 2026, evidence from education reports, labour statistics, policy reviews, and international studies helped expose participation gaps and strengthen advocacy efforts to improve inclusion. Data became more than a reporting tool. It gradually became part of the public conversation around opportunity, inequality and national development.

Participation Trends

Available research shows a gradual improvement in girls' participation in STEM education, although disparities remain visible across technical and engineering disciplines. National education reports and university statistics indicate an increase in female enrolment in science-related courses over the years, particularly in medicine, biological sciences, and environmental studies (National Universities Commission, 2019). However, representation in engineering, computing, and advanced technology fields continues to lag behind that of men.

The expansion of digital learning initiatives, coding programmes and technology-focused advocacy campaigns contributed to stronger engagement among girls and young women. Programmes supported by organisations such as W.TEC, UNICEF, and development agencies expanded access to digital literacy and STEM learning opportunities, particularly for underserved communities (Women's Technology Empowerment Centre, 2024; UNICEF Nigeria, 2023).

Graduation rates also reveal mixed progress. While more women now complete tertiary education programmes in STEM-related disciplines, their transition into employment and leadership positions remains uneven. According to the World Bank (2020), women continue to face barriers linked to workplace bias, unequal access to mentorship and limited representation within technical leadership roles.

Employment representation within STEM sectors also reflects broader structural inequalities. National labour data shows that women remain underrepresented within technology-intensive industries despite increased educational participation (National Bureau of Statistics, 2024). The gap is particularly visible in software development, engineering and innovation-focused sectors where leadership and technical authority remain largely male-dominated.

Leadership and Representation

Research further highlights gaps in leadership and visibility within academia, research and innovation spaces. Although more women are participating in STEM education, fewer occupy senior academic, policy or industry leadership positions. The UNESCO Institute for Statistics (2024) reports that women remain underrepresented globally in scientific research and decision-making spaces, with similar patterns evident across many African countries.

At the same time, entrepreneurship and innovation programmes have created new opportunities for participation outside traditional institutional structures. Women-led start-ups, digital enterprises and innovation initiatives have become more visible within Nigeria's technology ecosystem, particularly between 2018 and 2026. Digital platforms and innovation hubs also improved visibility for women contributing to the science and technology sectors.

Key Challenges Identified Through Research

Research consistently identifies educational, socio-cultural and digital barriers affecting girls' participation in STEM across Nigeria.

Educational barriers remain closely linked to infrastructure limitations, inadequate laboratory facilities, teacher shortages and unequal access to quality science education. Rural schools and conflict-affected regions continue to face greater disadvantages in funding and educational resources (Federal Ministry of Education et al., 2021).

Socio-cultural barriers also remain influential. Gender stereotypes continue to shape educational expectations and career choices, particularly in communities where science and technology are perceived as male-oriented professions. Early marriage, household responsibilities, and financial limitations further affect girls' retention and long-term participation in some regions.

Digital barriers became increasingly visible as online learning and technology-driven education expanded. However, digital platforms improved access for many students; unequal internet access, device affordability and urban-rural connectivity gaps limited participation for others. UNICEF Data (2023) observed that the gender digital divide continues to affect equitable access to digital skills and technology opportunities across developing countries.

USING DATA FOR ADVOCACY

Between 2008 and 2026, data increasingly became part of advocacy and public communication strategies surrounding gender equity in STEM. Advocacy organisations, policymakers and development agencies relied on research findings to strengthen awareness campaigns, influence policy discussions and highlight gaps in participation.

Evidence-Based Communication

Evidence-based communication helped move conversations beyond assumptions and anecdotal observations. Statistics on enrolment, digital access, labour participation and leadership representation provided measurable evidence of inequality while also helping stakeholders track progress over time.

Reports produced by UNESCO, UNICEF, the World Bank, and Nigerian education agencies became important reference points in media discussions, policy dialogues, and advocacy campaigns (UNESCO, 2017; World Bank, 2020). Infographics, trend graphs and public data dashboards also made complex information more accessible to wider audiences.

Policy Influence Through Research

Research findings are increasingly influencing policy conversations related to digital literacy, girls' education, and innovation development. National education policies and digital inclusion frameworks drew upon statistical evidence highlighting gender gaps within STEM participation and workforce representation.

Data also strengthened accountability. Public reporting and evaluation frameworks enabled advocacy groups and development organisations to monitor progress and draw attention to areas where interventions remained limited.

Translating Data into Public Action

One of the major communication challenges involved translating technical data into public understanding and action. Advocacy campaigns became more effective when research findings were presented through relatable storytelling, community engagement and visual communication rather than statistics alone.

Media organisations and digital advocacy groups increasingly use simplified graphics, social media campaigns and public storytelling to connect research findings with everyday realities. This helped broaden public engagement around girls' participation in science and technology.

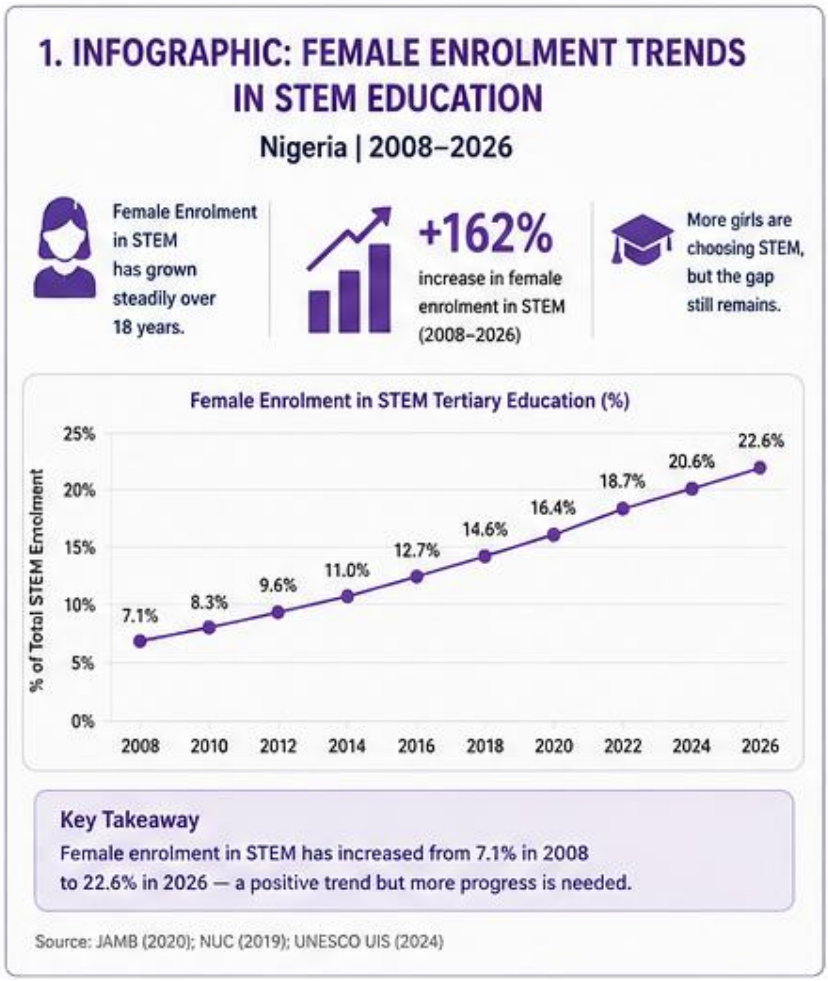
Research Accessibility

Although more STEM-related data became available during the period under review, access to localised and gender-disaggregated data remains inconsistent. Several reports highlight the need for stronger national data systems capable of tracking participation, leadership representation and digital inclusion across regions and educational levels.

Improving research accessibility will remain important for future advocacy efforts because evidence continues to shape policy priorities, funding decisions and public understanding of gender equity within STEM.

Visual Elements

Visual elements help present complex research findings in clearer and more engaging ways for diverse audiences. They also improve understanding by turning data and evidence into accessible communication tools that support informed discussion and decision-making.



2. COMPARATIVE TABLE: GENDER PARTICIPATION ACROSS STEM DISCIPLINES (2023)

STEM Discipline	% Female Enrolment	% Female Graduates	% Female in Employment
Education Sciences	68.4%	72.1%	61.3%
Health Sciences	61.7%	67.5%	63.8%
Natural Sciences	44.2%	45.3%	38.6%
Agriculture & Related Sciences	37.6%	41.2%	35.4%
Information Technology	23.5%	24.7%	19.6%
Engineering	16.8%	16.1%	12.7%
Physical Sciences	28.9%	30.4%	24.3%
Mathematics & Statistics	33.1%	34.8%	28.2%

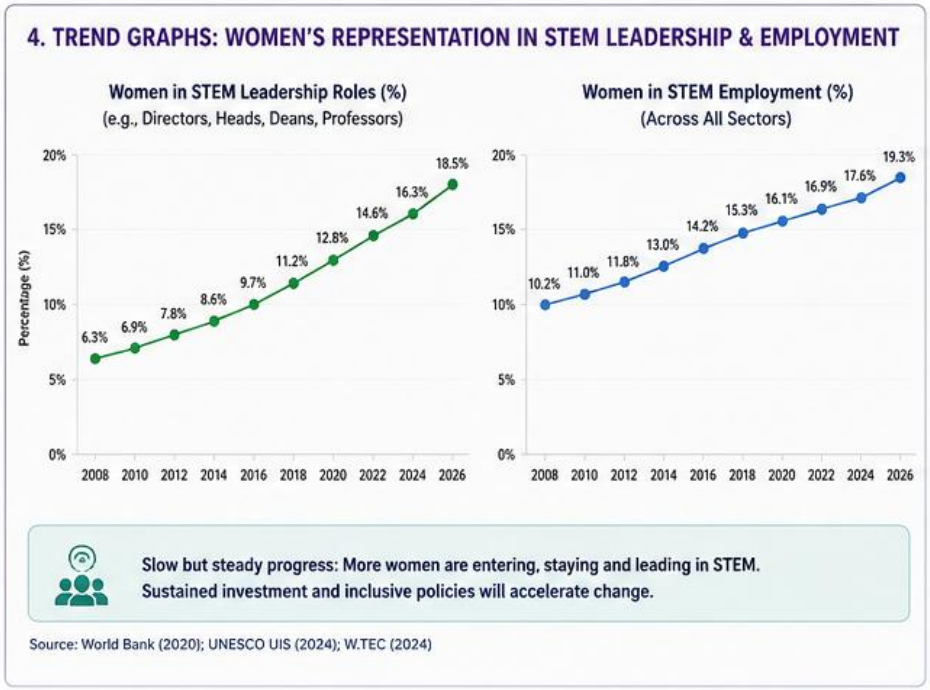
Source: NUC (2019); JAMB (2020); World Bank (2020)

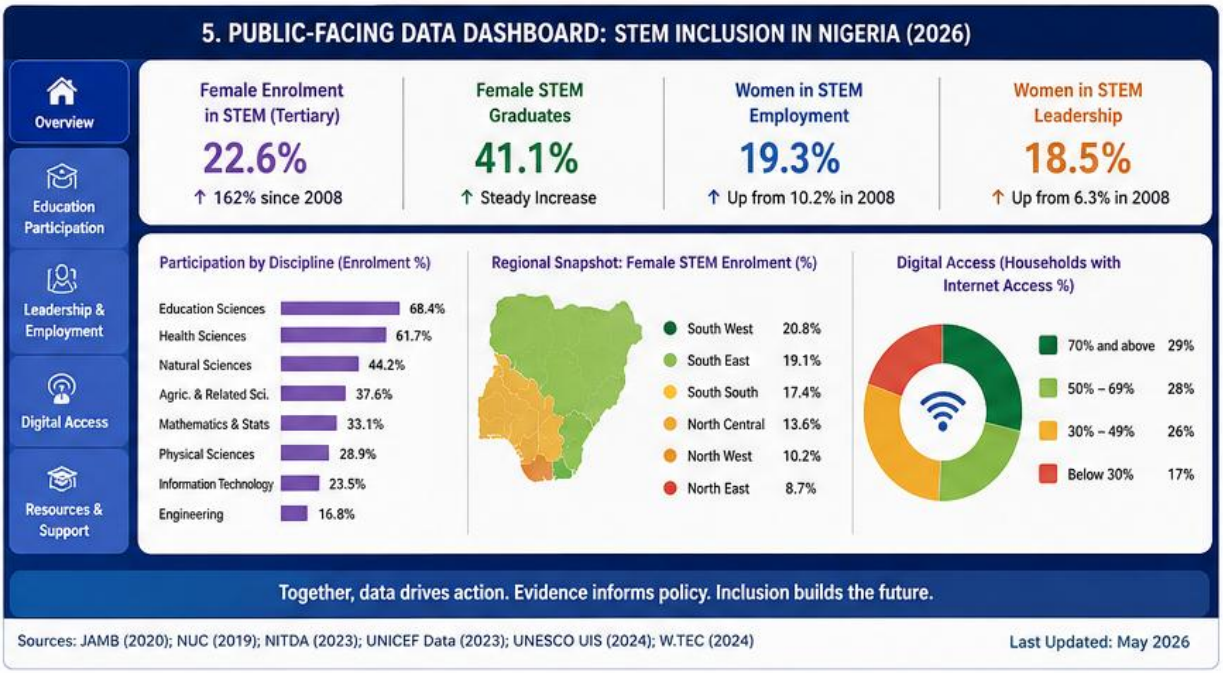
3 REGIONAL DISPARITIES IN DIGITAL ACCESS & FEMALE STEM PARTICIPATION (2026)

Digital Access Index & Female STEM Enrolment (%)

Higher digital access and female STEM participation are concentrated in South West and parts of South South, while Northern regions lag behind.

Sources: NBS (2024); NEMIS (2022); UNICEF Data (2023)





Together, these visual elements simplify complex research findings and make STEM inclusion trends easier to understand for policymakers, educators, advocates and the wider public. By presenting data in clear and engaging formats, they strengthen communication, encourage informed discussions and support evidence-based action towards gender equity in STEM.

CHALLENGES, GAPS AND LESSONS LEARNED

Persistent Challenges

Despite increasing awareness and visible progress between 2008 and 2026, gender equity in STEM in Nigeria continues to face several structural, social and institutional barriers. Funding limitations remain a major challenge, particularly for public schools and community-based programmes operating in underserved areas. Many schools still lack adequate laboratories, digital facilities and qualified science teachers, affecting the quality of STEM learning available to girls (Federal Ministry of Education, 2023). Uneven regional access also continues to shape participation, with rural communities experiencing greater educational and digital disadvantages than urban centres.

Social barriers remain deeply rooted. Persistent stereotypes about gender and technical competence continue to shape girls' perceptions of STEM careers and society's responses to women in science and technology spaces. Research suggests that low confidence, belonging uncertainty and fear of exclusion still influence participation within male-dominated disciplines (Meyer et al., 2019). Family expectations, financial pressures, and cultural norms linked to caregiving and early marriage also limit educational continuity for many girls, especially in vulnerable communities.

Institutional challenges further affect long-term progress. Although several gender-responsive policies and initiatives exist, implementation remains inconsistent across institutions and regions. Monitoring and evaluation gaps make it difficult to measure long-term impact, and many interventions struggle to sustain themselves after donor funding ends. In some cases, programmes are introduced without strong institutional ownership or long-term integration into educational systems.

Key Lessons

The past eighteen years have also provided important lessons for strengthening future STEM inclusion efforts. One major lesson is the importance of partnerships. Collaboration among government agencies, schools, civil society organisations, development partners and private-sector actors has helped expand access, visibility and advocacy for girls' participation in STEM.

Another important lesson is the need for localisation. Programmes tend to achieve a stronger impact when they reflect local realities, community needs and cultural contexts rather than

applying uniform approaches across different regions. Mentorship ecosystems have also proven valuable in sustaining participation. Organisations such as W.TEC and APWEN have shown that mentorship, peer learning and role model visibility can strengthen confidence, belonging and long-term engagement for girls in STEM.

From a communication perspective, storytelling has emerged as a powerful tool for change. Public narratives influence how girls imagine their futures and how communities perceive women in technical fields. Representation, therefore, matters. Increased visibility of female scientists, engineers and digital innovators has helped challenge stereotypes and broaden public understanding of who belongs in STEM spaces. Community engagement has also shown that trust and participation grow more effectively when advocacy efforts involve parents, educators and local stakeholders rather than focusing only on institutions.

FUTURE OUTLOOK AND EMERGING PRIORITIES

The future of gender equity in STEM in Nigeria will increasingly depend on how effectively inclusion is integrated into emerging areas of science, technology and innovation. As global economies continue to shift towards digital transformation, artificial intelligence, robotics, climate science, biotechnology and data-driven innovation are becoming more central to workforce development and national competitiveness. Expanding participation of girls and women in these sectors is likely to shape not only economic opportunities but also the diversity of ideas informing future technological solutions. UNESCO (2021) notes that inclusive participation remains essential for sustainable scientific and technological advancement.

Future inclusion efforts will also need to pay greater attention to underserved and underrepresented groups. Rural inclusion remains a major priority due to persistent disparities in infrastructure, internet access, and the quality of STEM education across regions. Disability inclusion, youth leadership and intersectional approaches are also becoming increasingly important within education and innovation spaces. Programmes that recognise the different realities affecting girls across class, geography and social background are more likely to produce a sustainable impact.

From a communication perspective, future engagement strategies will need to become more youth-centred, digital and collaborative. Social media, virtual learning spaces and online mentorship platforms are already reshaping how young people access information, build networks and engage with STEM communities. Research suggests that representation and digital visibility continue to influence confidence, belonging and career aspirations among girls and young women (Steinke et al., 2024).

Pan-African visibility and knowledge-sharing platforms are also expected to play a stronger role in the coming years. Cross-border collaboration, regional innovation networks, and digital storytelling initiatives can help amplify African women's contributions to science and technology while strengthening mentorship and advocacy ecosystems. Future-focused storytelling that presents girls not only as participants, but also as innovators, researchers and decision-makers, will remain important for sustaining public support and long-term inclusion.

RECOMMENDATIONS

Achieving sustainable gender equity in Science, Technology, Engineering and Mathematics in Nigeria will require stronger collaboration, long-term investment and more inclusive systems across education, policy, media and community spaces. The experiences from 2008 to 2026 show that progress becomes more meaningful when institutions, families, and stakeholders work together to create supportive pathways for girls and women.

For government institutions, increased investment in STEM education and digital infrastructure remains essential, particularly within rural and underserved communities. Strengthening implementation frameworks, improving monitoring systems and expanding access to quality science education can help reduce regional disparities and improve long-term participation.

Educational institutions should continue to promote inclusive learning environments that foster confidence, participation, and a sense of belonging among girls in STEM disciplines. Mentorship programmes, career guidance services and practical learning opportunities can help students connect classroom learning with future career possibilities.

The media also has an important role in shaping public attitudes. Improving representation of women in science and technology, encouraging gender-sensitive reporting and supporting science communication initiatives can help challenge stereotypes and increase visibility for female innovators, researchers and technology professionals. Positive storytelling and relatable role models remain important in shaping aspirations and confidence among younger audiences.

For the private sector, expanding internship opportunities, scholarships and innovation partnerships can strengthen workforce inclusion while supporting the next generation of female STEM professionals. Greater investment in innovation ecosystems and female-led enterprises may also improve participation within emerging sectors such as artificial intelligence, robotics and digital entrepreneurship.

Communities and families remain equally important. Encouraging girls' participation in science and technology, challenging limiting stereotypes and supporting long-term educational pathways can significantly influence confidence and career decisions. Sustainable progress in STEM inclusion will depend not only on policies and programmes but also on

collective social support that enables girls and women to participate fully and confidently in innovation spaces.

CONCLUSION

The story of gender equity in Science, Technology, Engineering and Mathematics in Nigeria between 2008 and 2026 is one of gradual progress, growing visibility and continued resilience. Over the past eighteen years, stronger advocacy, expanded educational opportunities, digital innovation and stakeholder collaboration have created new pathways for girls and women to participate more actively within STEM spaces. Conversations that were once limited to policy circles have increasingly become part of public discourse, community engagement and national development discussions.

Despite these gains, significant challenges remain. Unequal access to quality education, infrastructure limitations, social stereotypes and uneven institutional support continue to affect participation and long-term inclusion. Many girls still face barriers linked to geography, economic realities, and cultural expectations that shape confidence, opportunity, and visibility in science and technology fields.

The experiences documented throughout this journal also show that sustainable progress depends on collective responsibility. Government institutions, schools, media organisations, civil society groups, private-sector actors, families, and local communities all have important roles to play in creating more inclusive and supportive environments. Communication remains especially important because public narratives influence how girls see themselves, how society understands leadership and who is considered capable of innovation.

Looking ahead, the future of STEM inclusion in Nigeria must move beyond access alone towards stronger representation, meaningful participation and long-term support systems. Emerging areas such as artificial intelligence, digital innovation, climate science and technology entrepreneurship present new opportunities for inclusion if approached intentionally and equitably. Building an inclusive STEM future will require continued investment, stronger partnerships, and a sustained commitment to ensuring that every girl and young woman has the opportunity to learn, lead, and contribute within Nigeria’s evolving innovation landscape.

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