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The Challenges of Science, Technology Engineering and Mathematics (Stem) Educators in Skill Development for a Sustainable National Development

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ABSTRACT

The study focused on the challenges of Science, Technology,Engineering and Mathematics (STEM) educators in skill development for a sustainable national development. The study area was Anambra State in Nigeria. A simple random sampling technique was used to select 300 Science, Technology, Engineering, and Mathematics lecturers: 100 lecturers from each of the three higher institutions (Nnamdi Azikiwe University Awka, Federal College of Education (Technical) Umunze and Federal Polytechnic Oko) all in Anambra State, Nigeria. The research instrument used was a questionnaire containing 23 items. The results of the findings show that Science, Technology, Engineering, and Mathematics educators are not adequately motivated in terms of the condition of services. The infrastructural facilities and teaching aids are inadequate. Competency is a must for effective teaching of STEM in our schools. It was recommended that STEM educators should be equipped in terms of enumeration and skill for the attainment of sustainable development.

Keywords: Skills acquisition, STEM, Sustainability, Development

INTRODUCTION

The cornerstone of human progress is education. It is one of the most important tools a country can use to improve all of its economic and political conditions for sustainable growth and to enable its population to become fully enlightened. It makes sense that Okonkwo (2019) claimed that education is the center around which all other progress is centered. This implies that for any country to develop quickly, the administration and planning of education must receive sufficient attention. Education, according to Uwazurike and Anokam (2022), is any action or encounter that shapes a person's character, mentality, or physical capabilities. It is the act of teaching or learning values, beliefs, habits, skills, and knowledge. It is also the culmination of all the procedures that kids go through to acquire skills, attitudes, and other valuable behavioral traits of society. Because of this, education is a vital instrument for human existence and, in the grand scheme of things, should be given top priority among all nations, including Nigeria.

The goal of education, especially science education, is to instill in the youth of any country the values, information, and skills necessary for them to blend in and responsibly contribute to the growth of their communities and countries. This opinion aligns with the principles of Nigeria's

educational philosophy as stated in the FRN (2013) that education is a tool for social change and national development.

The overarching objectives of science education align with the principles of Nigerian educational philosophy. Science is defined by Obialor et al. (2020) as the procedures by which concepts about the natural world that have been developed over time and are supported by empirical data are produced. Nigerian educational authorities have long been concerned about the quality and usefulness of education, particularly in the twenty-first century. This is most likely as a result of the increased interest in education around the world due to the Millennium Development Goals (MDGs), which aim to eradicate poverty worldwide

Education is the key factor in civilization and development of any nation and attainment of sustainable development which is the major aim of any nation that needed development. This can only be achieved through judicious combination and utilization of Science, Technology, Engineering and Mathematics (TEM) education. There are numerous ways that STEM education improves the quality of life, including through advancements in energy production, transportation, agriculture, health, nutrition, and industrial expansion. Science, Technology, Engineering, and Mathematics Education is an interdisciplinary approach to education where students apply science, technology, engineering, and mathematics in contexts that connect the world, global enterprise, and the school community Okolo (2023). Students can acquire literacy in science, technology, and math as a result, giving them the competitive edge in the new economy.

STEM benefits society to a position of self-sufficiency where it can provide basic needs as sufficient food, satisfactory shelter, transportation and communication that are cheap and easily available to all which is part sustainability goal of any nation.

STATEMENT OF THE PROBLEM

Nation-building, development, and economic emancipation all anchor around a well-established STEM education, which depends on the quality of the educators and other non-human variables. Abudulrahaman (2014), stated that no education system can rise above the quality of its teachers; the teachers translate the curriculum into practice, illustrating effectively teaching methods and strategies with realistic examples of how-to-do. What a teacher knows and can do, makes a great difference. What he cannot do, can be an irreparable loss not only to the child, but also to the nation and indeed in the posterity.

These challenges include material and non-material resources. According to Agu and Oliobi (2020), resources are the vast range of human and non-human variables used to facilitate the effectiveness of educational programmes. Challenges facing STEM educators in contributing towards the attainment of national sustainability, according to Ugo and Akpoghol (2016). Agu and Oliobi (2020) include a lack of qualified personnel, poor remunerations, payment of teachers' salaries, lack of funds to equip science laboratories, lack of textbooks, inadequate mastery of subject areas, and corruption, among others. Hence, the quality and pace of technological advancement, which is the catalyst to the attainment of a suitable economy as well as the development of human capital of any nation, is dependent on the quality and efficiency of the teachers.

LITERATURE REVIEW

Problems of STEM Education in Nigeria.

***Delivering instruction in a big class size*:** The ExperienceLesson Delivery in Large Class Size: Classes are overcrowded as a result of the UBE program's exponential enrollment. STEM requires pupils to participate in hands-on activities. Aina (2022) underlined that the laboratory is where all scientific learning must start and finish. They define the laboratory as a setting where students investigate issues, develop and test related hypotheses, and eventually uncover previously undiscovered ideas. Most of the time, teachers only complete practical two or three weeks before external exams like the SSCE because they are too busy juggling their teaching and laboratory support responsibilities due to the overcrowded classrooms and lack of laboratory support staff. This state of affairs will hurt overall productivity.

Deficient curriculum: It is past time for Nigeria's teacher education programs to be reviewed. The deficiencies observed in certain graduate instructors appear to be the result of a misalignment between the needs of the secondary school curriculum and teacher education programs. Agboola (2021) stated that the existing minimal requirement for the nine-year basic education curriculum appears to be insufficient at the College of Education level. For the UBE curriculum to be delivered effectively, the majority of N.C.E. graduates are unable to fit into the new Basic Education classroom, according to Aina (2022). According to Taiwo et al. (2022), there is a significant discrepancy between the education that most students receive in higher school and the abilities needed in the modern business. Teachers should instruct students under their training (Abdulraheem-Mustapha, 2021).

Poor teacher supply : STEM teachers are in short supply in Nigeria. In rural schools, the scarcity is even more severe. [14] stated that the proportion of instructors in rural areas is extremely low. According to Taiwo et al. (2022), one teacher is forced to teach almost all of the pupils in that subject at the school due to a lack of teachers, which renders the teacher exhausted every day and unable to function effectively. For this reason, most educators steer clear of student-centered instructional methods, including projects, field trips, excursions, and demonstrations. Their preference is for teacher-centered approaches, which are ineffective when teaching science.

Teacher incompetent. Some of the teachers in our schools today are extremely incompetent; they lack both pedagogical and content knowledge because they were careless during their undergraduate studies, and now they find themselves in classrooms where they are unable to provide instruction. These professors showed a significant degree of compromise throughout their undergraduate years, according to Abdulraheem-Mustapha (2021). They rejoiced with great fervor and pleasure when they received a score of 39% or 40% on an exam that was graded as 100%. Instead of teaching, these educators cheat and damage the profession's reputation.

***Unavailability of teaching facilities*:** The facilities and instructional tools required for efficient teaching and learning are lacking in Nigerian schools (Aina, 2022). The majority of schools, particularly those in rural areas, lack lab space and the required supplies. Teachers are only able to improvise so much. Problems with packed classrooms, the need to source and prepare instructional materials at every stage, and occasionally, administrative tasks make things extremely difficult.

Poor condition of service: Teachers need to be accorded respect and honour for the work they do. It is observed that teachers work in harsh conditions. A reassessment of Nigeria's teacher education

programs is long overdue. Some graduate instructors have deficiencies that appear to be caused by a misalignment between the needs of the secondary school curriculum and teacher preparation programs. Aina (2022) stated that the nine-year basic education curriculum appears to be insufficient with the present minimum norm at the College of Education level.
In the case of science teachers, no recognition is given. In some states, they are paid peanuts, e.g ₦1000.00 as science allowance. This uncompensated working condition does not motivate teachers, and so they can choose to do their work haphazardly (Abdulrahaman, 2014).

RESEARCH QUESTIONS

The following research questions guided the study

1. To what extent are the conditions of services of STEM educators motivating for effective instruction delivery for skills development?
2. To what extent are infrastructural facilities available for teaching STEM in schools
3. To what extent do STEM educators' competencies and self-efficacy affect skill development for a sustainable economy?
4. To what extent do STEM educators' qualifications and adequate numbers affect skill development for a sustainable economy?

Hypothesis

Ho_1: There is no significant relationship in the mean responses of STEM Educators among the three institutions

Ho_2: There is no significant difference in the mean response score among genders of the challenges faced by STEM Educators.

METHODOLOGY

Research design

The study was a survey research design. The area of the study was all the federal government higher institutions in Anambra state: specifically, Nnamdi Azikiwe University Awka, Federal Polytechnic Oko, and Federal College of Education (Technical) Umunze, all in Anambra state, Nigeria. The population of the study includes all the lecturers in Nnamdi Azikiwe University Awka (Faculty of Physical Sciences), Federal Polytechnic Oko (School of Applied Science and Technology), and Federal College of Education (Tech.) Umunze (School of Science Education and School of Industrial Technical Education). A total of 300 STEM lecturers were selected from the three Higher institutions, 100 from each institution, using simple random sampling by balloting.

Table 1: Distribution of the sample of the study

Institution	Male	Female	Total
University	58	42	100
Polytechnic	38	62	100
Colleges of Education	35	65	100
Total	131	169	300

Instrumentation

Questionnaires were used to collect information from the respondents on the four research questions. In order to determine the degree of acceptance and rejection of each of the items, four-point nominal values were assigned to the researcher's designed scale. The instrument was validated by three experts in science education. The instrument was trial tested with 20 lecturers to determine the internal consistency reliability test. A reliability coefficient of 0.82 was obtained and considered adequate for the study.

Data collection

Administration and collection of the questionnaire were done by a direct approach.

Data Analysis

The data collected were analyzed using descriptive statistical tools of mean, percentage, and histogram to answer the research questions. While ANOVA was used to test the hypothesis at a 0.5% level of significance

Model

The model below was developed to help in the analysis of the work

$\mathbf{ST = \alpha + \beta_1 x + \beta_2 x + \beta_3 x + \beta_4 x}$

Where β_1 **= (condition of services)**

β_2 = (availability of infrastructural facilities)

β_2 (adequacy of STEM teaching staff)

β_2 = (poor mastering of content)

RESULTS

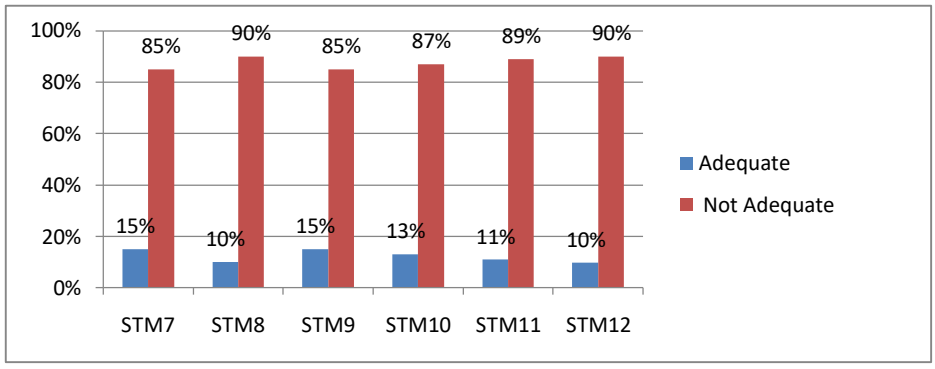

Figure 1: The response of STEM educators on the extent to which the conditions of services are motivating for effective instruction delivery for skills development

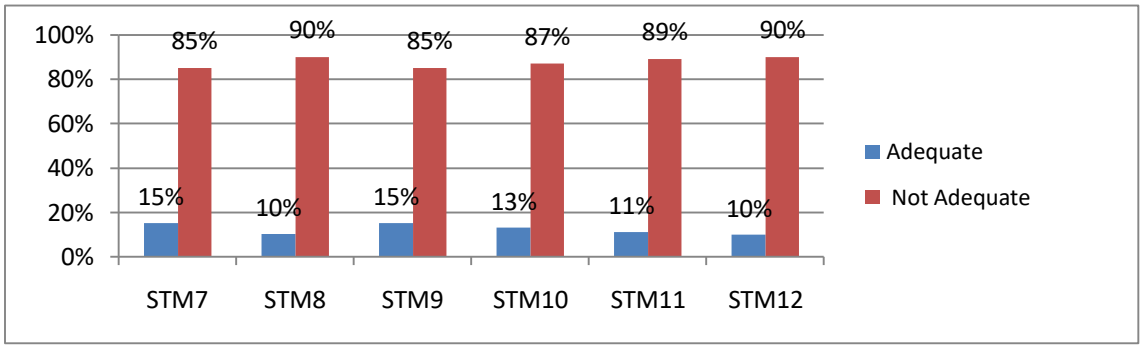

Figure 2: Response on the infrastructural facilities available for teaching of STEM in schools

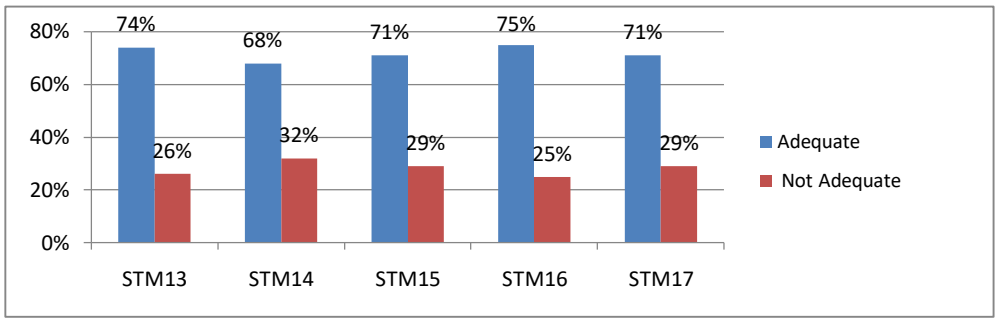

Figure 3: Response on the adequacy of STEM teaching staff in schools

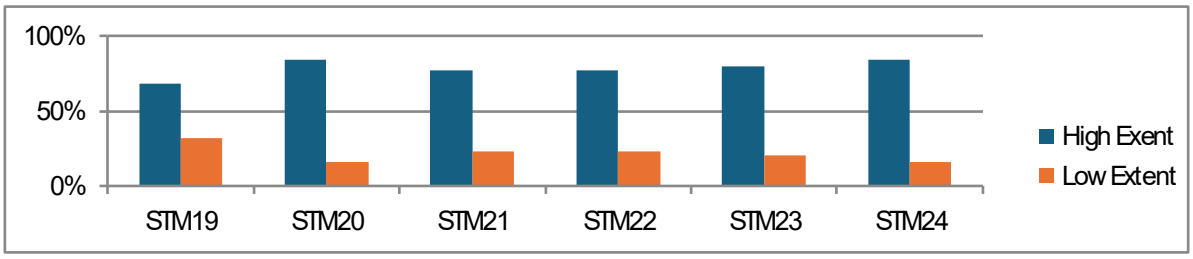

Figure 4: Response on the extent to which poor mastering of content, inadequate/poor lesson preparation and delivery pose a threat to skill acquisition to the attainment of sustainable national growth and development

The summary of the analysis of the challenges facing STEM educators in the research are presented in Table 2 below.

Table 2: Summary Output

Multiple R	0.9155952
R Square	0.8506937
Adjusted R Square	0.8136746
Standard Error	0.5169603
S Observations	300

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	4	3.003171	0.750793	2.809349	0.025834
Residual	295	78.83814	0.267248		
Total	299	81.84131			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	3.9626019	1.189945	3.330072	0.000979
X Variable 1	-0.178824	0.353114	-0.50642	0.01294
X Variable 2	-0.036549	0.321523	-0.11368	0.095727
X Variable 3	0.1329608	0.16533	0.804214	0.019208
X Variable 4	-0.869033	0.28397	-3.0603	0.002415

	Lower 95%	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.620745	6.304458	1.620745	6.304458
X Variable 1	-0.87377	0.516118	-0.87377	0.516118
X Variable 2	-0.66932	0.596221	-0.66932	0.596221
X Variable 3	-0.19242	0.458337	-0.19242	0.458337
X Variable 4	-1.4279	-0.31017	-1.4279	-0.31017

DISCUSSION

The results in Figure 1 indicate that the conditions of services are not motivating for effective instruction delivery for skills development, as all are below 20%.. This might explain why Aina (2022) stressed that nonpayment of science teachers' allowance and poor remuneration make it extremely difficult for the teaching profession to attract and retain the top-quality personnel that is needed in the system

This is in line with Aina (2022), who in their study viewed inadequate material as a threat to the actualization of sustainable national growth. Figure 2 shows that the infrastructure and instructional materials available in schools for effective teaching of STEM for skill development for a sustainable economy are inadequate. STEM laboratories are absent in most schools, and even when they are available, they are ill-equipped.

There are enough certified STEM teachers employed in schools, per the results shown in Figure 3. This implies that there are enough people on hand to instruct STEM in classrooms. This stands in contrast to the findings of Taiwo et al. (2022),who highlighted that STEM teachers are in short supply in the majority of schools and that these courses are often taught by unqualified

teachers. The most current government policy on science and technology may have included the necessary amount.

According to the findings in Figure 4, achieving a sustainable economy depends mostly on STEM educators' proficiency in their subject areas, lesson planning, and delivery. The model worked well for the study. The adjusted R-squared of 0.81 demonstrated this. The equation for the regression model becomes

$$\mathbf{ST = 3.96 – 0.17x_1 - 0.04x_2 + 0.13x_3 -0.87x_4}$$

The F value of 2.08 at a 0.5% level of significance was less than the table value of. Hence, the null hypothesis was rejected

Since **Significance F; 0.025** $\leq$ 0.05, we reject the null hypothesis, concluding that there is a statistically significance relationship in the mean responses of STEM Educators among the three institutions. Hence the condition of service, infrastructural facilities, adequacy of STEM teaching staff and mastering of content,all affect the teaching of STEM

CONCLUSION, LIMITATION AND RECOMMENDATION

This paper examined the challenges of Science, Technology, Engineering, and Mathematics (STEM) educators in skill development for sustainable national development in Nigeria. The paper was able to show that STEM educators' salaries are poor and do not motivate them to work hard. The infrastructure facilities in schools are inadequate for effective teaching and learning of STEM. On the other hand, the personnel to achieve transformable STEM skills for sustainable national development in Nigeria are adequate. The major problem here is the non-human resources that are inadequate.

To overcome these challenges, the government of Nigeria should ensure that incentives, science allowances, and motivating salaries are given to STEM educators in due course to serve as an encouragement. Proper inspection and supervision of STEM educators should be carried out from time to time by the appropriate agencies to make STEM more productive. The problem of funding education should be addressed in the national budget. Hence, money meant for education should be provided to the appropriate agencies for the provision of infrastructural facilities and the procurement of modern teaching aids.

However, there are several limitations to the current study that can be addressed in future research. A few of these restrictions are representativeness and sample size, which could affect how broadly the results can be applied. Including a more varied sample of professors in the institutions can improve the results' volatility and applicability. Engineers and technologists should not be categorized as one.

Finally, the development and dissemination of empirically verified professional development progress for STEM educators can improve the performance of the present generation of teachers and increase their students' interest in skill acquisition for sustainable national development.

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