# CREATING OPPORTUNITIES FOR PERSONS WITH DISABILITIES IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM)

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**Abstract**
The inclusion and empowerment of persons with disabilities in the field of Science, Technology, Engineering, and Mathematics (STEM) are crucial for fostering innovation and creating a diverse and equitable society. Against this background this paper highlighted opportunities for persons with disabilities in STEM. The paper discussed the importance of creating equitable environments and providing appropriate resources to empower individuals with disabilities to thrive in these key disciplines. While recognizing/identifying some challenges that persons with disabilities might face in pursuing careers in STEM, the author emphasized the need for collaborative efforts between educational institutions, employers of labour, and policymakers. Furthermore, the author recommended implementing inclusive educational practices, starting from early childhood education to higher institutions. This approach involves providing accessible learning materials, leveraging assistive technologies, and adapting teaching methods to accommodate diverse learning styles. It also emphasized promoting STEM education as an inclusive and accessible field for individuals with disabilities, eliminating the stigma often associated with disabilities in STEM.
**Keywords:** Disabilities, Engineering, Inclusive Practices, Mathematics, Opportunities, Science, Technology

## Introduction

There has been a growing global recognition that persons with disabilities alternatively referred to as PWD have the potentials to contribute significantly to various fields of human endeavour especially in the areas of Science, Technology, Engineering and Mathematics (STEM). However, in developing countries like Nigeria, the potential of PWDs to contribute to the advancement of STEM fields remains largely untapped, primarily due to systemic challenges that limit their access to education, employment, and opportunities for advancement. Perhaps, it is in support of this assertion that Obasanjo and Adedayo (2023) highlighted that despite the concerted efforts to promote inclusive policies for PWDs globally, in Nigeria, they still face multifaceted barriers that impede their active participation in the field of education in general and STEM in particular. These barriers range from inaccessible infrastructure and discriminatory practices to limited access to quality education and specialized resources.

Consequently, PWDs are disproportionately underrepresented in STEM-related disciplines, perpetuating a cycle of exclusion and hindering the nation's overall scientific and technological progress. Regrettably, the report of Oyeniyi (2023) contends that Nigeria still practiced a segregative system of education, with the establishment of special needs schools where PWDs learned separately from their non-disabled peers. According to this report, segregative system of education especially in the field of STEM does not promote inclusiveness and equality in pursue of knowledge and skills. Above all it does not also facilitate PWDs' active participation in the society. Accordingly, Obasanjo, and Adedayo (2023) affirmed that despite the enactment of several statutes for the prohibition of discrimination against PWDs, yet discrimination against the PWDs still persists especially in

terms of access to quality education in the field of STEM as majority of schools in Nigeria lack the resources and trained personnel to support students with disabilities, leading to exclusion from the education system.

It is against these numerous challenges when it comes to creating opportunities for PWDs in the field of STEM that this paper attempts to shed light on the importance of fostering inclusivity and equal opportunities in STEM for persons with disabilities in Nigeria, as well as identify key strategies to overcome the existing barriers.

**The importance of fostering inclusivity and equal opportunities in STEM for PWD in Nigeria**

Persons with disabilities (PWD) face significant barriers in accessing both educational opportunities and career advancement in the field of Science, Technology, Engineering, and Mathematics (STEM) in most developing countries, Nigeria inclusive. This view was corroborated by Wahab et al., (2022) who asserted that a significant portion of talent remains untapped due to barriers faced by PWD in Nigeria. However, fostering inclusivity and providing equal opportunities for PWD in STEM is a matter of social justice and crucial for driving innovation, economic growth, and societal development.

Thus, the importance of fostering inclusivity and equal opportunities in STEM for PWD in Nigeria as well as strategies to promote their participation and success are highlighted below:

1. Creating Accessible Technologies: By considering the needs of PWD from the outset, engineers and designers can create products and services that are more user-friendly, intuitive, and inclusive. Perhaps, it is in this regard that the World Health Organization (2020) hinted that Inclusive design practices in STEM can lead to the development of accessible technologies that benefit not only PWD but also the broader population.
2. Diverse Perspectives: According to the report of the National Science Foundation (2020) Inclusivity in STEM promotes diversity of thought and perspective which is essential for fostering creativity, innovation, critical- thinking and problem-solving techniques. By including individuals with diverse backgrounds and experiences, including PWD, STEM fields can benefit from a broader range of ideas and solutions.
3. Addressing Societal Challenges: Many of the societal challenges facing Nigeria, such as healthcare, infrastructure, and environmental sustainability, require interdisciplinary approaches and technological innovations (United Nations Development Programme, 2021). Thus, by engaging PWD in STEM, Nigeria can tap into their unique insights and expertise to address these challenges more effectively.
4. Tapping into Untapped Talent: By providing equal opportunities, Nigeria can tap into a pool of untapped talent. According to United Nations Development Programme, (2021) some of the PWD possess valuable skills and capabilities that can significantly contribute to the advancement of STEM fields.
5. Diverse Perspectives: Inclusivity in STEM ensures a diverse range of perspectives and approaches to problem-solving. PWD bring unique insights and experiences, contributing to creative solutions and innovations (National Science Foundation, 2020)
6. Enhanced Problem-Solving: It has been asserted that Inclusive STEM environments foster collaboration among individuals with diverse backgrounds, leading to more effective and innovative problem-solving. The report of the World Health Organization (2020) reveals that PWD often approach challenges with unique problem-solving skills, enriching the overall STEM landscape.

However, despite the growing global recognition for PWD in driving economic growth, innovation, and social development through STEM education, yet in developing countries like Nigeria, the PWD are still exposed to several barriers in accessing STEM education and pursuing careers in STEM fields.

**Barriers Faced by Persons with Disabilities in STEM:**

Although the national policy on education indicates that Nigerians (irrespective of their physical conditions, i.e whether physically able or disabled) have the right to an inclusive education and that schools should provide conditions which lead to successful education of all, however, investigations revealed that PWD are not only the most marginalized and excluded groups in the pursuit of education but they are also facing a myriad of challenges in realizing their right to quality education especially in the field of STEM. This assertion is in consonant with the findings of Obasanjo and Adedayo (2023).

Thus, PWD are still faced with numerous barriers that hinder their access to and participation in STEM education and employment. Some of the most prominent challenges prevalent includes:

1. Limited Access to Education:

One of the major challenges confronting PWD in Nigeria is that most of the educational institutions either have limited or in most instances, lacks the necessary infrastructure and accommodations to make STEM education accessible to PWD. This includes inaccessible buildings, lack of assistive technologies, and inadequate resources for specialized support services. Perhaps, it is in support of this observation that Jones (2019) revealed that majority of persons with disabilities in Nigeria face significant barriers to accessing quality education due to the absence of inclusive environments as well as lack of accessibility tools and resources which makes it difficult for them to make any meaningful contribution in the field of STEM.

2. Social Stigma and Discrimination: People with disabilities often face social stigma as a result of societal misconceptions, stereotypes, and discrimination towards persons with disabilities. This leads to isolation and self-esteem thus contributing to their exclusion from STEM career opportunities in Nigeria. Consequently, these negative attitudes hinder their inclusion in mainstream educational institutions and workplaces, where they can make substantial contributions. Thus, this hinders their full participation in society. According to Abdulraheem, (2021) even in the present 21$^{st}$ century, the negative attitudes and stereotypes of individuals toward PWD persist in most parts of Nigeria, consequently this leads to social exclusion and discrimination against PWD. This stigma often discourages PWD from pursuing education and careers in STEM fields.

3. Limited Representation and Role Models: The lack of visible representation of successful persons with disabilities in STEM fields creates a lack of role models and discourages aspiring students from pursuing STEM subjects or careers due to limited external inspiration. Reports by Ahmed et al., (2020) revealed that the underrepresentation of PWD in STEM professions is capable of discouraging the PWD from venturing into the field of STEM education or related careers as the struggle to find relevant role models becomes not only a mirage but virtually unattainable.

4. Lack of awareness and training on disabilities: Many STEM educators and professionals lack awareness and education about disabilities, which can hinder the inclusion and support of PWD in STEM fields. According to Abdulraheem (2021) lack of relevant training and awareness on the part of the teachers is a major barrier to STEM education by PWD because most of the Educators lack the necessary training and awareness to support PWD effectively in STEM education, hence leading to their exclusion and marginalization in STEM-related career.

Consequently, most STEM professionals and educators lack awareness and education about disabilities, which can lead to barriers in supporting PWD in STEM education and careers.

5. Inadequate facilities and Assistive Technology: Insufficient infrastructure, including inaccessible public facilities and inaccessible information and communication technology (ICT), inhibit the full participation of persons with disabilities in STEM-related activities.

Lack of affordable and appropriate assistive technology worsens this issue. In support of this assertion Oluwole and Ojo (2018) observed that in the few institutions where STEM facilities are available, they still lack adequate infrastructure for PWD, making it difficult for them to access laboratories, workshops, and other learning spaces.

6. Lack of Inclusive Curriculum: The curriculum of STEM education is not designed to be adapted to accommodate diverse learning needs thus hindering the participation of PWD. According to Oyeniyi (2023) the absence of inclusive curriculum development processes leads to a lack of appropriate learning materials and methodologies for PWD in STEM subjects. This also translates to lack of inclusive educational environments. Consequently, the PWD face challenges in finding inclusive educational environments in STEM fields which is not only capable of hindering their success but also participation in STEM. Thus, PWD often face barriers in accessing inclusive and accessible STEM education environments, which limits their ability to fully participate and succeed in stem-related careers and education.

7. Limited job opportunities and career advancement: Although the issue of unemployment is a global phenomenon, it is also one of the major issues confronting Nigeria as a nation. The problem is also not only peculiar to persons who are physically okay but even PWD face severe challenges in accessing job opportunities and advancing in their STEM careers. A report by the National Science Foundation found that many PWD struggle to find job opportunities in STEM fields, and face barriers to advancing in their careers due to discrimination and lack of support (National Science Foundation, 2020).

8. Limited networking and mentorship opportunities: PWD often face challenges in accessing networking and mentorship opportunities in the field of STEM, consequently this can limit their ability to advance in their careers. To buttress this assertion, Abdulraheem (2021) discovered that PWD have limited access to mentorship and networking opportunities, which hinders their career development and advancement.

**Strategies to overcome barriers and Create Opportunities for PWD in STEM**

1. To overcome the problem of limited access to education among the PWD, there is an urgent need for both government and non- governmental organizations to invest heavily in infrastructure modifications to make institutions of learning and workplaces more accessible to PWD. According to Frueh (2023) this can be achieved through construction of ramps, elevators, accessible restrooms, modifying classrooms with adjustable desks and ensuring that buildings comply with global accessibility standards for the PWD. Additionally, providing transportation services tailored to meet the needs of PWD's can improve access to quality education in general and STEM in particular. Thus, providing accessible learning environments, assistive technologies, and reasonable accommodations to support the diverse learning needs of PWD will ensure equal access to quality education which is fundamental for empowering PWD to pursue careers in STEM.

2. The social stigma and discrimination against PWD occasioned by the negative attitudes of the society towards disability which hinders their participation in STEM can be overcome through extensive awareness campaigns to challenge stereotypes and promote inclusivity. Teachers and peers can be educated on the capabilities of PWD which can foster a more supportive environment. Additionally, enacting and enforcing government policies that promotes inclusivity and equal opportunities for PWD in STEM, including reasonable accommodations and anti-discrimination measures is capable of eradicating the social stigma and discrimination against PWD in the field of STEM (Jones, 2019). Consequently, initiating training programs, educational awareness campaigns, and public outreach initiatives can help dispel myths and stereotypes about PWD and promote a culture of inclusion in STEM.

3. Another strategy to allow for full participation of PWD in STEM involves creating STEM outreach and mentorship programs. Initiating STEM outreach and mentorship programs plays

a crucial role in inspiring and supporting PWD to pursue careers in STEM. Accordingly, these programs are not only capable of providing opportunities for PWD to connect with renowned role models, but they can also allow them to gain hands-on experience, and thus develop essential skills for success in STEM fields (Frueh, 2023). Consequently, the initiative can promote the visibility of successful PWD in STEM fields through outreach activities, media campaigns and mentorship programs. Above all, highlighting the achievements of role models among PWD can inspire aspiring students and professionals and challenge stereotypes.

4. Most teachers lack adequate training to effectively teach STEM to PWD (Oluwole & Ojo, 2018). This is another major factor contributing to non-participation of PWD in STEM education and career pursuit. Therefore, it is paramount to provide training and awareness programs for STEM educators and professionals on and inclusive teaching practices for disabilities. This measure should include implementing inclusive education training programs, workshops and professional development opportunities for the educators. Consequently, it is also essential to seek for collaboration with non-governmental organizations especially disability organizations and experts can also provide valuable insights. This can also help them better support PWD in STEM education and careers. Thus, workshops, seminars and online resources can be utilized.

5. To address the challenge of lack of assistive technology as a barrier to accessing STEM education, there is a need for the government to invest in the development of accessible ICT infrastructure, adaptive tools, and assistive technology to ensure barrier-free learning for all students. The development and subsequent provision of these critical learning resources, such as Braille textbooks, screen readers, online learning platforms and other related assistive technologies can facilitate the participation of PWD in STEM education. According to Ahmed et al. (2020) these resources can help to overcome barriers to learning and thus enable PWD to effectively participate in STEM activities.

6. Encouraging the development of inclusive curriculum materials and methodologies that cater to diverse learning needs is another strategy that can be adopted to overcome the problem associated with lack of inclusive Curriculum and adaptations to accommodate diverse learning needs which is peculiar to STEM curricula (Oluwole & Ojo, 2018). Thus, the development of inclusive teaching materials which incorporates universal design principles into lesson planning, and offering personalized learning plans for PWD is a strategy that can ensure full participation of the PWD in STEM coursework. Additionally, the Involvement of PWD in the curriculum development process which shall make provisions for alternative teaching methods, flexible assessment strategies, and fostering a supportive and inclusive culture within educational institutions can ensure that their perspectives and needs are adequately represented.

7. Creating job opportunities and advancement in STEM career by PWD is possible if the government and other employers of labour can be encouraged through diversity and inclusion initiatives, mentorship programs, and partnerships with disability advocacy organizations. Additionally, advocating for policy changes at the government level to promote the rights and inclusion of PWD in STEM-related careers and employment. According to Obasanjo and Adedayo (2023) this may involve lobbying for legislation that mandates accessibility standards, anti-discrimination policies, and incentives for inclusive practices. This measure is capable of encouraging employers to create more job opportunities for PWD in STEM fields and to provide support for their career advancement.

**Conclusion**

Creating opportunities for persons with disabilities in STEM fields is essential for not only enhancing inclusivity but also harnessing their skills and potential to drive innovation and socio-economic progress. The paper dwells on the need to prioritize educational reforms,

inclusive policies and infrastructure development to ensure equal access and participation for persons with disabilities in STEM. By addressing the barriers and implementing the strategies discussed in this paper, Nigeria can unlock the untapped potential of its disabled population and foster a more inclusive, diverse, and prosperous society. Thus, the inclusion of PWDs in STEM fields is not just a matter of social justice but an essential requirement for sustainable development and global competitiveness of the nation. Consequently, the paper asserted that by harnessing the talents and potential of PWD Nigeria can attain new pathways to innovation, economic growth, and social progress. Through concerted efforts to remove barriers and create inclusive opportunities, Nigeria can pave the way for a more equitable and prosperous future for all.

**Recommendations**

The following recommendations are proffered to enhance opportunities for PWD in STEM field:

1. There is an urgent need to invest in accessible Infrastructure and resources. To this end, educational institutions, government and NGOs should invest in modifying infrastructure and providing necessary accommodations to make STEM learning environments accessible to PWD. This includes constructing ramps, elevators, accessible restrooms, and ensuring classrooms comply with global accessibility standards.
2. Establish STEM Outreach and Mentorship Programs. These programs can provide opportunities for PWD to connect with role models, gain hands-on experience, and develop essential skills for success in STEM fields. Highlighting the achievements of successful PWD in STEM through media campaigns and mentorship initiatives can challenge stereotypes and inspire aspiring students and professionals.
3. Training programs, workshops, and professional development opportunities should be provided for STEM educators and professionals on inclusive teaching practices for disabilities. Collaboration with disability organizations and experts can offer valuable insights to better support PWD in STEM education and careers.
4. There is the need to create extensive awareness campaigns to challenge societal misconceptions, stereotypes, and discrimination towards PWD. Educating teachers, peers, and the general public about the capabilities of PWD can foster a more supportive and inclusive environment in STEM fields. Government policies promoting inclusivity and anti-discrimination measures should be enacted and enforced to eradicate social stigma and discrimination against PWD in STEM.

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