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THE GENDER GAP IN NIGERIAN TERTIARY STEM EDUCATION: CAUSES AND SOLUTIONS

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Abstract. The systematic review discovers in what directions African scholars examine gender gap in STEM in Nigerian universities. The article describes the situation with gender inequality in the Nigerian STEM universities majors. However, African scholars do not discuss it widely. The database of articles published between 2013 and 2023 and (1) published in peer-reviewed journals, (2) related to gender stereotypes in Nigerian tertiary education (3) related to trends and status of women and girls in STEM in Nigeria contains just 15 items. This small number indicates that gender stereotypes are largely responsible for gender gap in STEM enrolment and presents threats to girls already enrolled in male-dominated STEM fields. The influence of the institutional conditions and culture in universities on girls enrolled in male-dominated STEM disciplines presents an understudied theme in the existing literature.
Keywords*:* STEM, gender stereotypes, higher education, Nigeria

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Научная статья

ГЕНДЕРНЫЙ РАЗРЫВ В НИГЕРИЙСКОМ ВЫСШЕМ STEM-ОБРАЗОВАНИИ: ПРИЧИНА И РЕШЕНИЯ

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Аннотация. Представлен систематический обзор, раскрывающий, в каких направлениях африканские ученые изучают гендерный разрыв в технических специальностях нигерийских университетов. Дана статистика, характеризующая гендерное неравенство и низкую представленность женщин в нигерийских университетах, специализирующихся в области STEM. Показано, что влияние институциональных условий и культуры в университетах на девочек, зачисленных на обучение по дисциплинам STEM, где преобладают мужчины, представляет собой недостаточно изученную в литературе тему.
Ключевые слова: STEM, гендерные стереотипы, высшее образование, Нигерия

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Introduction

Gender inequality in education is critical to a country's sustainable development because of its huge impact on women in terms of the perpetuation of poverty in both the present and the future [1]. Studies on women's education in the Sub-Saharan Africa region have shown that the patriarchal family structure, which fostered preference for male children over female children, has contributed to providing greater opportunity for boys than girls to pursue education. Girls' access to education is also hampered by poverty, child marriage, and violence against women which is prevalent in the region. As a result, girls are less likely to enrol in school, stay enrolled, or advance academically. Thus, generally, the education attainment of girls is poor since the majority of girls leave school before completing junior secondary education [2. P. 2].

The fields of Science, Technology, Engineering and Mathematics (STEM) in higher education are important in addressing the challenges of the twenty-first century. Several facets of our lives, such as health, agriculture, infrastructure, and renewable energy, have already benefited from advances made possible by STEM education. STEM education is also essential in reshaping future professions and empowering future generations to actively participate in creating sustainable societies [3]. More than ever, society is being advanced by higher quality education and the innovations and technologies that go along with it. Despite this, a lot of developing countries struggle to keep up with the rapid pace of development, leading to challenges in economic growth and responding to the needs of the most deprived parts of their societies.

Furthermore, STEM education is beneficial as it helps students become more creative, rational, innovative, productive, and immediately tied to real-world situations [4]. Employers across all industries value and demand for skills developed from STEM disciplines making STEM students extremely desirable while also opening up a variety of career choices for those with advanced technical training outside of STEM fields. Regrettably, women and girls are underrepresented in STEM fields in both their educational and professional careers.

From primary to tertiary institutions in Nigeria, there is a dearth of female students in scientific and technology disciplines [5. P. 7]. Generally speaking, the proportion of women in science and engineering in Nigeria decreases as students move up the academic ladder to postgraduate and professional levels as a result of gender stereotyping which is quite evident in the culture and customs of many ethnic groups in Nigeria [6. P. 2016]. As it is, automation, artificial intelligence, and the Internet of Things are now more important than ever in driving the Fourth Industrial Revolution and the future of employment according to the 2023 World Economic Report [7]. The optimal involvement of girls in studying and working in STEM fields will increase their potential for scientific innovations and improve the quality of STEM outcomes. For all countries, gender equality in STEM is therefore a successful development strategy as closing the gender gap in STEM is vital in

preventing the loss of enormous human resources that may support national growth and worsen gender inequity in society.

There is an urgent need to upgrade Africa's STEM environment. STEM personnel from African countries are needed to solve its development issues, addressing many challenges that the continent faces, such as poverty and inequalities, diseases, climate change impact, food and nutrition security, and digitization, among others, but the region currently falls short of satisfying this need [8]. Hence, issues relating to women in Nigeria are crucial to the development of the entire region. Nigeria has not done well when it comes to gender equality. According to the 2021 UNDP report, Nigeria scored 0.88 points in the Gender Development Index (GDI) in 2019, an increase from 0.87 points in previous years, showing a worsening gender disparity condition in the areas of wealth, health, and education [9].

With Nigeria having the biggest population in Africa and the greatest population of young people in the world, the optimal engagement of females in STEM disciplines at higher education levels is a necessary condition for achieving Nigeria's economic and social progress by enhancing human capital, slowing population growth, and alleviating poverty. This study seeks to assess relevant literature to understand in what directions African scholars examine fewer girls enrolling for STEM academic disciplines in Nigerian universities and what role gender stereotypes play in girls' identifying with STEM fields as well as the role of universities in bridging this gap in STEM fields.

Methodology

Literature search and selection

A combination of methods was used to identify the journal articles that were reviewed in the study. The research questions were used to search Google Scholar, which was the primary database utilized in the study. The results were supplemented with hand searches of literature using key concepts through major publishers (SAGE, Taylor & Francis) because they have peer reviewed journals that focus on gender, STEM, education and development.

A 10-year time factor was incorporated in the search, because the gender gap in STEM education only started receiving substantial attention by Nigerian scholars about a decade ago when the United Nations sustainable development goal 5 targeted empowering girls and women in STEM. Although there are numerous publications that assess the issues of gender equality in STEM globally, only 15 publications made up the final sample that was analysed in this review[1]. In order to determine eligibility, I included studies that are: (1) published in peer-reviewed journals, (2) related to gender stereotypes in Nigerian tertiary education, (3) related to trends and status of women and girls in STEM in Nigeria, (4) published between 2013 and 2023. The studies that were excluded are: (1) related to primary and early childhood education, (2) related to women in the STEM workforce, (3) do not focus on female interests in STEM education, (4) do not provide sufficient information.

[1] The summary of the selected articles can be found here: https://docs.google.com/document/d/165JLOTRfLPOjfMWR5JFciigKS3Hvq0e4/edit?usp=sharing&ouid=114664093225572044245&rtpof=true&sd=true

FINDINGS AND DISCUSSION

In order to answer the research inquiry of the study, the qualitative analysis categorised the final publications selected into three subgroups: gender gap in STEM enrolment, gender stereotypes in STEM higher education, and role of universities in closing the gender gap in STEM.

Gender gap in STEM enrolment

The significant low enrolment of girls in the fields of science, technology, engineering, and mathematics may be caused by a variety of socio-cultural and socio-psychological factors.

GENDER ROLES AND SOCIALIZATION

The practice of assigning values, status, and attitudes to people based on their gender during the socialization process have generated different forms of discrimination, deprivation, and inequities between boys and girls. Even when a large percentage of female secondary school students enrol in science courses, the misconception persists that women are by nature technologically illiterate and unable to absorb scientific and technological information. As a result, many women choose to major in the humanities and social sciences in universities [10. P. 12]. Additionally, stereotypes are also frequently present in the educational materials utilised by young people. Textbooks are the most common form of educational material in developing countries like Nigeria, and, as a result, they have precedence in the educational system. The Nigerian Government's recommended textbooks support and perpetuate the stereotypes that teachers are female and scientists are male. Men are typically featured more frequently than women in the STEM text books used in Nigerian schools [11. P. 4]. A study [12] demonstrated that there are gender discrepancies across STEM fields in Nigerian higher educational institutions. The study discovered that only medicine had a predominance of female students. The preference of majority of women in medical professional is due to the specialty primarily focused on treating and working with people. However, the predominance of female students in medicine does not translate into practice, as studies have shown that men outnumber women in several major medical specialties. And in contrast to male doctors, who held positions in a wider range of specialties, female doctors were concentrated in just one of two sub-specialties, gynaecology and paediatrics [13].

SELF EFFICACY

Self-efficacy is a concept from Bandura's popularised social cognitive theory that refers to a person's confidence in their capacity for accomplishment in a specific area of life [14]. As a result of the misconception that women lack the aptitude to succeed in STEM disciplines, their engagement in STEM has been significantly retarded [15. P. 10]. Lack of interest and confidence of young girls to enrol in STEM courses is as a result of the attribution of STEM fields as a masculine domain. However, in order to motivate more girls to enrol in STEM courses in universities, there should be early exposure of girls to STEM subjects. Adequately equipping students for professionalism by observing career days

regularly in schools to lecture them on the different career options available in STEM could also spike up the interest of girls.

Gender stereotypes in STEM higher education

Although it is logical to presume that girls enrolled in male-dominated STEM fields have effectively navigated stereotypes at home and in the classroom, making them less vulnerable to stereotypes and their effects, the reports of the lived experiences of these students reveal stereotypes, biases, chilly campus cultures, unsteady identities, and a wavering sense of belonging are still obstacles to a successful degree completion and profession entry.

STEREOTYPE THREATS AND CAREER ADVANCEMENT

Stereotype threat refers to a circumstance in which a person has a negative stereotype about his or her group and is anxious about being evaluated or treated negatively as a result of this stereotype [16]. Female undergraduates in male-dominated disciplines often reported greater rates of gender bias and stereotype threat [17]. Furthermore, [18] confirms that women who take STEM courses in tertiary institutions are less likely to pursue STEM professions and exit them earlier than their male colleagues. Although, there is a good trend in the performance of female engineering students relative to their male counterparts with an increase in the proportion of female students graduating with a first-class degree especially in electrical and mechanical engineering [19. P. 9], not every enrolled female engineering student completed their bachelor's degree in the field. The majority of those who did not finish switched to non-engineering courses for a variety of reasons while they were still in school. These girls reported different challenges including gender discrimination, masculinization of engineering, socio-cultural factors, self-limitation, sexual harassments, ignorance of prospects, fear-of-the-unknown, parental influence, energetic task, demand for ruggedness, fear of limited job opportunities and lower salaries, marital discrimination, leadership opportunities, etc. [20]. Clearly, gender stereotypes continue to diminish the sense of belonging and desire for young girls to advance in STEM careers.

ROLE MODELLING

Adopting role modelling and mentorship platforms are effective strategies for reducing the negative impact of gender stereotypes threats in STEM. However, these strategies are underutilised in Nigeria [21. P. 39]. The role of female role models in enhancing the participation of girls in STEM entails two unique challenges. The first is expanding the recruitment of women who enter the STEM pipeline and then enhancing the retention of women who are already in STEM. Female role models help in both of these endeavours by increasing the sense of belonging in STEM. Female students acknowledged the influence of female role models or mentors as inspirations to enrol in engineering and mathematical studies in sectors that they believed to be male-dominated [6. P. 2017]. This shows that women who are successful in STEM fields can significantly influence and attract young females into the industry. Such mentorship platforms can be established through organizing forums, workshops and STEM-posiums with sessions ranging from topics on new innovations, emerging discourses as well as challenges of students enrolled in STEM in Nigeria.

Role of universities in closing the gender gap in STEM

In addition to their customary responsibilities for producing knowledge via research and taking the lead in the development of highly skilled human resources via instruction and training, universities are expected to take on the role of defining gender equality and promoting women's leadership engagement while contributing to the transformation of society [22].

GENDER EQUITY IN ACADEMIA

The majority of lecturers in STEM departments in Nigerian universities are men [23]. This itself portrays the underrepresentation of females in STEM and justifies the notion that STEM fields are masculine in nature. Furthermore, women continue to trail considerably behind in managerial roles and positions of leadership in Nigerian universities [24]. While it is not true that women lack the ability, experience, qualifications, potentials, or attributes to be excellent leaders, the issue of gender has been actively debated in light of the prevalence of women in positions of decision-making in academic settings. Their awareness of this gender stereotype has progressively been ingrained, to the point that women themselves lack the confidence to take on leadership responsibilities [25]. Nonetheless, more women need to be promoted by universities into higher administrative and academic roles which would make them key players in decision-making.

FUNDING

Funding STEM education is crucial for Nigeria's global competitiveness, job creation, addressing skills gaps, and promoting gender equality and social inclusion [26]. Women and girls are often deprived of the access to be involved in innovative scientific and technological research due to limited finance. Scholarships for young girls and financing for women scientists are exceedingly scarce, signalling that more should be created. There are a few sporadic scholarships offered to exceptional female students in STEM disciplines. Collaborative efforts from the universities and the government and civil societal organizations are required in Nigeria in order to attract and retain more girls in STEM.

Conclusions and further research opportunities

The highlights of the review point at the sociocultural beliefs and practices which significantly influence socialization and attribution of gender roles to individuals as the main explanation of gender gap in STEM enrolment. The study also highlights how gender stereotypes and stereotype threats continue to diminish the sense of belonging and desire for girls to advance in STEM careers. Furthermore, the function of tertiary education as a societal institution as well as its role in closing the gender gap in STEM fields were further explored in the study. An increased emphasis on closing the gender gap in STEM fields has resulted from the realization that these fields have a large and directly causal role to play in economic productivity and innovation. This has an impact on the demands placed on universities to produce a sufficient gender-balanced number of qualified graduates despite persistent institutional and socio-cultural biases that inhibit representation of women in STEM education and career. Thus, there is a need for a better understanding of this subject in the context of Nigerian education landscape;

hence, further research can explore under-studied themes on how the institutional conditions and culture in universities influence the gendered experiences of female students enrolled in male-dominated STEM disciplines. Additionally, subsequent research can study the efficiency of specific initiatives designed to address the gender gap in STEM education, while also investigating the involvement of various stakeholders in translating gender equality policies into practice in order to encourage the recruitment and retention of females in STEM academic disciplines.

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