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FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

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THEME:

EMERGING TRENDS IN STEM AND TVET IN  
THE 21<sup>ST</sup> CENTURY

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## Gender Issues and STEM Education in 21<sup>st</sup> Century

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### Abstract

*The history of gender in education and the workforce has shifted over the past decades. Women have made gains in representation, equitable pay, and recognition through awards, grants, and publications. Despite overall change, differences persist in the fields of science, technology, engineering, and mathematics (STEM). This Viewpoints article on gender issues and STEM offers a primary perspective by addressing what STEM is, importance of STEM, what gender and gender issues are, gender issues in STEM, causes of gender issues in STEM and how the issues may be solved. This paper also talks and creativity on stem briefly. The moral issues surrounding equal access aside understanding and addressing the complex issues surrounding gender in STEM are important because of the possible benefits to STEM and society that will be realized only when full participation of all capable and qualified individuals is guaranteed. There is also need to integrate creativity into STEM*

**Keywords:** STEM, Gender, and 21<sup>st</sup>-century

### Introduction

Science, Technology, Engineering, and Mathematics (STEM) is a curriculum based on the idea of educating students in four specific disciplines—Science, Technology, Engineering and Mathematics. In an interdisciplinary and applied approach. Rather than teach the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive learning paradigm based on real-world applications. The acronym STEM was created after many strong similarities and connections between science, technology, engineering, and mathematics were acknowledged (Bequette&Bequette, 2012). STEM incorporates professional and technical support occupations in the areas of life and physical sciences, computer science and mathematics, and engineering. STEM education goes beyond school subjects. It gives a skill set that governs the way we think and behave. Merging science, technology, engineering, and mathematics, STEM education helps us to solve the challenges the world faces today. STEM education gives people skills that make them more employable and ready to meet the current labor demand. It encompasses the whole range of experiences and skills. Each STEM component brings a valuable contribution to a well-rounded education. Science gives learners an in-depth understanding of the world around us. It helps them to become better at research and critical thinking. Technology prepares young people to work in an environment full of high-tech innovations. Engineering allows students to enhance problem-solving skills and apply knowledge in new projects. Mathematics enables people to analyze information, eliminate errors, and make conscious decisions when designing solutions. STEM education links these disciplines into a cohesive system. Thus, it prepares professionals who can transform society with innovation and sustainable solutions.

STEM education prepares the world for the future. It is based on teamwork and collaboration of professionals from different disciplines. As a STEM student, you do not need to be an expert in each particular subject. You rather acquire a mindset that enables you to become a part of the

highly qualified workforce, which functions in collaboration. Teamwork brings a significant increase in productivity, work satisfaction, and profitability. There is a high demand for STEM skills in society. STEM education enables people to make informed decisions within the discussed subject areas. Moreover, STEM awareness is necessary for any job as most industries are more or less connected to science and technology: from an essay writing service and college to a paper company. Thus, such education will allow children to grow into active citizens who can speak up in STEM discussions with sound knowledge of the subject. STEM subjects are focused on providing solutions to the concerns society has today. Human history had seen years of thoughtless exhaustion of natural resources. Such a lack of environmental education led to numerous challenges. These issues affect the health and well-being of all living organisms on our planet. Our environment needs protection. Thus, sustainability became one of the most urgent aspects studied by STEM disciplines.

The world we live in is changing, and we must keep pace with it. STEM education changes society by offering learners a new mindset and skills valued in any profession. They allow young people to be flexible, look for patterns, find connections, and evaluate information. Besides, STEM education raises social awareness. It communicates global issues to the general public. Therefore, STEM opportunities move us to a knowledge-based economy and enhanced sustainability literacy. What separates STEM from the traditional science and math education is the blended learning environment and showing students how the scientific method can be applied to everyday life. It teaches students computational thinking and focuses on the real world applications of problem solving. As mentioned before, STEM education begins while students are very young. Much of the STEM curriculum is aimed toward attracting underrepresented populations. Female students, for example, are significantly less likely to pursue a college major or career. Though this is nothing new, the gap is increasing at a significant rate. Male students are also more likely to pursue engineering and technology fields, while female students prefer science fields, like biology, chemistry, and marine biology. Overall, male students are three times more likely to be interested in pursuing a STEM career.

Many current curricula in going beyond traditional goals, increasingly foster creativity in science classrooms, declaring creativity a core skill of the 21<sup>st</sup> century. For enhancing creativity in science classrooms, the subject Arts is considered to offer a potential way from STEM (science, technology, and engineering, mathematics) to STEAM (STEM with Arts). Creativity can be defined as the formation of new and useful ways to solve a problem. (Sternberg & Kaufmann, 2010). Creativity is the use of imaginations or original ideas to create something, similar to inventiveness, imagination, innovation, originality, individuality, artistry, expressiveness, inspiration, vision, resourcefulness, ingenuity, enterprise. Also, creativity is a phenomenon whereby something somehow new and somehow valuable is formed. STEM and creativity, links science and technology subjects with creative processes. This method are meant to encourage students to seek interdisciplinary, creative ways to solve problems, and to support them in seeking innovative ideas and alternative approaches for addressing complex issues. Biology which is the study of life, also need critical thinking to enhance the understanding of the concept and linking it with STEM. STEM provide the skills and competencies required to support creativity productivity and expression of the innermost self. It is important because it contribute to the development of the country. Even as STEM subjects and skills are becoming more essential in today's World, gender disparities are prevalent in these fields.

In recent years much work have been done to help inspire girls and women also many organization many have organized skill acquisition and funds are been given out as loans to pay at their convenience and free funds were also given to study and inspire them in STEM and biology fields. It can put major constraint in individual life of women and contribute to transmitting gender in equalities across the generation. From an economic perspective, various studies have been shown that combined and diverse themes in organizations in which women and men introduce new skills attitude and perspectives to the work place are beneficial for innovation and the development of organizations.

### **Gender Issues**

Gender according to World health Organization refers to the characteristics of women, men, girls and boys that are socially constructed. This includes norms, behaviors and roles associated with being a woman, man, girl or boy, as well as relationships with each other. Gender issues include all aspects and concerns related women's and men's lives and situation in society, to the way they interrelated, their differences in access to and use of resources, their activities, and how they react to changes, interventions and policies (Eige2014). Gender issues include Gender inequality and discrimination faced by women and girls. These barriers include restrictions on mobility; lack of access to decision-making power; lower literacy rates; discriminatory attitudes of communities etc.

### **Gender Issues in Stem**

Most research have shown that mathematics and science are perceived as male domains, and scientists as predominantly male. Most especially in Nigeria educational system or should I say culture/beliefs that biological sciences is mostly for females. Girls and women remain substantially underrepresented in mathematics, science and technology in schools. Most of the books found around us and in the libraries most of the authors are male, they publish fewer articles, there is extensive yet fragmented, evidence of gender difference suggesting that women are underrepresented in most scientific disciplines and publish fewer articles throughout their carrier and they acquire fewer citation.

Gender difference also exist in STEM disciplines for example more boys go for engineering, medicine, ICT manufacturing industries, etc. while girls go for biology courses, educational courses and Art related courses such as journalism, mass communication, etc. Girls show more interest in STEM at their tender age but once they are married and begin to have kids and other marital issues their interest decreases. Most men have higher interest in STEM and mostly to go further in biology courses. During my undergraduate days at Ahmadu Bello University, zaria most of the doctors and professors were men. Ladies vacate stem courses mostly at the university level, in secondary schools most of them only offered the subjects because it was made compulsory for them. Elementary school teachers are mostly predominant females, and many are anxious in teaching biology which can lead to lower achievement in biology.

### **Some of the Causes of Gender Issue in STEM**

Gender issues which include Gender inequality are initiated by the following reasons. Some dedicated and committed women according to Francisca (2019) lack confidence in themselves. Also lack of opportunities and encouragement from those around them. Rachel (2020) pointed out a number of reasons for women's and girls' low levels of engagement in STEM, stereotypes within schools and families of boys being better at science and mathematics or more likely to succeed in

STEM-based jobs; perceptions that heavily male-dominated STEM careers are not suitable for women; and continued attitudes in some cultures that investing in education is more important for boys than girls. Moreover some of the topics which are difficult in biology are been skipped and some male teachers skip them too.

### **Difficulty in learning biology**

Biology is a subject that is difficult to learn because of its abstract nature. The difficulty affects student achievement. In addition, the difficulty makes students less motivated to learn the subject. As a result, it is hard for them to achieve a good result of their studies. Biology covers some topics that are considered difficult to learn. According to Cimer(2012), there are five topics that are the most difficult, which are: matter cycles, endocrinesystem and hormone, aerobic respiration, cell division, and genetics found for the learning difficulty. Cimer (2012) explained that the nature of the topic, teachers' style of teaching, students' learning habit, students' negative feelings and attitudes towards the topics and lack of resources were the main cause of students' concern to study biology. Any improvement that is related to learning habit, teaching style and attitude will help students to learn biology. For example, cell division process consists of two different processes. Therefore, teaching the subject requires appropriate method. The use of supporting materials, like model, graph, and video and laboratory activities can be used to overcome these difficulties, although it did not necessarily mean that it increased students' creativity.

### **How to Resolve Gender Issues In Stem**

In recent years much work have been done to help inspire girls and women also many organization have organized skill acquisition and funds are been given out as loans to pay at their convenience and free funds were also given to study and inspire them in STEM and biology fields. Also, some of the leaders in Niger state and other states also give their indigenes scholarships and some annual funds which inspires the youth.

More STEM courses facilities should be introduced in our state universities to encourage the ladies to further more in STEM cures. After marriage most women find it hard to return back to school but once they have the STEM at their door step it encourages them and they find it easier. According to Francisca(2019), strategies that could be employed to attract more women in STEM include; Encouraging women in STEM to engage in international and national collaborative scientific research particularly with more advanced countries. Involving female scientists in Nigeria in the development of STEM policies. Encouraging young girls to develop an interest in STEM and empowering women through ICT. Exploring online engagement to strengthen participation and awareness. Sponsoring Ideas to foster creativity in learning biology

### **Creativity in STEM**

Creativity is a highly-desired skill in our world of rapid change and ever-increasing social, emotional, and intellectual demands. Content knowledge is not enough to be successful today; one also needs to determine how to use knowledge in novel and efficient ways. Educators have recognized the value of creativity and, consequently, have included it in the 21st century skills list. The parable that the arts are creative and the sciences are quantitative forms the way we approach education. And that can be a problem because the skills that come with creativity are necessary in STEM (science, technology, engineering, and math) fields too. It's not that we didn't

already value creativity, but understanding it as a core competency in science is a new idea for some of us. Alison (2020).

The acronym STEM was created after many strong similarities and connections between science, technology, engineering, and mathematics were acknowledged (Bequette&Bequette, 2012) and became the base for the interdisciplinary approach to teaching STEM subjects (Kubat&Guray, 2018). Interdisciplinary approaches allow teachers to create learning opportunities that mimic real life situations that are often complex and ill-defined. This pedagogical tactic has been shown to foster creativity in students (Kubat&Guray, 2018; Roberts, 2015). An interdisciplinary approach to teaching STEM subjects also provides students with increased motivation because authentic learning opportunities are meaningful and have a clear purpose to which students can relate. Interdisciplinary projects promote the use of problem finding, problem solving, analysis, synthesis, and other 21st century skills including creativity (Kubat&Guray, 2018).

Based on research on creativity in learning biology, it was found out that there is a need to integrate different finding of research across different subjects (Dunbar, 1997; Lawson, 2001). De Haan (2009) put emphasis on integrating material across subject areas. It was supported by both Dunbar (1997) and Lawson (2001) that suggested analogy as a way to connect different ideas to enhance creativity among students of biology.

Another suggestion for enhancing creativity was proposed by Mumford (2010) and Dunbar (1997), regarding unexpected finding of a research activity. Those unexpected finding, like any result of experiment that is different from what was expected, may lead to a new alternative for a certain problem. It will be a new thing that can be useful in certain situation. It can be applied in educational setting, as it can help student to find out a solution.

1. Creativity needs to be taught to students, in order to learn biology better. Torrance (1972) pointed out that creativity involves skills, beside motivation. Therefore, the skills have to be taught to students, so the students can think creatively.
2. Images of female mathematicians or scientist should be shown or added throughout classroom materials and assigning individual or group work that summarizes women achievement in this subject and can also shift perceptions about who belongs.
3. We will advise Nigeria to nurture and empower people of all gender to pursue STEM in order to literally make the world a better place. Women who pursue STEM bring unique talent since they love glitters and other enticing things.
4. Secondary school students should be connected to a role model and STEM activities to inspire them.

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