
BIOLOGY TEACHERS PERCEPTION OF THE CHALLENGES OF THE APPLICATION OF STEM EDUCATION RESEARCH IN CLASSROOM DELIVERY IN THE FCT

Dr (Mrs) S.S.Tamanuwa

FCT Universal Basic Education Board, Garki, Abuja, Federal Capital Territory, Nigeria.

Dr. (Mrs) B. C. Urieto

FCT Education Resource Centre, Zone 7 Wuse Abuja, Federal Capital Territory, Nigeria.

ABSTRACT: *The study investigated biology teachers' perception of the challenges of the application of STEM educational research in classroom delivery in the FCT. A survey was designed for the study and the population comprised of 100 biology teachers in the Senior Secondary Schools (SSS) in FCT. Questionnaire developed and validated by the researchers was used in collecting the data. Research questions were answered using mean and standard deviation. The study revealed that biology teachers in FCT have little knowledge of STEM research outcome, some are not able to assess them and do not employ them as instructional strategy in biology teaching and learning.*

KEYWORDS: *biology teachers, stem education, research, classroom delivery, FCT*

INTRODUCTION

According to Hom (2014) STEM is a curriculum that is based on the idea of educating students in four specific disciplines. Rather than teach the four disciplines as separate and discrete subjects, it uses an interdisciplinary and applied approach that integrates them into a cohesive learning paradigm based on real-world applications. The four specific disciplines are science, technology, engineering and mathematics and 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 also teaches students computational thinking and focuses on the real world applications of problem solving where rigorous academic concepts are coupled with real-world problem-based and performance-based lessons. At this level, STEM education exemplifies the axiom "the whole is more than the sum of the parts." It is also advisable that STEM education should begin while students are very young. Before the use of technology in the teaching and learning process, the teacher is the custodian of knowledge and disseminate to the students only what he/she have in order words the process was teacher centred. However with the adoption of technology in the classroom teachers now focus attention upon their students. The teaching and learning process is now students centred. They want to know what impact it will have on students' learning outcomes and most teachers use technology because it motivates students and offers a different mode of presentation.

Consequently successful technology adoption in teachers' classrooms is dependent upon school administrators providing an individualized, differentiated process of training and implementation. Teachers' technology beliefs are influenced by their philosophy. Resistance to adopting new technologies stem from teachers' existing teaching beliefs such as 'one size

fits all' approach that meets the needs of only a few participants". Teachers must see how technology fits within their localized classroom setting and be willing to change their role in the classroom to those of facilitators and students take a proactive role in learning. Often, this change of teaching philosophy and methods focuses on learners-centred teaching and constructivist teaching practices and Teachers use multiple pedagogical strategies to transform their knowledge of the subject content into a form that can be easily understood by learners. Okoye and Okechukwu, (2010).

The National Policy on Education (Federal Republic of Nigeria, 2004) had advocated improvements in the teaching and learning of Science, Technology and Mathematics (STM) in order to create the foundation of technologically oriented workforce in line with the needs of national development. Learning biology as well as other sciences is, therefore, becoming more essential not only for the well-being of the individual, but also for the entire society. Biology occupies a special position in the senior secondary school curriculum in Nigeria. In the National Policy on Education (FRN, 2004), each senior secondary school student is expected to study at least a science subject (one of Biology, Chemistry, Physics or Health science). In FCT Biology is mostly registered for in the Senior Secondary School Certificate Examination (SSCE) of West African Examination Council (WAEC) and National Examinations Council of Nigeria (NECO). WAEC Annual Report Analysis have shown that students perform poorly in science subjects including biology. The results of biology in Senior Certificate Examination for a period of 14 years (2000-2013) have an average percentage of passes at credit level is only 40.72% while the average percentage of failure is 59.28% (Tamanuwa, 2014). Some authors have investigated reasons for students' low achievement in biology. Among the reasons were teachers' instructional techniques and students' inability to understand lessons, large class size, overloaded curriculum, excess work load, students' feelings towards biology, inadequate learning facilities and low teacher quantity and quality etc. (Ukpai & Ezeaghasi, 2007; Imhanlahimi & Aguele, 2006). These problems may have limit the effective teaching and learning of biology.

Accepted methods to overcome poor academic achievement in science have included the promotion of more effective teaching strategies and creation of more positive attitudes towards the learning of science. It has also been accepted that an effective strategy for achieving better examination results was to create and maintain more effective learning environments through the development of more student-centred classrooms and greater reflectivity in Classroom interaction of biology teachers refers to the whole range of activities and experiences through which teachers; curriculum, materials, and learners interact. It has to do with the interactive processes through which teachers' implement the curriculum and impart learning to students using available materials. Studies have shown that teacher classroom interactions is central to effective curriculum implementation as it has a strong influence on students' learning outcomes (Okoye and Okechukwu ,2010)

Onwuachu and Nwafor (2009) reported that students' perceptions of their teacher classroom interactions influenced attitudinal outcomes, adding that where students perceive teachers as initiating satisfactory classroom interactions, their feelings, motivation and attainment in the biology curriculum, were positively affected. This inadequacy of teaching material resources, laboratory equipment / reagents / chemical, and laboratory space, has been of serious concern to educators. The decline in performance in STEM may not be unconnected with poor learning

environment created by this state of infrastructure facilities also emphasized that the availability and adequacy of these facilities promote effective teaching and learning activities in schools while their inadequacy affects the academic performance negatively.

Several efforts have been extended by Science Teachers Association of Nigeria (STAN) to train secondary school teachers on improvisation techniques and the use of new innovative teaching strategies in various science subjects including Biology, hence there is need to evaluate how far teachers have been able to imbibe the use of these teaching strategies such as concept mapping. Problem solving, cooperative and individualised computer assisted instructional strategies etc. for effective teaching and learning process. Moreover, a careful consideration of the statistics of contribution of STEM in Nigeria reveals low application of STEM education research in classroom delivery even with the evidences from the research results that showed significant difference in the performance of students taught using the above teaching and learning process than the traditional method. If all the biology teachers will use some of these STEM education research in classroom delivery with the required enabling environment there would be a significant achievement in the teaching and learning of biology in the FCT and Nigeria in general.

The Permanent Secretary, Federal Ministry of Education, Abuja, Dr. MacJohn Nwaobiala, has reiterated the Federal Government's commitment to the effective teaching of Science, Technology, Engineering and Mathematics (STEM) subjects in the country when Speaking to reporters in Lagos recently at the 44th Inter House Sports Competition of Federal Science and Technical College (FSTC) Yaba, Nwaobiala said Education Minister, Mr. Ibrahim Shekarau remains committed to improving the quality of teaching, and ultimately learning outcomes in schools across the country, with emphasis on STEM subjects. He said the ministry was aware of the dearth of STEM subject teachers across the country, adding that through its adjustment methods, all the issues would be systematically addressed.

Nwaobiala hinted that in addition to adopting new approaches to tackle STEM challenges, the ministry is also working out feasible modalities to improve teachers' lot and restore their respect, dignity and status in the country. He added that STEM is the area they are focusing on now to ensure our children receive quality training in these core subjects. "We cannot give enough as required by the schools. But what we are trying to do is to make some adjustments. For instance, we try to strike a balance between computer science teachers and pure science teachers so that a teacher that teaches computer science as his/her core subject, can also be retrained to teach science, we are trying to make some adjustments, and the challenges are there, but we want to make the best use of what we have. It is a deliberate policy. There is a focus on not art or social sciences, but on these core subjects," he said. As reported By Ujunwa Atueyi on February 25, 2015 of the Guardian Newspapers.

Statement of the Problem

In spite of the fact that STEM education is an important tool in enhancing science and technology development of a nation, the teaching and learning of STEM subjects at secondary schools is facing the challenges of poor enrolment, students' lack of interest, poor performance. To remedy these challenges, researchers in STEM education have come up with innovative teaching and learning methods proving to be effective in improving learning outcomes in STEM education. The study investigated biology teachers' awareness of STEM education

research, and the challenges they encounter while applying these STEM researches in classroom delivery.

Purpose of the Study

The study was designed to (1). find out biology teachers' perception of the challenges of applying STEM educational research in classroom delivery. (2). To possible relations between teachers' perceptions and selected characteristics like training and the gender of the teacher.

Research Questions

Specifically the study sought answer to the following questions:

1. How do the secondary school biology teachers perceive the challenges of the application of STEM educational research in classroom delivery?
2. Are biology teachers trained in the use of the application of STEM research in classroom delivery?
3. To what extent do male and female biology teachers differ in their perception of these challenges of the application of STEM education research in classroom delivery?

METHOD

The method used for the study is a survey design. The study was carried out in secondary schools in the FCT (Federal Capital Territory) Abuja, Nigeria. The FCT presently has 59 public senior secondary schools. The population covered the entire 354 biology teachers (141 males and 213 females) in public secondary schools in the FCT there was no sampling, the entire population of biology teachers was used for the study. The instrument for data collection was 22 items structured questionnaire on a 4- point likert type scale which was weighted as follows. Strongly agreed(SA)=4; agree(A)=3; disagree(D)=2 and strongly agreed (SD)=1, developed by the researchers. The researchers' developed questionnaire was validated by three science educators. The questionnaire was validated and had a reliability coefficient of 0.72. The questionnaire was made up of two parts; part1 and part2. Part 1 contains items on personal data of the respondents while part 2 contains items that address the research questions. A total of 120 questionnaires were administered directly to the teachers in their various schools with the help of research assistant, but only 100 questionnaires were retrieved and used for data analysis. Mean and standard deviation were used for the data analysis.

RESULTS

The data obtained with the questionnaire were analysed and used to answer the research questions and summary of the findings are presented in tables below:

Research question 1: How do the secondary school biology teachers perceive the challenges of the application of STEM education research in classroom delivery?

TABLE 1: Mean and standard deviation of biology teachers perceived challenges of applying STEM education research in classroom delivery.

S/N	ITEMS	MALE MEAN	SD	FEMALE MEAN	SD	DECISION
1	Using STEM educational research outcomes in classroom delivery is difficult	2.6	1.58	2.6	1.6	A
2	Using the STEM educational research outcomes takes more time	2.7	1.6	2.7	1.6	A
3	Using the STEM educational research outcomes takes less time	2.0	1.4	2.1	1.5	DA
4	Using stem research outcomes makes it difficult to control the class	1.7	1.3	1.6	1.2	DA
5	Using STEM outcome makes lesson planning more difficult	1.8	1.3	1.5	1.2	DA
6	Getting the resource materials to implement stem research outcome makes it more expensive	3.0	1.7	3.0	1.7	A

From table 1, the mean ratings of the respondents scored up to the acceptable mean of 2.5 or above in items 1, 2 & 6 which indicated that the respondents agreed with the statements in the questionnaire while the mean ratings of the respondents scored below the acceptable mean of 2.5 are seen in items 3, 4 & 5 indicating the respondents disagreement with the statements in the questionnaire. Thus indicating the level of the biology teachers perceived challenges in the application of STEM research outcomes for classroom delivery.

Research question 2: Are biology teachers trained in the use of application of STEM research in classroom delivery?

TABLE 2: Mean and standard deviation of biology teachers' skills in the use of STEM research outcomes.

S/N	ITEMS	MALE MEAN	SD	FEMALE MEAN	SD	DECISION
1	You need technical support	3.0	1.7	3.0	1.7	A
2	Using the STEM research outcomes depends on the teachers level of acquired skills and qualification	1.7	1.3	1.4	1.2	DA
3	Using the STEM research outcomes makes my lesson more diverse	3.0	1.7	4.0	1.9	A
4	Helps me to discuss teaching ideas	3.3	1.8	3.1	1.8	A
5	You have adequate skill in the use of stem research outcome in classroom delivery	2.3	1.5	2.1	1.5	DA
6	It gives more confidence	3.3	1.8	3.4	1.8	A
7	I have not use STEM research outcomes for my classroom delivery.	3.0	1.7	3.0	1.7	A

From table 2, items 1,3,4,6 & 8 have mean ratings that are above the cut-off point of 2.5 for the respondents respectively. Thus, the respondents were perceived to agree with the statements on the questionnaire. However, items 2 and 5 have mean ratings below the cut-off point of 2.5. Thus, the respondents were perceived to disagree with the statement on the questionnaire.

Therefore biology teachers need to be train and re-train in the use of application of STEM research in classroom delivery.

Research question 3: To what extent do male and female biology teachers differ in their perception of these challenges of the application of STEM education research in classroom delivery?

TABLE 3: Mean and standard deviation of the extent to which male and female biology teachers differ in their perception of the application of STEM research outcomes in classroom delivery.

S/N	ITEMS	MALE MEAN	SD	FEMALE MEAN	SD	DECISION
1	Many of these research outcomes are accessible	1.7	1.3	2.1	1.4	DA
2	Using the STEM research outcomes makes my lesson more interesting	3.2	1.7	2.9	1.7	A
3	Using the STEM research outcomes increases students motivation	2.8	1.7	2.8	1.7	A
4	Using the STEM research outcomes reduces students motivation	1.5	1.2	1.3	1.1	DA
5	Using STEM research outcome makes my teaching or lesson more enjoyable	3.3	1.8	3.1	1.8	A
6	Makes my lesson delivery participatory to the students	3.7	1.9	3.3	1.8	A
7	Restrict the coverage of the content of the lesson	2.3	1.5	2.4	1.5	DA
8	Using the STEM research outcomes improves presentation of material for my lesson	4.0	1.9	3.0	1.7	A
9	Helps to cover the content of the lesson easily	2.8	1.7	2.7	1.6	A

From table 3 items 2, 3,5,6,8 & 9 have mean ratings that are above the cut-off point of 2.5 for both male and female respondents respectively. Thus, the respondents were perceived to agree with the statements on the questionnaire. However, items 1, 4 and 7 have mean ratings below the cut-off point of 2.5. Thus, the respondents were perceived to disagree with the statement on the questionnaire. This indicates that both male and female biology teachers do not differ in their perception of these challenges of the application of STEM education research in classroom delivery.

DISCUSSION

The findings of the study revealed that most biology teachers in FCT have little knowledge of STEM research outcomes, for some of the teachers that have the knowledge, are not able to assess the STEM research outcomes while those who could assess do not employ them as instructional strategy in biology teaching and learning. However, all the biology teachers agreed to the challenges of the application of STEM research outcomes in classroom delivery. Teachers also agreed that they need to be train and re-train in the application of STEM research outcomes in classroom delivery. However, both male and female biology teachers do not differ in their perception of these challenges of the application of STEM educational research in classroom delivery as shown in the data analysis of table 3.

RECOMMENDATION

1. Biology teachers should be train to face the challenges of using STEM research outcomes for classroom delivery
2. Biology teachers should be encourage to have access to the STEM research outcomes and use them in their classroom delivery
3. All the STEM educational research outcomes should be made available at the Educational Resource Centre for easy access to the biology teachers.

References

- Atuenyi . U (2015). Government to tackle STEM Subjects Challenge with new Approaches
The Guardian Newspapers publication of 15 February 2015
- Federal Republic of Nigeria, (2004). *National Policy of Education Fourth Edition*. NERDC press
- Hom. E.J.(2014). What is STEM Education? Live Science Contributor. Retrieved from
[http:// www.livescience.com/43296](http://www.livescience.com/43296)
- Imhanlahimi, E. O & Aguele, L.I. (2006). Comparing three instruments for assessing biology teachers' effectiveness in the instructional process in Edo State, Nigeria. *Journal of Social Sciences*.13(1): 67-70
- Okoye,N. S., & Okechukwu, R.N (2010). The Effect of Concept Mapping and Problem Solving Teaching Strategies on Achievement in Biology among Nigerian Secondary School Students. *African Journal of Educational Studies in Mathematics and Sciences*.
- Onwuachu, W. C. & Nwafor,. O. (2009). Students' Evaluation of Classroom Interactions of Their Biology Teachers: Implications for Curriculum Implementation (pp. 349-361)
An International Multi-Disciplinary Journal Vol. 3 (1), (Online): www.afrevjo.com
- Tamanuwa.S.S (2014). The Relative Effect of Co-operative and Individualised Computer Assisted Instructional Strategies on Secondary School Students' Achievement and Retention in Genetics. An Unpublished Ph.D. Thesis, Faculty of Education, Nasarawa State University Keffi.
- Ukpai, K.U., & Ezeaghasi, E.N. (2007). Review of factors which influences the attitudes of Students towards effective study of biology in senior secondary schools in Nigeria. *Nigerian Journal of Science and Education Research*, 1 (1), 239-246