



Science, Technology, Engineering, and Mathematics (STEM) and Leadership skills acquisition among Girls in Angwan Rukuba, Nigeria

Evelyn UDOFIA¹; Tomisin ADEYEMI²; Roy Tokunbo OLOWU³

^{1,2}Four18 Humanitarian Initiative, Nigeria.

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ABSTRACT

Despite the recognised global importance of women in leadership and Science, Technology, Engineering and Mathematics (STEM) education, girls in rural areas encounter significant barriers in working towards leadership and science-based careers. This study explores the impact of non-formal education (NFE) initiatives such as community hubs and after-school programs, using a case study of the Four18 Humanitarian Initiative's Pad-a-Girl community development program in rural community of Angwan Rukuba, Jos, Plateau State, Nigeria as case study. This study employed a qualitative research design to explore the impact of non-formal education (NFE) initiatives, specifically community hubs and after-school programs, on promoting leadership and skills among girls in rural communities. The research shows that this paradigm of learning promotes values and attitudes through critical thinking, problem-solving, and collaborative learning skills essential for success in leadership and STEM subjects. This observation is linked to the educational philosophy of Paulo Freire which has developed into a cross-curricular Global Learning (GL) experience now adopted as Global Citizenship Education (GCE) in schools and higher institutions. SDGs 3, 4 and 5 provide targets and indicators for gender inequality such as, limited resources, gender stereotypes, state and community crisis, and cultural norms which hinder girls' participation in leadership and STEM-related activities.

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1. Introduction

In today's rapidly evolving world, fostering leadership skills and promoting Science, Technology, Engineering and Mathematics (STEM) education among young girls is paramount for achieving sustainable development and gender equality. However, girls in rural communities face arduous obstacles in pursuing these pathways due to various socio-economic and cultural challenges (UNESCO, 2020). This study aims to explore innovative approaches to address these barriers and empower girls in rural areas to excel in leadership and STEM education through non-formal education (NFE) initiatives.

The research is conducted in Angwan Rukuba, a rural community in Jos, Plateau State, Nigeria with a population of twelve thousand people. Despite the recognised global significance of women in leadership roles and STEM fields, girls in this region encounter substantial impediments on their journey towards these career paths with only a 5% engagement rate. These barriers include limited resources, pervasive gender stereotypes, community crises, and entrenched cultural norms that restrict girls' participation in leadership and STEM-related activities (Kanyip, 2018). The study is undertaken by the Four18 Humanitarian Initiative organisation, leveraging their Pad-a-Girl community development program. This initiative focuses on menstrual hygiene and well-being while integrating

concepts from UNESCO's Sustainable Development Goals (SDGs), particularly SDGs 3 (Good Health and Well-being), 4 (Quality Education), and 5 (Gender Equality). The initiative aims to provide holistic support to girls in rural areas, addressing not only their educational needs but also their health and well-being.

The research investigates the impact of NFE initiatives, such as community hubs and after-school programs, in promoting leadership and STEM skills among rural girls. Drawing inspiration from the educational philosophy of Paulo Freire, particularly his emphasis on critical thinking and collaborative learning, the study explores how these initiatives instill values and attitudes crucial for success in leadership and STEM subjects (Freire, 1970).

Moreover, the study aligns with the concept of Global Citizenship Education (GCE), a cross-curricular approach that emphasizes understanding global issues and taking action to address them. By integrating GCE principles into NFE initiatives, the research seeks to cultivate a sense of global responsibility among rural girls, them to contribute meaningfully to their communities and beyond (UNESCO, 2014).

2. Statement of the Problem

Jos, the capital city of Plateau State, with a population of one million people (Macrotrends Report, 2024), has experienced recurring ethno-religious conflicts, resulting in widespread displacement, loss of lives, and disruption of social structures (Omowunmi, 2019). These crises have had a profound impact on the educational landscape, intensifying existing challenges faced by girls in accessing quality education and pursuing opportunities in leadership and STEM fields.

Despite the recognized global importance of promoting leadership skills and STEM education among girls, those residing in rural communities, particularly in Jos, Plateau State, Nigeria, face significant barriers hindering their access to quality education and opportunities in these fields. The combination of limited resources, pervasive gender stereotypes, recurring ethnoreligious conflicts, and entrenched cultural norms pose formidable challenges to girls' participation in leadership and STEM-related activities (Kanyip, 2018; Omowunmi, 2019; UNESCO, 2020).

The ethno-religious conflicts in Jos have resulted in widespread displacement, loss of lives, and disruption of social structures, exacerbating existing educational challenges and further marginalizing vulnerable populations, including girls (Omowunmi, 2019). As a consequence, girls in rural areas often lack access to adequate educational facilities, qualified teachers, and relevant learning resources, hindering their academic progress and limiting their prospects in leadership and STEM fields.

Furthermore, pervasive gender stereotypes and cultural norms uphold the perception that certain fields, such as leadership and STEM, are more suited for boys, discouraging girls from pursuing these areas of study and perpetuating gender disparities in education and employment (UNESCO, 2020). As a result, girls in rural communities are often steered towards traditional gender roles (like staying at home and taking care of normal house chores of sweeping, washing and cooking) and are less likely to explore opportunities in leadership and STEM-related careers, thereby limiting their potential for personal and professional growth. Adu and Olowu (2022) posit that environments of violence will be affected by a barrage of news reports in the media with violent images to which both teachers and learners will be exposed thereby affecting the psychological health of girls. (Adu & Olowu, 2022:57)

To address these challenges there is a critical need for innovative pedagogical approaches that go beyond traditional formal education systems. Non-formal education (NFE) initiatives, such as community hubs and after-school programs, have the potential to provide girls with access to alternative learning environments, practical skills training, and mentorship opportunities that can equip them with the confidence, knowledge, and skills needed to succeed in leadership and STEM fields.

However, NFE initiatives can be used to promote leadership and STEM education skills among rural girls remains currently underexplored, necessitating further research to assess their impact, identify best practices, and develop tailored interventions that address the unique socio-economic, cultural, and educational challenges faced by girls in rural communities (UNESCO, 2020). By understanding the root causes of these challenges and leveraging NFE initiatives as a means of empowerment, stakeholders can work collaboratively to create inclusive educational pathways that unlock the full potential of girls in rural areas and contribute to sustainable development and gender equality in Nigeria and beyond.

3. Research Questions

1. How do recurring ethno-religious conflicts impact girls' access to quality education and opportunities in leadership and STEM fields?
2. What are the underlying socio-cultural factors that discourage girls in rural communities from pursuing leadership roles and STEM-related careers?
3. What is the impact of non-formal education initiatives on promoting leadership skills and STEM education among girls in rural communities?

4. Methodology

This study employed a qualitative research design to explore the impact of non-formal education (NFE) initiatives, specifically community hubs and after-school programs, on promoting leadership and skills among girls in rural communities. The research was conducted as a case study focusing on the rural community of Angwan Rukuba, Jos, Plateau State, Nigeria, utilizing a comprehensive approach to understanding the complexities of the context and the effectiveness of NFE interventions.

5. Findings

Ethno-religious conflicts in Jos, Plateau State, Nigeria, have profound implications for girls' access to quality education and opportunities in leadership and STEM fields. Four18 Humanitarian Initiative during their outreach and sensitization program discovered that these conflicts disrupt social structures, destroy educational infrastructure, and result in widespread displacement, particularly affecting marginalized populations of girls in Angwan Rukuba (Omowunmi, 2019; Kanyip, 2018).

Four18 Humanitarian Initiative, recognizing the urgent need to address these challenges, implemented targeted interventions to support girls' education in this particular location. The implementation of the PAD A GIRL project in Jos involved providing comprehensive support, including access to quality education, mentorship, and psychosocial support for girls affected by ethno-religious conflicts. Four18 Humanitarian Initiative also found out that pervasive gender stereotypes and cultural norms have significantly influenced girls' educational aspirations and career choices in Jos, Plateau, Nigeria. These stereotypes discourage girls from pursuing leadership roles and STEM-related careers, limiting their opportunities for personal and professional growth.

In response to these challenges, the Four18 Humanitarian Initiative has implemented innovative approaches to promote gender equality and empower girls in rural communities. Through the Pad-a-girl program which is an after-school program, the organization provided girls with access to non-formal education settings which was an effective platform for mentorship, and leadership development through conversations. By incorporating culturally relevant content and promoting positive role models, the program challenged gender stereotypes and encouraged girls to pursue their interests in leadership and STEM fields. Through these initiatives, the Four18 Humanitarian Initiative created a supportive and inclusive environment where girls could thrive by having conversations on their specific areas of interest regardless of societal expectations.

Non-formal education (NFE), such as community hubs also play a pivotal role in promoting leadership skills and STEM education among girls in rural communities. Four18 through their findings noted the positive impact of community hub gatherings in providing girls with essential skills and knowledge in leadership and STEM subjects. Leadership and STEM skills were promoted among girls while addressing broader social and health-related challenges faced by girls in the community. This was possible because girls assembled in a church which was used as a meeting hub and they could express themselves freely without any fear on areas of concern including their interests in leadership and STEM subjects.

In response to the findings, Four18 Humanitarian Initiative prioritized the implementation of NFE initiatives through community outreaches where girls meet after school in different places (community hubs). By aligning NFE initiatives with the specific needs and interests such as health and well-being, self-esteem, self-awareness and skills acquisition of girls in rural communities as discovered during the outreach, stakeholders can maximize their impact in empowering girls to pursue leadership and STEM opportunities.

6. Recommendations

Some of the recommendations from this paper include:

Investing in Infrastructure and Resources: It is important to allocate resources to rebuild educational infrastructure in conflict-affected areas like Jos, and Plateau State and provide essential resources such as textbooks, laboratory equipment, and technology to enhance the quality of leadership and STEM education. Additionally, ensure the availability of safe and conducive learning environments that prioritize girls' education and foster their interest in leadership and STEM subjects.

Promoting Gender-Inclusive Policies: It is also necessary to advocate for gender-inclusive policies at the local, regional, and national levels using the Nigeria policy framework (2018) to address socio-cultural barriers and promote girls' participation in leadership and STEM fields. These policies should focus on eliminating gender stereotypes, providing equal opportunities for girls in education and employment, and empowering girls to pursue their aspirations without societal constraints.

Creating Inclusive Learning Environments Aligned with Community Needs: The research by Four18 highlights the importance of creating inclusive learning environments that resonate with the needs and values of the community. Leadership and STEM programs should go beyond traditional classroom settings to incorporate informal learning opportunities, mentorship, and hands-on experiences. Additionally, initiatives should consider cultural sensitivities and norms to ensure that they

are accessible and relevant to all girls in the community. Girls should be exposed to Global consciousness which relates to how the individual understands self in the world and becomes aware of the perspectives of others and Global competencies which relate to the skills and knowledge needed to be a global citizen (Dill, 2013). By aligning leadership and STEM education with community needs and preferences, initiatives can foster greater engagement and participation among girls, ultimately leading to more equitable outcomes.

Facilitating Collaboration among Stakeholders for Sustainable Impact: Collaboration among stakeholders is essential for the long-term success and sustainability of leadership and STEM initiatives, as emphasized by Four18's findings. Partnerships between local organizations, schools, government agencies, and businesses can leverage resources and expertise to support leadership and STEM education effectively. By fostering a collaborative ecosystem, initiatives can maximize their impact and reach, ensuring that girls have access to quality leadership and STEM education opportunities. Additionally, ongoing dialogue and engagement with stakeholders can facilitate continuous improvement and adaptation of programs to meet evolving community needs and priorities. Partnerships with the private sector to align their corporate responsibility projects with the need for leadership and STEM education for girls should also be considered as well as effective mentorship programs

Building community Tech Hubs for empowerment: Based on the findings by Four18, it is recommended to establish tech hubs as integral components of STEM education initiatives. These tech hubs can serve as dynamic learning environments where girls have access to state-of-the-art resources, mentorship, and hands-on experiences in STEM fields. By leveraging technology and innovation, these hubs can provide a collaborative space for students to explore and experiment with STEM concepts, fostering creativity, problem-solving skills, and entrepreneurial spirit. These centres offer hands-on activities, experiments, and projects in areas such as robotics, coding, engineering, and environmental science while addressing basic life issues. Additionally, tech hubs can facilitate partnerships with local businesses, universities, and industry professionals, creating pathways for girls to gain real-world experience and pursue careers in STEM-related fields. Through the establishment of tech hubs, initiatives can provide sustainable and scalable solutions to promote STEM learning and empower girls in underserved communities.

Encouraging after-school programs: After-school programs are structured activities that take place outside of traditional school hours and provide additional learning opportunities for students. These programs are designed to complement and extend the learning that occurs during the regular school day, offering enrichment activities, academic support, and extracurricular opportunities. In the context

of promoting leadership and STEM skills among girls in rural areas, Four18 discovered that after-school programs play a crucial role in providing access to hands-on STEM experiences and fostering a supportive learning environment.

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