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TEACHING SUBJECT CHALLENGES AND AREA OF TEACHING SUBJECT: IMPLICATION FOR SECONDARY SCHOOL SCIENCE, TECHNOLOGY AND MATHEMATICS TEACHERS

Babayemi, John Olakunle[1] ; Itighise, Atim Edet[2] ,Umanah, Felicia Imeh[3] & Abasi, Andrew Umo[4] & Umoh, Etim Bassey[5]
[1]Department of Science Education, Akwa Ibom State University, Akwa Ibom State, Nigeria.
[2]Department of Science Education(Educational Technology Unit),Akwa Ibom State University
[3]Department of Science Education (Chemistry Unit),Akwa Ibom State University, Akwa Ibom State
[4]Department of Science Education (Mathematics Unit),Akwa Ibom State University, Akwa Ibom State
[5]Department of Science Education (Biology Unit),Akwa Ibom State University, Akwa Ibom State
Email: babayemioluwole@gmail.com, atim_itighise@yahoo.com, [3]umanah.felicia@yahoo.com, andrewumoeka@gmail.com, etimumo@aksu.edu.ng

ABSTRACT

This study investigated secondary school science, technology and mathematics teachers' teaching subject challenges in Onna Local Government Area. Two research questions were used for the study. Descriptive survey design was used. The population of the study comprised of all the secondary school science, technology and mathematics teachers in the nine public secondary schools in the study Area. A sample size of 51 secondary school science, technology and mathematics teachers drawn from seven randomly selected secondary schools was used for the study. One instrument used was Questionnaire on Teaching Subject Challenges (QTSC). The instrument was validated by two (2) lecturers and found to have a reliability index of 0.75 using cronbach alpha. Data obtained from research instrument were analyzed using mean score, standard deviation, percentages, frequency count and analysis of variance (ANOVA) was used to test the hypotheses at 0.05 level of significance. The result showed that teachers encountered most teaching challenges, all the teachers that were used for the study irrespective of their areas of teaching subject, had similar teaching challenges. It is therefore, recommended that secondary school science, technology and mathematics teachers should endeavour to collaborate on professional issues and undergo on-the-job-training in order to solve the most classroom teaching challenges.

Keywords: *Teaching Challenges, Area of Teaching Subject, Subject Specialization, Basic* Science and Technology, Physics, Chemistry, Biology, Mathematics

INTRODUCTION

The poor status of science teaching and learning in schools, fall in standard of education in developing countries especially in Nigeria, wrong education policy and budgeting, the challenge of 21st century education and technological advancement, teaching subject challenges in schools among others have become serious challenges to the teachers who happen to be at the grass root level of curriculum implementation. Teachers must teach and students must learn irrespective of dominating challenges as much as classrooms open daily for instructional processes. They need to prepare themselves for the classroom challenges of 21st century (Babayemi *et al.*, 2023). One major challenge of 21st century to teachers is the demands it takes to acquire and use technology in classrooms (Akpan & Itighise, 2019; Akpan & Itighise, 2021). Teachers, therefore, need to reorganize themselves in such a way as to face the teaching and learning challenges for students' learning (Udo & Babayemi, 2019).

Teachers face considerable challenges in lesson preparation and science teaching. First of all these, teachers need to understand the structure and nature of the discipline and learn unfamiliar content knowledge, which is known as subject matter knowledge. Secondly, they need to transform the content knowledge into suitable activities, analogies, demonstrations or simulations and adapt them to the different students' abilities to help them learn, what is described by (Shulman 2016, 2017) as pedagogical content knowledge. This study sets out to examine the challenges faced by Science, Technology and Mathematics teachers when teaching their area of expertise (teaching subject). Inadequate background in the subject knowledge is one of the main factors that contributes to such challenges and will have an impact on the development of the teachers' pedagogical content knowledge (Udo & Babayemi, 2019).

The teachers' knowledge base strongly influences all aspects of teaching like preparation, planning and decision making regarding the choice of content to be learned (De Jong *et al.,* 2012). The knowledge base for teaching is made up of seven categories, which include subject matter knowledge (SMK), pedagogical content knowledge (PCK), curricular knowledge, general pedagogical knowledge, knowledge of the learners and their characteristics, knowledge of educational contexts and knowledge of educational purposes (Shulman, 2011). According to Shulman (2016, 2017), subject matter knowledge is based on two main

areas: the organization of concepts, facts, principles and theories and the nature and structures of knowledge which refer to the ways "in which truth or falsehood, validity or invalidity are established" (Shulman, 2016). In other words, the teachers' subject matter knowledge incorporates not only knowledge of specific topics of the curriculum but also knowledge about the epistemology of science or the nature of scientific knowledge.

According to Dussault (2018), being a teacher is hard. Whether you are just starting or have taught for decades, teachers everywhere in the world are faced with similar challenges. The obstacles encountered by teachers can arise from many directions: with students, parents, administrators, or with the many roles and responsibilities they maintain. Challenges faced by teachers are identified by Dussault (2018) as:

1. Lack of teamwork, empathy, and support between teachers and students
2. Teachers working too many roles at the same time.
3. No time to deal with bodily functions: All throughout the day, teachers must jump from one task to the next and are often forced to neglect their own bodies.
4. Not enough time to plan: Teachers often decry the lack of time they are given to prepare, plan and execute all the tasks that are demanded of them.
5. Excessive paperwork for data collection: In order to build reliable statistics, school and district administrations ask that teachers compile large amounts of data, such as grades and student growth indicators.
6. Keeping up with the expectations of school administration: A lot of teachers feel more is expected of them from their school's (or district's) administration such as offering constant support to the students, keeping a line of communication open with parents, giving more personalized help to students who need more attention to succeed, and so on.

Effective teaching of Science, Technology and Mathematics in schools is crucial to scientific and technological development and this should be in the heart of Science, Technology and Mathematics educators. In order for students to reach educational success in Science, Technology and Mathematics, there are a good number of challenges that are identified in literature which must receive solutions.

For the teaching of Biology as one of the science subjects, Ajemba *et al.* (2021) highlighted the teaching challenges as inadequate funding, teaching of large classes, poor training and retraining programme, inadequate laboratories, shortage of instructional materials, poor motivation, unconducive working environment and inadequate infrastructural facilities, ineffective supervision ,poor curriculum development, lack of candidates' interest and insecurity problems.

Another science subject that is germane to this study is Chemistry. Chemistry plays a fundamental role in physical wellbeing of a healthy life. Its roles permeate pharmaceutical, industrial and production industries for the survival of human. A lot of studies show different challenges facing the teaching of Chemistry in secondary schools. Ineffective teaching strategies adopted by Chemistry teachers are a major challenge (Umanah & Etiubon, 2022; Umanah & Sunday, 2022) and advocated for the use of innovative teaching strategies to improve its teaching in schools. Prominent among the studies is also the study conducted by Bedada and Fita (2022) which highlighted the following challenges:

1. Lack of Chemistry laboratories and the school facilities
2. Teacher experience
3. Lack of Chemistry teachers that used local variable materials for teaching students
4. Students' attitude towards Chemistry and
5. Parent involvements were found to be a contributing factor.

On teacher factor, some Chemistry teachers teach Chemistry as if it is all about formula and calculations thus making students seeing Chemistry as an embodiment of only writing formula and solving calculations. How can a Chemistry teacher teach throughout a given academic period (say a whole term) without entering the laboratory? As such, students view Chemistry as a mere product but not as process. Chemistry should not be taught in an abstract world of minds-on but in a concrete world of hands-on activities supported with minds-on critical thinking. A number of deep-rooted issues has been identified which are peculiar to Physics subject in senior secondary schools and needs to be addressed. In a study conducted by Uboh and Utibe (2023) showed that teachers lack relevant teaching strategy and they need to adopt appropriate strategy that will enhance students' academic achievement of rural and urban Physics students. Akpan and Babayemi (2022) identified lack of knowledge transfer as one major challenge facing the teaching and learning of science

in secondary schools. These researchers advocated for the use of community resources to ameliorate the effect of this challenge.

Other challenges common to the teaching of secondary school Physics are lack of materials and personnel with respect to teaching the subject, lack of laboratories and equipment, inability of the teachers to impact the subject to the students, which might be due to the problem of teachers' qualification and effectiveness, The overloading of West African examination council syllabus, shortages in the supply of Physics teachers. Another major challenge is poor environments in which physics practical are taught and lack of means to develop and communicate research findings in Physics (Babayemi & Utibe, 2017). The ability of this subject to inspire and interest pupils, particularly girls; and other factors such as careers advice which affect pupils' desire to study physics at higher levels.

In Nigeria, Basic Science and Technology is a subject that presents the learners with first exposure to scientific and technological concepts. This foundation in science and technology supports the learners in their choice of careers in science and technology. At the rudimentary level of learning Basic Science and Technology, there are diverse challenges that need to be highlighted.

1. Lack of relevant activities and
2. Lack of appropriate active learning teaching strategy.
3. Class devoid of teaching materials
4. Overpopulated classroom/large class size
5. Work overload
6. Science misconceptions
7. No enough specialists to teach the subject
8. Inadequate training in content and pedagogy
9. No specialized laboratory designated to teach the subject
10. Few tertiary institutions offer the course
11. Failure of Government to pay attention and provide necessary supports for effective curriculum implementation.
12. Lack of regular in-training programme for Basic Science and Technology teachers.
13. Low teacher motivation and
14. Learners' poor attitude towards the subject

Olagunju and Babayemi (2014) remarked that when Basic Science and Technology class lacks relevant activities and appropriate active learning

teaching strategy, students will only be familiar with the scientific concepts but will not also be able to live in the real world of science. To live in a real world of science, a laboratory designated to teach and learn Basic Science and Technology must be built in schools. The beauty of learning science is to discover innovations. Innovation centre for scientific investigation is the laboratory (Babayemi & Kareem, 2019).

Basic Science and Technology is designed for pupils at the lower basic and middle basic levels of primary education. The teaching of this subject therefore requires specialist science teachers capable of originating and maintaining suitable learning conditions in and outside the classroom. The federal government, being fully aware of the importance of specialist teachers at this level, listed the provision of specialist teachers in some subjects including science and mathematics as one of the educational services that will be provided at the primary education level (FME, 2013). Some efforts were made in this direction but much still needs to be accomplished. Most of the teachers handling Basic Science at the primary school level are non-professional as they were not specially trained to teach science subjects at the primary school level.

It is highly disheartening that only one teacher teaches all the subjects at primary school level of learning Basic Science. In most cases, these are non-specialist teachers. In fact, in some private schools, secondary school leavers and university graduates in different fields different from education are employed to teach the subject. Okigbo and Okeke (2011) blamed this practice for being responsible for poor pupils' achievement at the primary education level. It could also be responsible for the Nigerian primary science pupils' poor performance at international competitions. Other teaching subject found relevant in this study is Mathematics. The requirement which is basic for any candidate going for science and technology as major is Mathematics. The teaching and learning of Mathematics have not been without challenges. For some time now, there has been a growing concern over the poor teaching and learning of Mathematics in schools virtually at all levels of education. The low performance in both internal and external examinations is an indicator.

In fact, Abasi and Umoinyang (2020) lamented that the teaching of Mathematics in most schools lack innovative pedagogical approaches which would have helped learners in their learning of Mathematics without tears. Most Mathematics teachers lack teaching affective

characteristic and insufficient teacher training program, lack of clear objectives. On the side of students, it is loss of interest in learning Mathematics and the teachers not showing enough motivation to arouse student's interest in learning Mathematics.

From ongoing, it is very obvious that the major challenges facing the teaching and learning of Science, Technology and Mathematics in secondary schools are grouped under the following:

1. Inadequate infrastructures including ill-equipped laboratories
2. Lack of instructional materials
3. Poor funding
4. Inadequate number of Science, Technology and Mathematics professionals
5. Inappropriate pedagogy
6. Large class size
7. Students' interest and attitudinal dispositions
8. The design of Science, Technology and Mathematics curricula
9. Lack of Information and Communication Technologies (ICTs) to support the teachings.
10. No tangible collaboration among Science, Technology and Mathematics teachers.

Therefore, this research investigated secondary school Science, Technology and Mathematics teachers' teaching subject challenges and areas of teaching subjects in Onna Local Government Area, Akwa Ibom State.

Purpose of the study

The purpose of the study is to determine the perception of secondary school teachers about team teaching approach and teaching subject challenges in Onna local government area. Specifically, the study:

1. Examine the teaching subject challenges of secondary school science teachers.
2. Determine the influence of area of teaching subject on teaching subject challenges of secondary school Science, Technology and Mathematics teachers in Onna Local Government Area.

Research Questions

1. What teaching subject challenges do Secondary school science teachers encountered in Onna Local Government Area?
2. How does area of teaching subject of secondary schools Science, Technology and Mathematics teachers influence their teaching subject challenges in Onna local government Local Government Area?

METHODOLOGY

Design used for the study was descriptive survey. The researcher had to depend upon the literature available and structured questionnaire administered to secondary school science teachers working in the public secondary schools. The descriptive research methods are concerned with the conditions or relationship that exist and investigate the current status and the nature of phenomenon. Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual or group and the most social research come under this design. The design benefited the study due to the use of sample population as respondents and using questionnaire together with the interview as the instruments for collecting data whereby the researcher obtained detail information from the respondents which helped to establish team teaching among secondary schools science teachers.

The population of the study consisted of all the secondary schools science teachers in the nine (9) public secondary schools in Onna Local Government Area. The population was 51 secondary school science teachers. The sample comprised of 51 secondary school Science, Technology and Mathematics teachers which were drawn from seven (7) randomly selected public secondary schools in Onna Local Government Area. Science, Technology and Mathematics teachers (Physics, Chemistry, Biology, Mathematics, and Basic Science and Technology) of the selected schools were used for the study. The instrument used for the study was questionnaire on teaching subject challenges which was developed by the researchers to elicit response from secondary school Science, Technology and Mathematics teachers. The Questionnaire was developed in the light of the objectives of the study and was responded to on the basis of yes or no for obtaining the information from the secondary school Science, Technology and Mathematics teachers.The instrument was validated for face and content validity by two lecturers in the Department of Science Education, Akwa Ibom State University. All

their comments, criticism and corrections were incorporated into the final version of the Instrument. To ensure that the instrument measured consistently what it was supposed to measure, the instrument was administered (trial tested) on 20 Science, Technology and Mathematics in schools different from the schools used for the study but in the same Senatorial District. The data collected were subjected to analysis using Cronbach Alpha which yielded reliability index of 0.75. To collect the data for the study, the researchers visited the selected schools for the study. After due permission from the principals, the researchers were introduced to the Science, Technology and Mathematics teachers. They were thereafter informed on how to complete the instrument. The completed instrument was retrieved by the researchers for data analysis. The data collected were analyzed based on the research questions raised using Mean score, Standard Deviation, Percentages, Frequency count and Analysis of Variance (ANOVA) to answer the research questions.

Results

Research Question 1: What teaching subject challenges do secondary school science teachers encounter in Onna Local Government Area?

Table 1: Mean and Standard Deviation of Teaching Subject Challenges Secondary School Science Teachers

S/N	STATEMENTS	YES	NO	Mean	Std.D
	What are the challenges faced by you in your teaching subject area?				
1	In-adequate preparatory science teachers' programme	43 84.3%	8 15.7%	1.84	.367
2	In-adequate instructional materials such as; textbooks, ICT, laboratory, etc and other materials.	41 80.4%	10 19.6%	1.80	.401
3	Inability to use laboratory apparatus due to lack of practical skills	44 86.3%	7 13.7%	1.86	.348
4	There is the need for regular professional development.	49 96.1%	2 3.9%	1.96	.196
5	Lack of enough classroom and over-populated classroom.	49 96.1%	2 3.9%	1.96	.196
6	Regular transfer of teachers with or without replacement leads to heavy workload.	48 94.1%	3 5.9%	1.94	.238
7	Teachers' mastery of subject matter	39 76.5%	12 23.5%	1.77	.428
8	Inability/Negligence of parents to provide academic assistance to their children after school.	45 88.2%	6 11.8%	1.88	.325

9	Lack of students' interest and contributions to the lesson.	29 56.9%	22 43.1%	1.57	.500
10	Skipping of difficult concepts in the curriculum due to lack of acquisition of relevant knowledge by the teachers	31 60.8%	20 39.2%	1.61	.493
11	Lack of encouraging incentives to science teachers	47 92.2%	4 7.8%	1.92	.272
12	Teachers not implementing the newly introduced curriculum and deciding if it is having the desired effect on students' learning.	4 7.8%	47 92.2%	1.08	.272
13	Innovative Teaching methods and strategies	3 5.9%	48 94.1%	1.06	.238
14	Lack of professional guidance counselor in the school.	31 60.8%	20 39.2%	1.61	.493
15	Teachers' competence in his or her subject area.	44 86.3%	7 13.7%	1.86	.348
	Weighted Mean=1.71				

Table 1 shows the challenges encountered by secondary school science teachers in Mkpat Enin Local Government Area. These challenges are: inadequate preparatory science teachers' programme (Mean = 1.84), inadequate instructional materials such as textbooks, ICT, laboratory, etc and other materials (Mean =1.80), science teachers are unable to use laboratory apparatus due to lack of practical skills (Mean=1.86), the need for regular professional development (Mean=1.96), lack of enough classroom and over-populated classroom (=1.96), regular transfer of teachers with or without replacement leads to heavy workload (=1.94), teachers' mastery of subject matter (=1.77), inability/ negligence of parents to provide academic assistance to their children after school (=1.88), lack of students' interest and contributions to the lesson (=1.57), skipping of difficult concepts in the curriculum due to lack of acquisition of relevant knowledge by the teachers (Mean=1.61), lack of encouraging incentives to science teachers (Mean=1.92), lack of professional guidance counselor in the school (Mean=1.61) and teachers' competence in his or her subject area (Mean=1.86).

Table 1 further shows the weighted mean score of 1.71 out of the maximum 2.00, which is higher than the standard mean of 1.50. This implies that secondary school science teachers encountered most teaching subject challenges.

Research Question 2: How does area of teaching subject of secondary school Science, Technology and Mathematics teachers influence their teaching subject challenges in Onna local government Local Government Area?

Table 2: Mean and Standard Deviation of School Science Teachers Teaching Subject Challenges by Area of Specialization

Area of Teaching Subject	N	Mean	Std. D
Physics	11	26.00	2.757
Chemistry	8	24.50	4.276
Biology	10	24.40	4.648
Mathematics	10	26.20	2.394
Basic Science and Technology	12	27.00	1.954
Total	51	25.7255	3.299

Table 5 reveals that secondary school Science, Technology and Mathematics teachers had similar teaching subject challenges. Basic Science and Technology science teachers had the most teaching subject challenges ($\bar{x}$=27.00) followed by Mathematics science teachers ($\bar{x}$ =26.20), followed by Physics science teachers ($\bar{x}$=26.00), followed by Chemistry science teachers ($\bar{x}$=24.50) and Biology science teachers had the least teaching subject challenges ($\bar{x}$=24.40). This influence on their teaching challenges was not statistically significant (see table 3). This means that there was no remarkable influence of science teachers' area of teaching subject on their teaching subject challenges.

Table 3: Analysis of Variance (ANOVA) of Secondary School Science Teachers Teaching Subject Challenges by Area of Teaching Subject

Source	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	52.157	4	13.039	1.219	.316
Within Groups	492.000	46	10.696		
Total	544.157	50			

Table 3 reveals that there was no significant influence of area of specialization on secondary school science teachers teaching subject challenges (F=1.219; P>.05).

DISCUSSION OF FINDINGS

The tables 1 and 2 show most challenges encountered by secondary school Science, Technology and Mathematics teachers and that these teachers had similar teaching subject challenges. One of the challenges is inadequate preparatory science teachers' programme. The result is in line with the findings of Shulman (2016, 2017), reporting that teachers are facing challenges in lesson preparation and science teaching. To this researcher, teacher needs to understand the structure and nature of the discipline and learn unfamiliar content knowledge, which is known as subject matter knowledge. Secondly, they need to transform the content knowledge into suitable activities and analogies. Scholars Jabbar and Hardaker lamented that current teacher education is highly flawed and primarily geared towards a western dominated curriculum. These researchers suggested that teacher education should be inclusive and take into account multiple backgrounds and variables to allow teachers to be responsive to the requirements of their students (Jabbar & Hardaker, 2013)

Previous researchers recommended that high quality academic instruction should be designed and appropriate to students' educational levels (Rimm-Kaufman & Sandilos, 2018). This means that the training program should be structured in such a way as to adequately prepare Science, Technology and Mathematics teachers during training to qualify them and be made competent to teach the target levels of students that will be under their instructional care. The findings further showed that there was a challenge of well-equipped laboratory. Godwin, Adrian, and Bull (2015) concluded that there are no adequately equipped laboratories in schools. Laboratory facility is important to investigate knowledge acquired during scientific encounters. The laboratory should be specially designated for this purpose.

The result also revealed another major challenge which is dearth of Science, Technology and Mathematics experts. According to Dengerink, Lunenberg and Kools (2015), teacher educators must be specialists in their various fields. Science educator is the one that has acquired training in the content, context and pedagogy of the subject which now qualify him to transmit science instructions to the learners. The teachers' knowledge base strongly influence all aspects of teaching like preparation, planning and decision making regarding the choice of content to learn (De Jong, Veal, & Van Driel, 2012). Teacher needs to be a researcher finding out

new knowledge and innovations in his area of teaching subject regularly, consult relevant agencies for support, carefully select teaching strategies that match students' learning style and alternative provisions of instructional materials (through improvisation), among others. By doing so, some peculiar challenges will be overcome

Educational Implication of the Findings

1. This result implies that secondary schools Science, Technology and Mathematics teachers encountered most teaching challenges which should inform the relevant stakeholders about the need to urgently arrest the situation for quality in the educational sector.
2. This result revealed that secondary schools science teachers should apply team teaching approach. Most of their teaching challenges encountered would be solved.

CONCLUSION

This study investigated secondary school Science, Technology and Mathematics teachers teaching subjects challenges and areas of teaching subject secondary school Science, Technology and Mathematics teachers encountered most teaching subject challenges. Secondary school Science, Technology and Mathematics teachers had similar teaching subject challenges in their different areas of teaching subject. The study concluded that team teaching approach, well defined collaborations among Science, Technology and Mathematics teachers, professional interactions and communications, human and non-human resource sharing are all essential to ameliorate the teaching challenges.

RECOMMENDATIONS

Based on the results of the study, the following recommendations are made:

1. Teacher training institutions should always review the training curriculum to prepare the would-be teachers in content and pedagogy for effective classroom performance. Government should always organize on-the-job training programme for in-service Science, Technology and Mathematics teachers.
2. Science, Technology and Mathematics teachers should always make concerted efforts to improvise instructional materials and relevant textbooks. This will enable them to arrange for meaningful class activities.

3. Science, Technology and Mathematics teachers should develop their practical skills through either online or offline or both approaches to enhance skills' acquisition.
4. Government and other stakeholders in education as a necessity should attach priority to professional development programs for teachers.
5. Philanthropists, communities and Alumni of schools should make provisions to support building infrastructures to help reduce over-populated classroom.
6. The governmental and non-governmental organizations should support the improvement of working environment by building teacher's houses, providing teaching and learning materials and increasing number of teachers which will make the teachers to have an opportunity of living together, increase their interaction and minimize the teaching subject challenges faced.

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