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Competency-Based Curriculum Factors as Correlates of Middle Basic Pupils' Effectiveness - Achievement in Abuja

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Abstract

The study examines the extent to which competency-based curriculum factors predict the achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council (AMAC) of the Federal Capital Territory, Abuja. In this regard, the researcher formulated three research questions along with three null hypotheses to guide the study. This study was a correlational research design. The population of the study consisted of all 156 public primary schools with 2100 teachers in Abuja Municipal Area Council (AMAC) of the Federal Capital Territory, Abuja. With the aid of the Taro Yamen Sampling Formula, the sample size of 210 respondents was randomly drawn from the total population. Four self-designed non-cognitive instruments titled "Teachers' Unawareness of

CBC Scale" (TUCBCS), "Lack of a Clear Framework for CBC Scale" (LCFCBCS),

"Lack of CBC requisite Knowledge and Skills Scale" (LCBCKSS) and "Achievement of Effectiveness Scale" (AES) were used for

data collection. Face and content validities of the instruments were ensured by three experts in the Department of Educational Curriculum, at the National Open University

of Nigeria. The Cronbach reliability coefficient was used to establish the reliability coefficients of the instruments. TUCBCS, LCFCBCS, LCBCKSS and AES yielded reliability indexes of 0.89, 0.85, 0.87 and 0.82 respectively. Simple and multiple regression were used to answer the research questions while t-test and ANOVA associated with linear and multiple regression were used to test the null hypotheses. The study found as follows: teachers' unawareness, lack of a clear-cut CBC framework, and lack of CBC requisite knowledge and skills significantly relate to little or no achievement of effectiveness under CBC initiative in the area council which independently and jointly predicted the reason the middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja are not experiencing the expected results or positive impacts of CBC initiative as implicitly mentioned in the objective statements of UBE. The study recommended among other things that sensitization programmes and special training should be given to primary school teachers to have a better understanding of CBC and how it works, AMAC in collaboration with relevant authorities in the Federal Capital Territory, Abuja should develop a clear-cut framework for CBC initiative to which every primary school teacher is to be familiarized and professional development programmes should be organized for primary school teachers to acquire the appropriate and relevant knowledge, skills and attitudes that make CBC initiative to succeed.

KEYWORDS: Competency-based Curriculum Factors, Achievement of Effectiveness, Middle Basic Education Pupils, Knowledge-based Curriculum, Universal Basic Education

Introduction

The Educational Foundation of a child is crucial for his growth into a responsible and productive adult and for making meaningful contributions to society. Middle Basic Education is the foundational education that pupils usually receive at their formative stages of life in Nigeria. Middle Basic Education covers primaries 4 to 6 going by the 9-3-4 educational system introduced under the current Universal Basic Education (UBE) programme, while middle basic education pupils are those pupils in primaries 4 to 6 under the basic education in Nigeria. The rationale behind the introduction of the 9-3-4 system of education is to bring primary education in Nigeria in line with the World's educational agendas of "Education for All" and the Millennium Development Goals, which makes it compulsory for every child in Nigeria to at least have basic education. Basic Education covers 9 years and is graded into three (3) namely Lower Basic Classes covering Primaries 1 to 3, Middle Basic Classes covering Primary 4 to 6 and Upper Basic Classes covering Junior Secondary School (JSS) Classes 1 to 3. The Universal Basic Education (UBE) programme was launched by former President Olusegun Obasanjo on 30th September 1999 in Sokoto to eradicate illiteracy, ignorance and poverty as well as stimulate and accelerate national development, political consciousness, and national integration. The objectives of the UBE include:

1. Ensure unfettered access to nine (9) years of formal basic education.

2. The provision of free Universal Basic Education for every Nigerian child of school-going age.

3. Reducing drastically the incidence of dropout from the formal school system, through improved relevance, quality, and efficiency.

4. Ensuring the acquisition of appropriate levels of literacy, numeracy, manipulative, communicative and life skills as well as the ethical, moral, and civic values needed for laying a solid foundation for life-long learning (UBEC).

Getiha (2012) defined a competency-based curriculum (CBC) as an education system that emphasizes a learner's unique talents and abilities rather than focusing wholly on academics and examination performances. Thus, the key aims of CBC are to help identify learners' special capabilities and then nurture them through relevant teachings so that learners benefit from their talents and to produce a holistic individual with competencies, values, knowledge, and skills necessary to succeed in a highly competitive world. K'Ochuka (2019) is of the view that CBC emphasizes the practicality of learning, where the central focus is the learner, not the teacher being a 'robot' that teaches passive pupils/students. According to Benjamin (2018), competency-based training and curriculum depend on the premise that there are specific measurable outcomes that students/trainees need to demonstrate.

Competency-based curricula are usually designed around a set of key competencies that can be cross-curricular and/or subject-bound (IBE-UNESCO, 2017). It implies that learners should acquire and apply the knowledge, skills, values, and attitudes to solve situations they encounter in everyday life and across the globe. Frank, Mungroo , Ahmad, Wang, De-Rossi and Horsley (2010) defined "a competency-based education (CBC) as an approach to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and organized around competencies derived from an analysis of societal and patient needs. It deemphasizes time-based training and promises greater accountability, flexibility, and "learner-centredness". Consequently, a competency-based curriculum capitalizes on competency-based learning which focuses on understanding the concepts, skills, and attitudes which in turn calls for changes in teaching, learning and assessment approaches (World Bank, 2011; Wangeleja, 2010; Woods, 2008).

From the above-attempted definitions, we can deduce that a competency-based curriculum (CBC) possesses the following features (1) it is outcome-based, in that the first step in competency-based learning is to define precise learning outcomes. All lessons are hence geared towards the achievement of the set skills/competencies, (2) it is learner-centred, in that CBC advocates that teaching and learning processes must be driven by pupils/students themselves. For this reason, CBC empowers

learners to master valuable skills/knowledge at their own pace. As Everhart (2014) succinctly puts it, competency-based learning empowers learners to focus on mastery of valuable skills and knowledge and learn at their own pace, and (3) it is differentiated in that CBC learning practices must be adjusted to meet the individual needs of specific learners. All the interventions are determined by the learning requirements of the pupil. There are three (3) main differences between a competency-based curriculum and traditional education or knowledge-based curriculum (KBC) which is predominantly in practice in Nigeria. First is that there is a difference in terms of their structure; in traditional education, the year is set out in advance for every pupil. Thus, at the end of each unit, every pupil must move forward, whether they fully understand the material or have mastered the necessary skills. The second is that there is a difference in terms of their learning outcome. In traditional education, learning outcomes are focused on memorization and comprehension to pass tests, while in competency-based learning, the focus is placed on a deep understanding that is demonstrated through the application. This means that learning outcomes are proven by action and focus on building the skills pupils need to become better learners into adulthood. The third is that there is a difference in terms of their grading. While traditional grades are made up of test scores, assignments, and behaviour, competency-based education scores are based on the performance levels of each pupil, without bias. With personalized and creative assessments, teachers can collect and understand data on pupils' progress. Then, they use this data to develop scores that are transparent and help both pupils and parents to understand what is going on.

According to Kim (2015), the creation of the CBC must be done by following three main stages: 1. Identifying competencies: to identify competencies simply means to provide a framework based on performance outcomes around which a curriculum is developed and delivered and against which performance can be measured. Thus, a competency-based curriculum is organized around competencies required for practice. It is also grounded in the empirically validated principle that pupils/students, when given appropriate instruction, can all master the prescribed performance outcomes; **2.** Linking competencies to school subjects; the next step was to articulate how pupils/students would attain and acquire the competency. Particularly, this will lead to addressing the following questions: What content is needed to support the development of competency in the curriculum? What instructional strategies and methods are most effective in developing competency? Lasnier cited in Kim (2015) argues that instructional strategies and methods that lead to competency development are action-based, areas closely related to the real task as possible and take place in as authentic a setting as possible **3.** Assessing competencies in the curriculum; to deliver a competency-based curriculum, pupils must know, can apply, and can execute knowledge, skills, and abilities desired by the industry. When assessing competency two important questions to be addressed are: Have students acquired the program competencies by the end of the program? If so, was the acquisition of the competencies a result of the program? A variety of assessment methods are needed for assessing the pupil's/students' competencies. Portfolios appear to have the potential to integrate these methods and are effective assessments of both formative and summative performance. Portfolios are often used as an instrument that allows pupils to see each part of the process in its wider context, encouraging self-assessment.

To achieve effectiveness, the application of a competency-based curriculum (CBC) must follow these six principles as stipulated by (Juraschka, 2021): The first is the principle of equity. Equity does not mean giving each pupil the same thing as everyone else. Instead, it means giving each student what they need to reach the same end goal. This is the main principle of competency-based education because it purposely seeks to understand and remove bias in school leadership. The competency-based curriculum also helps create an inclusive culture where all are respected. The second principle is to the effect that classes must emphasize measurable competencies that help build skills for life. Competencies must be defined in advance and set as learning objectives for each student. What are these competencies based on? Rather than just testing for head knowledge, competencies focus on the practical understanding

that a student has of the subject. These competencies can be based on: (a) an understanding of key concepts, (b) the ability to apply knowledge to meaningful problems and (c) mastery of relevant skills. For the results to be measured, competencies must be defined in advance by school leadership. Do not try to do this alone: get the input of the whole teaching staff to develop ideas on what knowledge and skills are necessary to determine mastery. The third is the principle of transparency. It helps the learners take ownership. What is the end goal for each pupil in a particular class? The answer to this question should not only be available to teachers. The learning objectives that are set for the class (and the school as a whole) should be clear to both pupils and parents. In a competency-based education system, students understand these three things when starting the class: what they need to learn, how mastery is defined and how they will be assessed. The fourth principle is that the pupils/students must get the support they need individually. The fifth principle is to the effect that teachers must assess their pupils/students for growth and mastery. Assessments come in many shapes and sizes. Here are three types of assessments that are especially useful for competency-based education: (a) formative assessments: These assessments help teachers to determine where each student is in the learning process and adjust their teaching as necessary. Formative assessments give teachers the ability to adjust in real time by clearly identifying the key areas where students need to improve. These types of assessments allow students to demonstrate their understanding of the subject, which is the basis for competency-based learning. Then, the teacher can adjust the next lesson accordingly or plan one-on-one time with pupils who showed less understanding of the subject. (b) authentic assessments: Getting students to take their knowledge and apply it to real-world situations is another great way to demonstrate mastery. A competency-based curriculum uses authentic assessment methods such as portfolios, classroom or field observation, projects, oral presentations, self-assessment, interviews, and peer assessment (Kitta & Tilya, 2010). The sixth principle states that the pupils/students must move forward only if they demonstrate mastery. When students demonstrate a clear understanding of the topic, prove their ability to apply that understanding, and show how they've developed important skills, it is time for them to move forward (Juraschka, 2021).

According to Drucker (2006), effectiveness is doing the right things to achieve positive results or desired goals. The effectiveness or rather the positive results of any competency-based curriculum initiative does not happen in a vacuum, meaning that it is the teachers who are the main implementers of the CBC initiative that would make its positive results be felt. Mwanza (2017) observed that teachers are central to achieving universal access to high-quality and equitable education for all learners because teachers have first-hand knowledge of the learning environment, the learners and how the two relate. The competency-based curriculum may appear uncomplicated in design, but it is not as easy as it appears, in theory, it requires teachers to be knowledgeable of the key principles of the curriculum and equipped with skills and desirable attitudes to teaching using competency-based approaches appropriately (Mulenga & Kabombwe, 2019). Therefore, it is important for teachers to know and understand the kind of curriculum a nation is using to interpret it correctly and avoid wastage of educational resources and ensure that necessary skills are attained. Thus, curriculum designers need to provide proper guidelines to teachers so that the curriculum is implemented effectively. Teachers are familiar with the classroom situations therefore might discover the gaps and bring about change and improvements that can help learners achieve the specified outcomes (Mulenga & Mwanza, 2019). Smith (2001) stated that the role of teachers can no longer be overlooked, for policy changes would not have the desired effect if they were not accompanied by a supportive process intended to strengthen the role of teachers. Zheng and Borg (2014) argued that teachers need to follow a guideline provided by the curriculum developers that suit the competency-based approaches. Okech and Asiachi cited in Kabombwe and Mulenga, (2020) added their views and suggested that teachers need to interpret the curriculum correctly to the learners for it to be successful. Hence, teachers' knowledge of the competency-based curriculum for successful implementation of the curriculum is paramount in the implementation

stage of the competency-based curriculum. For the competency-based approaches to be successful, teachers should be knowledgeable enough to let their learners get involved in the learning process since teachers are major players in curriculum implementation (Botha & Reddy, 2011; Wangeleja, 2010). Teachers also need to have expertise in their subjects for them to yield targeted products (Moodley, 2013).

Statement of the Problem

As the system of education across the globe is changing from traditional content-based to competency-based, it seems that Nigeria is being left behind. What is available in Nigeria is implicit or suggestive mentioning of CBC in the UBE objectives, particularly in the fourth objective; thus, the objective statements of the UBE do not explicitly mention CBC. Again, there is no explicit or clear-cut framework for a competency-based curriculum (CBC), and neither is there any special training for teachers on CBC in Nigeria. There seem to be a lack of CBC awareness, lack of in-depth understanding, requisite knowledge, skills, and attitudes toward CBC on the part of teachers due to the failure or neglect to provide them with the right training on the workings of CBC. There also seems to be an obvious absence or non-effectiveness of CBC on pupils/students in the Federal Capital Territory, Abuja. Or if there are any arguments otherwise, why all these primary or secondary school pupils/students roaming the street aimlessly, indulging in various forms of social vices such as street hooliganism and gangsterism, cultism, advance-free fraud (Yahoo-Yahoo), drug abuse and misuse, addictive gambling and the rest of them? It is a general presumption that any child who diligently passes through the processes of basic education will be able to have developed the knowledge, skills and attitudes that will enable him to fend for himself (self-reliance) and make meaningful contributions to society in which they live. A key indicator of this underlying challenge is that while the curriculum documents are now expressed in terms of outcomes/competencies of learning, the practices and particularly the assessment approaches remain superficial at best (Nyabanyaba, 2020).

Agitated by the above challenges, the researcher decided to investigate the extent to which competency-based curriculum factors predict the achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council (AMAC) of the Federal Capital Territory, Abuja.

Aim and Objectives of the Study

This study aims to investigate the extent to which competency-based curriculum factors predict the achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council (AMAC) of the Federal Capital Territory, Abuja. Specifically, the study seeks to actualize the following objectives:

1. To find out the extent to which teachers' unawareness of CBC predicts little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.
2. To ascertain how the lack of a clear-cut framework for CBC in FCT predicts little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.
3. To examine the extent lack of requisite knowledge and skills predicts little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Research Questions

The following research questions guided the conduct of this study:

1. To what extent do teachers' unawareness of CBC predict little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja?
2. How does the lack of a clear-cut framework for CBC in FCT predict little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal

Area Council of the Federal Capital Territory, Abuja?

3. To what extent does lack of CBC requisite knowledge and skills predict little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja?

Hypotheses

The following null hypotheses tested at 0.05 alpha level of significance guided the conduct this study:

Ho1: Teachers' unawareness of CBC does not significantly predict little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Ho2: Lack of a clear-cut framework for CBC does not significantly predict little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Ho3: Lack of CBC requisite knowledge and skills does not significantly predict little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Methodology

This study was a correlational research design. The population of the study consisted of all 156 public primary schools with 2100 teachers in Abuja Municipal Area Council (AMAC) of the Federal Capital Territory, Abuja. With the aid of the Taro Yamen Sampling Formula, the sample size of 210 respondents was randomly drawn from the total population. Four self-designed non-cognitive instruments titled "Teachers' Unawareness of CBC Scale" (TUCBCS), "Lack of a Clear Framework for CBC Scale" (LCFCBCS), "Lack of CBC requisite Knowledge and Skills Scale" (LCBCKSS) and "Achievement of Effectiveness Scale" (AES) were used for data collection. The TUCBCS contained 7 items, LCFCBCS 7 items, LCBCKSS 7 items and AES 7 items respectively. Face and content validities of the instruments were ensured by three experts in the Department of Educational Curriculum, at the National Open University of Nigeria. The Cronbach reliability coefficient was used to establish the reliability coefficients of the instruments. TUCBCS, LCFCBCS, LCBCKSS and AES yielded reliability indexes of 0.89, 0.85, 0.87 and 0.82 respectively. Simple and multiple regression were used to answer the research questions while t-test and ANOVA associated with linear and multiple regression were used to test the null hypotheses.

Results

The results of this study are presented as shown below.

Research Question 1: To what extent does teachers' unawareness of CBC predict little or no achievement of effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja?

Table 1a: Simple regression on the extent Teachers' Unawareness of CBC predicts Achievement of Effectiveness among Middle Basic Education Pupils

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.9227[a]	0.8012	0.5789	1.494525

Table 1a shows that teachers' unawareness of CBC has a high positive relationship of 0.923 with little or no achievement of effectiveness among Middle Basic Education pupils. The coefficient of determinism of 80.1% shows the extent teachers' unawareness of CBC predicts little or no achievement of effectiveness for middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja. The remaining 19.9% was accounted for by other variables apart from teachers' unawareness of CBC.

Hypothesis 1: Teachers' unawareness of CBC does not significantly predict little or no achievement of effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Table 1b: T-test associated with simple regression on the extent to Teachers' Unawareness of CBC predicts little or no Achievement of Effectiveness among Middle Basic Education Pupils

Unstandardized Coefficients			Standardized Coefficients		
Model	Beta	Std. Error	Beta	t-Value	Sig.
1 (Constant)	3.137	1.78252		1.927	.001
Teachers' Unawareness of CBC	-.0722	.321106	- .616	-.281	.001

Table 1b revealed that teachers' unawareness of CBC has a beta value, t-value and significant values of -616, -281 and .001 and all at 0.05 alpha level significance. Therefore, the null hypothesis is rejected. By implication, teachers' unawareness of CBC significantly predicts little or no achievement of effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Research Question 2: How does the lack of a clear-cut framework for CBC in FCT predict little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja?

Hypothesis 2: Lack of a clear-cut framework for CBC does not significantly predict little or no achievement of effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Table 2a: Multiple regression and ANOVA associated with multiple regression on the joint prediction of How Lack of a Clear-cut Framework predicts little or no Achievement of Effectiveness among Middle Basic Education Pupils

R=0.915: **R^2= .**837

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	70.43215	2	29.341	12.753	0.001
	Residual	19.87472	15	2.234		
	Total	90.30687	17			

Table 2a was used to answer research question two and test null hypothesis two. Results obtained revealed that the regression square coefficient is 0.837. Therefore, the lack of a clear-cut framework for CBC in FCT predicts little or no achievement of effectiveness among middle basic education pupils by 83.7%. It was shown that the mean square for regression and residual variables are 70.432 and 19.875 respectively. With degrees of freedom of 2, and 15, the F calculated value is 12.753. F, (12.753), df (2,15), p>0.001. The ANOVA associated with multiple regressions showed that p- value is greater than the significant value of 0.001. By implication, the null hypothesis is rejected. Therefore, the lack of a clear-cut framework for CBC significantly predicts little or no effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Research Question 3: To what extent does lack of CBC requisite knowledge and skills predict little or no achievement of effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja?

Hypothesis 3: Lack of CBC requisite knowledge and skills does not significantly predict little or no achievement of effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja.

Table 3a: Multiple regression and ANOVA associated with multiple regression on the joint prediction of Lack of CBC requisite Knowledge and Skills predicts little or no Achievement of Effectiveness among Middle Basic Education Pupils

R=0.864: **R^2= .**747

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	55.49923	1	51.901		
	Residual	18.73435	11	2.733		
	Total	74.23358	12		22.706	0.001

Table 3a was used to answer research question three and test null hypothesis three. Results obtained revealed that the regression square coefficient is 0.747. Therefore, a lack of CBC requisite knowledge and skills predicts little or no achievement of effectiveness among lower basic education pupils by 74.7%. It was shown that the mean square for regression and residual variables are 51.901 and 2.733 respectively. With degrees of freedom of 1 and 11, the F calculated value is 22.706. F, (22.706), df (1,11), p>0.001. The ANOVA associated with multiple regressions showed that p-value is greater than the significant value of 0.001. By implication, the null hypothesis is rejected. Therefore, lack of CBC requisite knowledge and skills significantly predicts little or no achievement of effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja

Discussion

The discussion of findings is conducted as presented below.

The extent to which Teachers' Unawareness of CBC predicts little or no Achievement of Effectiveness among Middle Basic Education Pupils

It was found that teachers' unawareness of CBC predicts 80.1% of little or no achievement of the little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja. The result is therefore to the effect that teachers' unawareness of CBC remains a significant factor that can hinder the achievement of desirable results on CBC initiative. In other words, the result revealed that little or no achievement of the expected results among Middle Basic Education pupils relate to the teachers' unawareness of CBC and not knowing how it works. This result sprung no surprise as a teacher who is not aware of CBC and has no knowledge of how it works will achieve little or nothing under CBC initiative. This result is in consonance with the study of Benjamin (2014) which found that teachers' unawareness of CBC and how it works constitute a great impediment to achieving the expected objectives of CBC initiative. He found that 80% of the teachers who were surveyed from selected schools never took the trouble to use the competency-based approaches during the teaching/ learning process in Tanzania. The reason is that teachers believe that using a competency-based approach was time-consuming to practice in relation to the content coverage hence they always opted for a teacher-centred approach regardless of the understanding of the learners. Similarly, Kafyulilo (2012) found that teachers were continuing to use the normal lecture methods even after having been trained in the competency-based approaches.

The result showed that lack of CBC requisite knowledge and skills predicts 74.7% of little or no achievement of effectiveness among middle basic education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja. That is quite significant, as only 25.3% is predicted by factors other than lack of CBC requisite knowledge and skills. In addition, the result is to the effect that lack of CBC requisite knowledge and skills is very significant as it is one of CBC factors likely to lead to little or no achievement of positive outcomes under CBC

2. How does Lack of a Clear-cut Framework predicts little or no Achievement of Effectiveness among Middle Basic Education Pupils

It was found that lack of a clear-cut framework predicts 83.7% of little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the

Federal Capital Territory, Abuja. In essence, the result indicated that little or no achievement of the expected competencies or mastery of competencies among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja, relates significantly to a lack of clear-cut CBC framework in the area council. The result implies that having a framework that would define and provide appropriate guidelines for CBC implementation is fundamental for achieving positive outcomes under CBC initiative. This result is in accord with the study of Kim (2015) which revealed that teachers' and students' lack of cross-disciplinary expertise and lack of a clear-cut framework which delineates the steps involved in developing and implementing a CBC are the main impediments to ensuring the effectiveness of the competency-based curriculum.

3. Extent Lack of CBC requisite Knowledge and Skills predicts little or no Achievement of Effectiveness among Middle Basic Education Pupils

The result showed that lack of CBC requisite knowledge and skills predicts 74.7% of little or no achievement of effectiveness among Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja. That is quite significant, as only 25.3% is predicted by factors other than lack of CBC requisite knowledge and skills. In addition, the result is to the effect that lack of CBC requisite knowledge and skills is very significant as it is one of the CBC factors likely to lead to little or no achievement of positive outcomes under the CBC initiative. The reason is that lack of CBC requisite knowledge and skills would cause the teachers not to properly implement the CBC initiative thereby leading them to achieve little or no goals of the CBC scheme. This result is in agreement with the studies of Kim (2015) and Kabombwe and Mulenga (2020) which revealed that a lack of CBC knowledge and skills on the part of teachers constitutes a major impediment to ensuring the effectiveness of a competency-based curriculum.

Conclusion

Based on the results discussed above, it was concluded that teachers' unawareness, lack of a clear-cut CBC framework, and lack of CBC requisite knowledge and skills significantly relate to little or no achievement of effectiveness under CBC initiative in the area council which independently and jointly predicted the reason the Middle Basic Education pupils in Abuja Municipal Area Council of the Federal Capital Territory, Abuja are not experiencing the expected results or positive impacts of CBC initiative as implicitly mentioned in the objective statements of UBE.

Recommendations

Based on the findings, the following recommendations were made:

1. Sensitization programmes and special training should be given to primary school teachers to have a better understanding of competency-based curriculum (CBC) and how it works.

2. Abuja Municipal Area Council in collaboration with relevant authorities in the Federal Capital Territory, Abuja should develop a clear-cut framework for the CBC initiative to which every primary school teacher is to be familiarized.

3. Professional development programmes should be organized for primary school teachers to enable acquire the appropriate and relevant knowledge, skills and attitudes that make the CBC initiative succeed.

4. The development and implementation of the CBC initiative should involve collaborative efforts from educational policymakers, curriculum experts, teachers, students, parents, PTA, and other relevant stakeholders.

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Impact of Computer Based Instructional Package on Chemistry Students' Achievement in Learning Oxidation-Reduction Reactions

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Abstract

This study examined the impact of Computer Based Instructional Package on Chemistry students' achievement in learning oxidation-reduction reaction. Three research questions were raised and further hypothesised. The research design adopted for the study was the pretest posttest non-equivalent control group quasi experimental design. The population of the study was four hundred and eighty one (481) Chemistry students in senior secondary two in public schools in Oshimili South Local Government Area of Delta State. Simple random sampling (balloting) was used to

select two secondary schools. The instrument for data collection was the Chemistry Achievement Test (CAT). The reliability of the instrument was established using Kuder-Richardson Formula 21 and a value of 0.75

was obtained. Data collected were analysed using descriptive statistics (mean and standard deviation), t-test and Analysis of Variance. The study concluded that Computer Based Instructional Package significantly improved students' achievement in oxidation-reduction reactions. It was recommended that chemistry teachers should make use of Computer Based Instructional Package for the teaching and learning of chemistry.

Keywords: Computer Based Learning, Oxidation-reduction reactions and Achievement

Introduction

Chemistry is one of the science subjects taught at the secondary school level in Nigeria. It is a science that deals with the composition, properties and uses of matter. The knowledge of this subject is indispensable for the pursuit of professional courses in Engineering, Medicine, Nursing, Pharmacy and other science related disciplines. Poor knowledge of Chemistry at the Secondary School level will hinder future effort to promote scientific and technological development. Studies have shown that students perform poorly in chemistry in recent times. Many factors have been attributed to the students' poor performance such as high level of abstraction of some chemistry concepts and teachers find it difficult to concretize such concepts through laboratory demonstration and experimentation (Njoku &

Eze-Odurukwe, 2014). Also, science educators have identified factors such as learners' cognitive styles, learners' conceptions and border crossing, quality of teaching, quality of teachers, quality of curriculum and quality of teaching –learning resources. One of such concepts most students find difficult in chemistry is oxidation-reduction reaction.

Oxidation-reduction reaction is an important concept in Chemistry in which one specie loses electrons and another specie gains electrons simultaneously. This concept has a lot of applications to real life situations such as in photosynthesis, respiration, combustion and corrosion. Green plants manufacture their own food through this process and animals depend on plants for food and as such one can say without this concept there will be no life.

Achievement is the extent to which an academic goal is accomplished. The level of achievement is determined using both formative and summative evaluation. The class work, assignment and continuous assessment test given to students are formative evaluation while the assessment written at the end of the term is summative evaluation. Formative evaluation can be used to track students' progress and enables the teacher to know the kind of support the student requires before summative evaluation is given.

Gender is the state of being male or female. Studies on gender and achievement in Chemistry have shown that gender does not have anything to do with students' achievement in learning Chemistry. This is supported by Ajayi and Ogbeba (2017) who found no significant difference in the mean achievement scores of males and females taught stoichiometry using hands-on activities.

The empirical researches on computer based learning by scholars have confirmed the effectiveness and enhancement of this teaching strategy on students' achievement than the traditional lecture method. Adegbija and Falode (2014) observed that students that were taught concept of waves using animated based physics Camstudio instructional package performed significantly better than the students taught the same concept using conventional lecture method. Gambari, Falode and Adegbenro (2014) researched on the effectiveness of computer animation and geometrical instructional model on Mathematics achievement and retention among Junior Secondary School students. It was found that the students taught geometry using computer animation performed significantly better than the students taught geometry using conventional method.

Engaging students positively in the learning process increases their participation and motivates them to learn more which also leads to deeper understanding of the subject and eventually leads to better achievement. This study attempted to develop and use Computer Based Instructional Package as an innovative teaching strategy to actively engage students and improve their achievement in oxidation-reduction reactions.

Statement of the Problem

There has been persistent poor achievement of students in Chemistry in recent times. Literature and WAEC Chief Examiners' Reports have shown that many of the students lack knowledge of technical terms, have poor understanding of the demands of the questions, lack knowledge of stoichiometry, chemical reactions and lack good knowledge of oxidation-reduction reactions. The Chief Examiners' reports indicates that teachers do not cover the contents of the curriculum and are not familiar with the demands of the examination syllabus. These reports also noted that candidates memorise Chemistry concepts as they may not have been properly taught most of these concepts. Can the use of Computer Based Instructional Package meaningfully engage students and improve their achievement in oxidation-reduction reactions in Chemistry?

Research Questions

To guide this study, the following research questions were raised.

1. Is there a difference in the mean achievement scores of students taught with Computer Based Instructional Package and those taught using lecture method?
2. Is there a difference in the mean achievement scores of male and female students taught oxidation-reduction reactions using Computer Based Instructional Package?
3. Is there interaction effect of methods and gender on students' mean achievement score?

Hypotheses

Three hypotheses were stated to further guide the study and tested at 0.05 level of significance.

1 There is no significant difference in the mean achievement scores of students taught with Computer Based Instructional Package and those taught using lecture method.

2 There is no significant difference in the mean achievement scores of male and female students taught oxidation-reduction reactions using Computer Based Instructional Package.

3 There is no significant interaction effect of methods and gender on students' mean achievement score.

Methodology

The research design adopted for this study is the pretest posttest non-equivalent control group quasi experimental design was used with intact classes. The population of the study was made up of 481 Senior Secondary II students in Oshimili South Local Government Area of Delta State. The sample for the study consisted of one hundred and ninety one chemistry students (109 males and 82 females) in two sampled schools. Simple random sampling (balloting) was used to select two schools which are intact classes. All the chemistry students in senior secondary two in the experimental group and the control group were involved. Students in the experimental group were taught oxidation-reduction reactions using Computer Based Instructional Package while students in the control group were taught oxidation-reduction reactions using lecture method.

The validity of Chemistry Achievement Test was done by two science educators and one experienced Chemistry teacher. The content validity of this instrument was determined by using table of specification. The reliability of the instrument was established using Kuder-Richardson Formula 21 and a value of 0.75 was obtained. This means that the Chemistry Achievement Test score is reliable. Data were collected using the Chemistry Achievement Test (CAT). The instrument was made up sections A and B. Section A contains information on students' bio-data which includes student's registration number and sex. Section B consists of twenty multiple choice objective questions with four response options (A-D). Students were expected to read the questions carefully and then choose the correct option.

Computer Based Instructional Package was used to teach the students oxidation-reduction in the experimental group and the treatment procedure is as follows: In the first week of instruction, the pretest was administered to the students in both experimental and control groups. Lessons were taught to the experimental group using Computer Based Instructional Package. Students in their smaller groups in the experimental group were asked to watch animated videos on oxidation-reduction reactions. The students were selected based on their performance in Chemistry lessons taught by their teacher. The outstanding students, good students and those that need help were

selected and were grouped together in eight students per group. The control group was taught using lecture method of instruction. At the end of the lessons, a posttest was administered to both the experimental and control groups

Results/Findings

Pretest scores were analysed for significant difference before the treatment. The results shows a significant difference in the mean achievement score of students taught with Computer Based Instructional Package and those taught using lecture method but no significant difference was observed in the mean achievement score of male and female students taught oxidation-reduction reactions using Computer Based Instructional Package. Therefore, hypotheses one and two were tested using t-test of independent samples at post -test. However, the hypothesis on interaction effect was tested using two-way ANOVA instead of ANCOVA.

Hypothesis One: There is no significant difference in the mean achievement score of students taught with Computer Based Instructional Package and those taught using lecture method.

Table 1**: Summary of Independent samples t-test of Achievement scores of Students by groups at posttest**

Group	N	$\overline{X}$	SD	t	df	$\overline{X}$ diff	Sig (2-tailed)
Experimental	95	14.75	3.96	26.36*	189	11.24	.00
Control	96	3.51	1.33				

*significant at $\alpha < 0.05$

Result on Table 1 shows that the posttest mean achievement score for students taught with Computer Based Instructional Package is 14.75 and standard deviation of 3.96 while the posttest mean achievement score for students taught using lecture method is 3.51 and standard deviation of 1.33. The mean difference in achievement between the students taught using Computer Based Instructional Package and those students taught using lecture method is 11.24 yielding a t-value of 26.36 significant at 0.00. At 0.05 level of significance, the table shows a statistically significant difference at .00. The hypothesis tested significant difference in favour of use of Computer Based Instructional Package. The null hypothesis of no significant difference is rejected.

Hypothesis Two: There is no significant difference in the mean achievement score of male and female students taught oxidation-reduction reactions using Computer Based Instructional Package .is summarised in Table 2.

Table 2**: Summary of Independent sample t-test of mean achievement score of male and female students using Computer Based** Instructional Package **at posttest**

Gender	N	$\overline{X}$	SD	T	df	$\overline{X}$ diff.	Sig
Male	40	14.38	4.08	-.78*	93	-.64	.44
Female	55	15.02	3.88				

*significant at $\alpha < 0.05$

Table 2 shows a calculated t-value of -0.78 and a p-value of 0.44, since 0.44 is greater than 0.05 there is no significant difference in the mean achievement score of male and female students taught oxidation-reduction reactions using Computer Based Instructional Package. This may mean Computer Based Instructional Package impacts equally for males and females.

Hypothesis Three: There is no significant interaction effect of methods and gender on students' mean achievement score.

Table 3**: Summary of Two Way ANOVA on the interaction effect of methods and gender on students mean achievement score**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6039.500[a]	3	2013.167	231.014	.000
Intercept	13934.717	1	13934.717	1599.028	.000
Method	5325.044	1	5325.044	611.056	.000
Gender	2.122	1	2.122	.244	.622
Method * Gender	7.415	1	7.415	.851	.357
Error	1629.610	187	8.714		
Total	23484.000	191			
Corrected Total	7669.110	190			

*significant at $\alpha < 0.05$

Table 3 shows that F = 0.851, df = 1 and p-value of 0.357. The p-value is greater than alpha level 0.05. Results show no interaction effect of methods and gender on students mean achievement score. The null hypothesis of no significant interaction effect was accepted. Therefore, there is no significant interaction effect of methods and gender on students' mean achievement score.

Discussion of Findings

The finding of this study revealed that Computer Based Instructional Package teaching method actively engage students, rescuing students from boring traditional lecture method, increase their level of participation and significantly improved students' achievement in oxidation-reduction reactions. The finding of this study is in agreement with the studies (Gambari, Falode and Adegbenro, 2014; Njoku and Eze-Odurukwe, 2014; Aydin, 2015; Oskay and Efil, 2016; Falode, Sobowale, Saliu, Usman and Falode, 2016; Ikwuka and Samuel, 2017; Naomi and Chigozie, 2017) involving secondary schools students.

Also, there was no significant difference in the mean achievement score of male and female students taught oxidation-reduction reactions using Computer Based Instructional Package teaching method. This is in agreement with the studies (Gambari, Falode and Adegbenro, 2014; Falode, Sobowale, Saliu, Usman and Falode, 2016; Ajayi and Ogbeba, 2017; Godpower-Echie G. and Ihenko, 2017) involving male and female students. The study is not in agreement with Naomi and Chigozie (2017) who found that gender had significant effect on the academic achievement of male and female students that were taught Chemistry using Computer Animation in favour of the male students.

Similarly, there was no significant interaction effect of methods and gender on students' mean achievement score. The finding is in agreement with the studies carried out by Ajayi and Ogbeba(2017), Bamidele and Yoade (2017).

Conclusion

The results of this study have shown that the use of Computer Based Instructional Package is better in teaching oxidation-reduction reactions than lecture method. The researcher also concluded that students' gender had no significant influence on students' achievement in oxidation-reduction reactions in Chemistry. It was also concluded that there was no interaction effect of methods and gender on students' mean achievement score. Computer Based Instructional Package can be used to teach students irrespective of their gender for better achievement in oxidation-reduction reactions in Chemistry.

Recommendations

Based on the findings, the following recommendations are made:

1. The school administrators and Chemistry teachers should ensure the development of Computer Based Instructional Package for the teaching and learning of Chemistry concepts.
2. Government should make computers available (educational packages well installed) in schools with standby generators to teach Chemistry concepts.
3. The school administrators should encourage Chemistry teachers to use Computer Based Instructional Package in teaching and learning process.
4. Regular workshop should be organised to educate Chemistry teachers on the use of Computer Based Instructional Package to concretise abstract concepts.

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Effect of Blended Learning Approach on Biology Students' Achievement in Ose Local Government Area of Ondo State, Nigeria

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Abstract

This study investigated the effect of blended learning approach on Biology students' achievement in Ose Local Government Area of Ondo State, Nigeria. The study adopted the pretest-posttest non-equivalent control group research design. The population of this study comprised all the 516 SSS II Biology students in public co-educational schools in Ose Local Government Area of Ondo State. The sample of this study comprised all the 58 students from two intact classes selected. Two research questions were raised and all were hypothesized and tested to guide the direction of the study. The Biology Achievement Test (BAT) instrument comprising 30-items objective questions was used to collect data for the study. The instrument was validated by experts in the Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin. The BAT was trial tested on 20 students outside the sample area. The Pearson Product Moment Correlation Coefficient statistic was deployed to obtain a reliability co-efficient of 0.750. The data collected were analyzed using mean, standard deviation and ANCOVA statistics at 0.05 level of significance. It was found among others that there is no significant difference in achievement between students taught Biology with blended learning approach and traditional method. It was recommended among others that Workshops and seminars should be organized by states' ministry of education for secondary school teachers on how to use Blended learning approach in teaching biological concepts. Secondly, Provisions should be made by local school authority and state government for computers, internet and power generating facilities that would enable teachers to adopt and students to learn using the blended learning approach.

Keywords: Blended learning, Traditional method, Achievement

Introduction

Biology is a branch of natural science that deals with the study of living organisms. This includes their structures, functions, evolution, distribution and interrelationships. Biology occupies a unique position in the secondary school education curriculum because of its importance as a life science. In Nigeria, the secondary school Biology curriculum is designed to continue student investigation into the natural phenomena, to deepen students' understanding and attitude towards biological sciences and also to

encourage students to apply scientific knowledge to everyday life in matters of persons, community, health and agriculture. The knowledge of Biology have been crystalized into concepts, empirical laws and theories which form the basis of our material comfort. Biology as a very important science subject, stands as the bedrock upon which are based many other science courses/careers like Medicine, Pharmacy, Nursing, Biochemistry, Genetic and Agriculture, which are of great economic importance to a nation. Besides, in this 21st century, as the nation expect better health for all, abundant food for all, better knowledge of man, animals and plants and less polluted environments with sulphur (iv) oxide and radioactive substances are expected, there is the need to effectively teach and learn Biology to meet the impending challenges.

Teaching approaches employed by teachers are one of the most important areas that researchers have put their searchlight. This is because it can easily be manipulated to bring positive changes in learners. Teaching is a process of impacting knowledge which involves many activities on the part of the teacher and the learners (students). Teaching approaches includes the various means and activities of the teacher and learner in the learning process geared towards acquiring ideas, knowledge, skills and values that are built within the educational aims and objectives. According to Al-Quisi (2015) teaching approachs are set of performances that the teacher uses to achieve expected behavior among learners. Adunola (2011) added that in order to bring desirable changes in students the teaching approach used by teachers should be best for the subject matter explaining that teaching approach work effectively mainly if they suit learners' needs; teaching approachs are one of the components of the curriculum. Based on the above, a teaching approach can be defined as the description of learning objectives, oriented activities and the flow of information between teacher and students in the teaching and learning process.

Teacher-centred approach includes all the teaching methods in which the teacher dominates in the lesson procedure and takes the lead in coordinating the classroom activities as regards to what to be done. According to Mascolo in Serin 2018 the teacher-centered approach refers to communication of knowledge to students in a learning environment in which the teacher takes the primary responsibility; teachers are active while students are passive. This approach emphasizes and encourages memorization. The term teacher-centred approach therefore comes from the roles of the teacher in the traditional classroom as the teacher is the possessor of knowledge and decision maker and also decides the knowledge that will be transferred to learners in the teaching learning process. Hassen (2015) asserts that the most important reason for academic failure is the use of teacher-centered approach which turns some students or all of them into passive learners. In addition, the use of teacher-centred approach has received so much criticism for not creating an environment in the classroom to develop critical thinking, problem solving skills and exchange of ideas among students (Ganyaupfu 2013; Carter 2016; Muema, Mulwa, and Mailu 2018). For that reason, there is a shift from teacher-centered approach towards student-centered approach in classroom instruction

Student-centred approaches include all teaching methods that underscore the teacher as a decision maker and problem solver in the classroom but rather see the teachers as guides, facilitators, mentors, coach or consultants in the teaching and learning process. The term student-centred, child-centred or learner-centred are interchangeably used to refer to teaching methods that allow students to share some degree of responsibility and decision making in the classroom.

Student-centred approach is grounded in constructivism, with the epistemological view that learners are the architects of their own idiosyncratic meaning of concepts and natural phenomena. However, Campbell (2006) posited that the cognitive learning theory also advocates for student-centred idea. In discussing student-centred teaching approach, such terms like constructivism, inquiry and discovery learning are often interchangeably used. Nevertheless, in today's educational discussions, the term student-centred approach is a broad term that includes all innovative teaching methods that are usually activity oriented, where learners are expected to observe, analyze, synthesize and evaluate ideas or phenomena using materials or previous knowledge. Teaching methods emphasizing this approach include discovery, constructivism related method (concept mapping, co-operative learning), problem solving, graphic organizers, annotated diagrams, flipped classroom, role playing, simulations, blended learning, inquiry method and games. The student-centred approach is relevant to Biology teaching because it creates an environment that will encourage students to interact with materials and specimens that enable students to construct meaning, knowledge and learn Biology from first-hand experience. It may be for this reason that, Daluba (2013) opined that for better performance of students, there is the need for activity simulating and student-centered approach like demonstration method instead of depending on the conventional approach like lecture method. Student-centered approaches which are more effective should be more encouraged because they embrace the concept of discovery learning (Brindley, 2015).

Blended learning is one of such student centred learning methods that can be utilized in the teaching and learning of Biology. Blended learning has been defined in a number of ways and a generally accepted definition does not exist. It is used interchangeably with distance learning, online learning, e-learning, blended teaching, e-teaching, blended e-learning, hybrid learning and flexible learning. Literature defines blended learning in many different ways according to instructional method. There are three most common definitions documented by Graham, Allen and Ure (2005) under the following three headings: Combining instructional modalities, Combining instructional methods and Combining online and face-to-face learning. According to Skill and Young (2002), blended learning is a combination of in-class teaching and learning modalities with robust electronically mediated experiences. Singh (2003) sees blended learning as a combination of multiple instructional methods designed to complement each other and promote meaningful learning. Combining online and face-to-face learning according to Welker and Bernardino (2006) is the use of electronic learning tools that supplement but do not replace face-to-face learning. These definitions connote instructional systems that combines multiple delivery methods, that is face-to-face classroom with asynchronous online learning. The broad nature of these definitions stands as critics however, Oliver and Trigwell (2005) attacked the concept as ill-defined and eventually different understandings began to emerge.

Krasnova (2014) posited that blended learning is a method of teaching that combines the most effective face-to-face teaching techniques and online interactive collaboration, both constituting a system that functions in constant correction and forms a single whole. Also Staker and Horn (2015) defines blended learning as a formal educational program in which a student learns at least part through online delivery of content and instruction with some element of student control over time, place, path, or pace and at least in part at a supervised brick-and-mortar

location away from home. Balentyne and Varge (2017) viewed Blended Learning as an instructional strategy that involves a thoughtful combination of traditional face-to-face instruction and online instruction. Their definitions emphasized more on content and instruction that must be delivered online, meaning that a traditional face-to-face course in which students are encouraged to use the internet for research does not qualify as blended learning. In addition, blended learning courses can support students and has been proved to be very useful in improving teacher's abilities to respond to a wide range of students' need.

Gender is a sociocultural construct ascribing some characteristics and roles of sex such as male and female within the society. The concept of gender is equivalent to class and race and many social construct just as class and race (Roberts, 1996). Okeke (2007) observed that the circumstances of gender have strongly interacted with culture to produce sex role – stereotypes which cut across social, economic, political and educational development especially in the areas of science and technology. Also. Oludipe (2012) observed that in Nigeria, certain vocations and professions have traditionally been regarded as men's (medicine, engineering and architecture) and others as women's (nursing and catering, typing). Nevertheless, recent studies reported that although there is a decrease in the gap in gender difference in students' performance in science, female representation in sciences is still low in comparison with their male counterparts. Gender issues and its effects on students' academic achievement in science has persisted over the years with contradicting results and it stands out as a controversial issue in science education due to varying reports from different researchers. Researchers like Okoro, 2011; Gipps, 2014; and Kingdon, 2015 are of the view that males perform better than females in sciences while Calsambis, 2014 and Soyibo, 2014 found females better, whereas some other researchers like Oludipe 2012; Achor, Wude, & Duguryil, 2013; Ventura, 2013 and Ajayi & Ogbeba, 2017 are of the view that both male and females achieve equally in science when given equal opportunity and facilities.

Despite the enormous importance of Biology to mankind and the nation, the teaching and learning of Biology as a discipline has been characterized by poor academic performance over the years. This could be attributed to the continuous use of the traditional teaching method which does not give room for active participation and improvement in academic achievement of Biology students in the subject. Several factors have been identified as could also be responsible for this poor performance in Biology which includes teachers choice of instructional strategy, use and non-use of instructional materials, students' study habit, teachers' qualification and training, and so on. Several studies have been carried out to ascertain the effectiveness of blended learning approach in Nigeria and beyond. For instance, Khaled (2013) used blended learning on developing critical thinking skills and found no statistically significant difference between the pre-measurement and post-measurement in the experimental group in Saudi Arabia. Also, Ezeanyika and Okigbo, (2021) studied the effect of Blended Learning Instructional Approach on Secondary School Students' Academic Achievement in Computer Studies in Awka, Anambra state of Nigeria. The findings of the study revealed among others that there is a significant difference between the mean academic scores of the students taught computer studies using blended learning instructional approach and those taught using conventional method in favour of blended learning. In another study, Okoro (2011) investigated interactive learning patterns on achievement and interest in Biology and found that gender differences

existed in the achievement and interest of students in favour of male students who achieved more than the females in Enugu State. However, none of the above studies highlighted have been carried out in Ose Local Government Area of Ondo State. Also, none of these studies have considered the variables of blended learning, gender and achievement in a single study. It is on this note, that this study investigated the effect of blended learning approach on Biology students' achievement in Ose Local Government Area of Ondo State, Nigeria.

Purpose of the Study

The purpose of this study is to determine the effect of blended learning approach on Biology students' achievement in Ose Local Government Area of Ondo State, Nigeria. Specifically, this study:

1. ascertained the difference in academic achievement between students taught Biology with blended learning approach and traditional method,
2. investigated the difference in male and female students' academic achievement in Biology after treatment using blended learning approach.

Hypothesis

$H0_1$: There is no significant difference in the achievement between students taught Biology with Blended learning approach and students taught with traditional method.

$H0_2$: There is no significant difference in male and female students' achievement in Biology after treatment using Blended learning approach.

Method

This study utilized the pretest-posttest non-equivalent control group research design. The population of this study is 516 SSS II Biology students in public co-educational schools in Ose Local Government Area of Ondo State. The simple random sampling was used to obtain two schools for this study. A total of fifty-eight (58) students which comprises thirty-three males and twenty-five females from two intact classes were sampled for the study. The Biology Achievement Test (BAT) which was made up of thirty (30) multiple choice objective question items was utilized for data collection in this study. The instrument was validated by experts in the Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Edo State. The reliability was ascertained using the test-retest reliability technique and the Pearson Product Moment Correlation statistic was used to obtain a reliability coefficient index of 0.75 before it was put to use.

Results

Research Question One: What is the difference in academic achievement between students taught Biology with blended learning approach and traditional method?

Table 1: Mean and Standard Deviation Showing Achievement in Blended and Traditional Methods

Groups	N	Mean ($\bar{X}$)	Standard Deviation
Blended Learning	25	13.32	4.230
Traditional Method	33	16.15	4.177

The results in Table 1 show the mean scores for achievement for the experimental and control group. The data shows that the blended learning group means score was 13.32, a standard deviation score of 4.230. While for the control group, the participants' mean score of 16.15, a standard deviation of 4.177. The results show that the control group got a higher mean score after treatment.

Research Question Two: What is the difference in male and female students' academic achievement in Biology after treatment using blended learning approach?

Table 2: Mean and Standard Deviation Showing Achievement of Male and Female Students Taught Biology Using Blended Learning Approach

Groups	N	Mean	Standard Deviation
Male	10	15.50	4.577
Female	15	11.87	3.399

The results in Table 2 show the mean scores for posttest achievement for males and female in the experimental group. The data shows that male participants got a mean score of 15.50, and a standard deviation score of 4.577, while the female participants got a mean score of 11.87 and a standard deviation of 3.399. The results show that the male participants got a higher mean score which means that the males achieved more than their female counterparts.

$H0_1$: There is no significant difference in achievement between students taught Biology with Blended learning approach and students taught with traditional method.

Source	Type III Sum of Square	Df	Mean Square	F	Sig.
Corrected Model	79.211[a]	2	39.606	2.488	0.106
Intercept	483.107	1	483.107	30.347	0.000
Pretest (Covariate)	0.005	1	0.005	0.000	0.986
Group	79.156	1	79.156	4.972	0.036
Error	350.229	22	15.919		
Total	4865.000	25			
Corrected Total	429.440	24			

Table 3: Analysis of Covariance (ANCOVA) Showing Students' Posttest Achievement Scores

Source	Type III Sum of Square	Df	Mean Square	F	Sig.
Corrected Model	167.241[a]	2	83.621	4.922	0.011
Intercept	699.532	1	699.532	41.172	0.000
Pretest (Covariate)	53.200	1	53.200	3.131	0.082
Group	12.055	1	12.055	0.710	0.403
Error	934.483	55	16.991		
Total	14032.000	58			
Corrected Total	1101.724	57			

Table 3 shows the ANCOVA analysis of the achievement of students taught Biology using blended learning approach and conventional method. The result indicates that $F_{(1, 55)} = 0.710$, $p = .403$ which is not significant at 0.05 alpha level. This means that there is no significant difference in the achievement of students taught Biology using blended learning approach and the conventional method. Therefore, the null hypothesis of no significant difference is accepted.

$H0_2$: There is no significant difference in male and female students' achievement in Biology after treatment using Blended learning approach.

Table 4: Analysis of Covariance (ANCOVA) Showing Male and Female Students' Posttest Achievement Scores

Table 4 shows the ANCOVA analysis of the achievement of male and female students taught Biology using blended learning approach. The result indicates that $F_{(1, 22)} = 4.972$, $p = 0.036$ which is significant at 0.05

alpha level. This means that there is a significant difference in the achievement of male and female students taught Biology using blended learning approach. Therefore, the null hypothesis of no significant difference is rejected.

Discussions

In Table 1, the results indicated that the control group got a higher mean score at after treatment this finding is in alignment with that of Khaled (2013) who concluded that there is no difference between students taught using blended learning instructional approach and those taught with conventional method in Saudi Arabia. Also, the findings do not align with the findings of Ezeanyika and Okigbo (2021) in Anambra state who concluded that there is difference in the mean achievement scores of students taught using blended learning instructional approach and those taught using conventional method in favour of the blended learning instructional approach. The difference in finding could be attributed to other extraneous factors not controlled for in this study. The result as presented in Table 2 shows that male participants got a higher mean score which means that the males achieved more than their female counterparts. This finding agrees with the finding of Okoro (2011) in Enugu State who concluded that gender differences exist in the achievement and interest of students in favor of male students. In Table 3, it was found that there is no significant difference in the pretest-posttest achievement of students taught Biology using blended learning approach and the conventional method. This finding is in consonance with the findings of Khaled (2013) who found no statistically significant difference between the pre-measurement and post-measurement in the experimental group in Saudi Arabia. This finding also does not aligns with the findings of Ezeanyika and Okigbo (2021) in Anambra State who concluded that there is a significant difference in the mean achievement scores of students taught using the blended learning instructional approach and those taught using the conventional method in favour of blended learning instructional approach. The difference in finding could be attributed to location, school type and sample sizes between this study and the previous studies. In Table 4, this study found a significant difference in the posttest achievement of male and female students taught Biology using blended learning approach in favour of the males. This finding supports the study of Okoro (2011) who found that gender differences exist in the achievement and interest of students in favour of the males.

Recommendations

The following recommendations are made based on the findings of this study. First, Workshops and seminars should be organized by state ministry of education for secondary school teachers on how to use Blended learning approach in teaching biological concepts. Secondly, Provisions should be made by local school authority and state government for computer, internet and power generating facilities that would enable teachers to adopt and students to learn to use the blended learning approach.

Conclusion

This study has shown that teaching approaches and strategies used by teachers in science (Biology) teaching has a significant effect on male and female students' achievement at the secondary school level. The study also revealed that the male students performed significantly better in Biology when taught transportation system and mechanisms using blended learning approach.

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Influence of Covid-19 Pandemic Lock Down on the Socio- Economic Activities of Some Selected Artisans in Benin Metropolis

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Abstract

Lock down measures employed by many countries including Nigeria to minimize the spread of COVID-19 almost crumbled the economic activities in the world. Many economic activities including Small and Medium Scale Enterprises were negatively affected. However, some were more negatively affected than others due to the kind of services they rendered. During the lock down, people still visited the saloon to make their hair, fixed their vehicles, repaired their generating sets and mended their leaking roofs among others. Therefore, this study investigated the influence of COVID-19 pandemic lock down on the socio economic activities of selected artisans in Benin metropolis. The ex-post facto research design was used to carry out the study and the population of the study was 2,840 artisans operating in Edo State. The sample size was 284, representing 10% of the population. A structured interview was the instrument used for data collection. The research questions were answered with mean (x) statistics. It was found out that COVID -19 pandemic lock down had positive influence on the socio economic activities of motor vehicle mechanics and generator repairers. Whereas, it had negative influence on the socio economic activities of building services providers and the hair stylists. Based on the findings, it was recommended among others that citizens of Nigeria should acquire vocational and technical skills that could provide additional means of lively hood even during pandemics.

Keywords: COVID-19, Artisans, Socio economic activities.

Introduction

The COVID-19 pandemic was one whose impact was unparalleled in history. Although advances in technology helped its containment, the pandemic spread still posed a strong challenge. This resulted in countries of the world gathering resources, both intellectual and financial, to combat a common enemy. In spite of this, there appeared to be an increase in the spread globally with countries recording daily deaths that increased up to a thousand and more. Reports indicate that the countries most affected by this pandemic are located in Europe and North America (World Health Organization, 2020)

According to Jacob, Abigeal, and Lydia (2020), the first known occurrence of the virus began in December 2019 in Wuhan, the capital of the Hubei province of China. It began as a form of pneumonic cases in the province. The cases were reported to the World Health Organization (WHO) country office and it was discovered to be a new strain of the SARS-CoV virus of 2002. The name Covid-19 was given to the virus by the WHO on the 11th of February, 2020. It is an acronym which stands for Corona Virus Disease of 2019. The symptoms associated with the disease are common to that of the common cold. They include fever, cough, shortness of breath, loss of smell. However, the complications are of a greater degree than the symptoms as they could lead to pneumonia, viral sepsis, acute respiratory distress syndrome, kidney failure, and many more. The complications over time was said to worsen based on the health status of the individual. (Sohrabi, Alsafi, O'Neill, Khan, Kerwan, Al-Jabir, Iosifidis & Agha. 2020)

The virus is not airborne but could spread in various ways. It was primarily spread amongst people during close contact. If droplets from infected persons fell on surfaces, people could get infected by touching an already contaminated surface. Various studies have shown that the half-life of the virus outside the human body depends on the temperature and humidity hence, different regions can have different rates of spread. The best methods of control are to avoid crowded environments, constantly wash and sanitize the hands, regularly clean possibly contaminated surfaces and constantly wear a face mask. Despite these measures, the disease found its way into almost all countries of the world including Nigeria thereby necessitating different nations to provide contextual solutions to manage the situation while awaiting a vaccine.

According to the Nigeria Centre for Disease Control (NCDC), (2020), the first case of COVID-19 in Nigeria was confirmed in the Infectious Disease Centre, Yaba, Lagos State, Nigeria on the 27th February, 2020. An Italian citizen arrived at the Murtala Muhammed International Airport, Lagos at 10:00 p.m. on 24th February, 2020 on-board a Turkish airline from Milan, Italy. He visited his company's site in Ogun State the following day where he presented himself at his company's staff clinic. The physician-on-duty had a strong suspicion of the presence of the virus. This led him to refer the Italian citizen to Infectious Disease Hospital (IDH) and the COVID-19 status was confirmed (Nigeria Centre for Disease Control, 2020). The Nigeria Centre for Disease Control (NCDC) started the contact tracing of 'Persons of Interest' which included all persons on the manifesto of the flight that brought the index case to Nigeria, as well as people who had close contact with the index case while in Lagos and Ogun State. After a period of two weeks, a cluster of cases was detected in Lagos and Abuja, this was noted to be the emergence of the nationwide spread of the virus.

The Federal Government responded with the authorization of the closure of all non-essential services (businesses and industries) and restricted movement of people in Lagos State, Ogun State and the Federal Capital Territory, Abuja, on 29th March, 2020. Most State Governments restricted public gathering and there were restrictions on Inter-state movement. The Federal Government later authorized the gradual easing of lockdown in the previously restricted states on the 4th May, 2020. The nationwide spread of the virus led to the Federal government of Nigeria taking certain measures to contain the virus. The available information on the virus and the welfare of her citizenry were guiding beacons in periodic restrictions to maximize containment. Educational and Religious institutions were the first bodies restricted before containment

measures extended to non-essential services. The great lockdown was meant to curtail further spread of covid-19 virus.

The covid 19 lockdown led to closure of very many institutions and organizations including businesses of all sorts. Transporters were also affected because there was a drastic reduction in the number of commuters. The lock down, no doubt affected the economy of the country thereby increasing the level of poverty in the land. This led to government, charity organizations and individuals to engage in giving out palliatives to the poor and less privileged.

Despite the lockdown and its adverse effects on people's live and livelihood, the small scale business owners were still engaging in their daily activities as usual. In this study, technicians and artisans were used interchangeably and were considered to be categories of skilled persons who provide services of our daily needs. For example, the motor vehicle mechanic and those into maintenance and repair of building: bricklayers; carpenters; electrical installation technicians; plumbers; painters. Others who are self-employed include: electronics technicians, GSM repairers, television and other house hold appliances repairers, and the hair stylists: barbers and hair dressers opened their shops daily during the lockdown to attend to customers. Self-employed workers are those who operate personal businesses that involve buying, selling and rendering of labour including independent contractors, day labourers, or gig workers (Abraham et al, 2020).

Motor vehicle mechanics are artisans who specialized in the repair and services of motor vehicles. They diagnose and repair faults in the different systems of motor vehicles .Their workshops are found in different locations within Benin metropolis. Some of the mechanics are graduates of technical college while others are trained under the open apprenticeship system. The services rendered by motor vehicle mechanics are needed even during pandemic periods and other forms of crises in the country. During such period, motor vehicles owners carry out maintenance to enable them move around easily with their motor vehicles. The bricklayers, carpenters, electrical installation technicians, plumbers and painters are other categories of artisans whose services are needed to carry out maintenance in buildings irrespective of the prevailing situation in the country. Auto-mobile technology is the learning of basic knowledge and skills necessary to diagnose and repair mechanical defects in motor vehicles. The artisans trained for diagnosing and repairing faults in motor vehicles are known as motor vehicle machanics (Schaller, 2010) These artisans were able to sustain their means of livelihood during the COVID-19 pandemic lock down. In recent times, communication has become a key to day to day activities. The convenience provided by the use of mobile phone connot be over emphasized. The repair of cell phone has become a lucrative business to the technicians. According to Okala (2015) regular maintenance of house hold appliances is key to comfortable living in the modern world. They seemed to become busier during the pandemic lockdown. People needed to fix their faulty cell phones during the lock down to enable them communicate for business transactions and for other reasons.

It was observed that these categories of artisans were still engaged in rendering their services despite the pandemic lockdown. During the lockdown, people needed to service and repair their motor vehicles and their generator sets, mend their leaking roofs, fix their faulty plumbing system and ratify electrical faults in their houses, repair their cell phones, television and other electronic gadgets. Indeed, it seemed that it was the period of lockdown that people visited the hair saloon most. Therefore, the activities of these categories of artisans involved in these

services seemed not to have been affected by the lockdown as one would imagine. These artisans, through their skills were able to render useful and relevant services to various individuals and households, thus, likely making a lot of income for themselves and their families. This is exactly what Technical and Vocational Education and Training (TVET) seeks to achieve.

Technical and Vocation Education and Training encourages skill acquisition; knowledge and attitude needed for professional careers, and through its orientation, the social and economic inclusion of the rural population and the marginalized communities are addressed (Okala,2015). Considering the fast evolving changes in world economy occasioned by the forces of globalization and ICT expansion, coupled with the fact that foreign investors place premium on skills and technical competencies of local workforce, neglecting the TVET sector will be tantamount to compromising the wellbeing of the populace and the national economy. Boström (2013) described TVET as any educational programme (including training of artisans) organized to orientate people into skills acquisition, as well as teach them the attitude and knowledge necessary for the appropriate utilization of such skills. It is education designed to develop specific occupational skills. TVET creates educational background necessary for democratization of entrepreneurial skills in a broader and in an organized manner for a chosen occupational field. TVET thus has the potential to train the skilled workforce that the nation needs, and create employment for the youths to emerge out of poverty.

The nature of the vocational skills acquired through TVET is such that they are on daily demand. In other words, the services rendered by these entrepreneurs, technicians and other small-scale business owners are so crucial that they are regularly required regardless of the situation prevailing in the counry. This implies that these groups of persons and their services to a large extent are not limited by time or seasons. This fact makes it arguable that the technicians or small scale business owners, like other businesses, seemed not to have been adversely affected by the lockdown due to the covid 19 pandemic. It is against this background that the researchers therefore wished to examine the extent to which the lockdown due to covid-19 pandemic influenced the economic activities of technicians or artisans in Benin metropolis in Edo State.

Statement of the Problem

Despite the funds provided for quick economy recovery from the pandemic, several micro, small and medium scale enterprise seem not to have fully recovered from the effect of COVID-19 pandemic. However, many technicians and artisans continued with their economic activities uninterrupted. Within this said period for example, the artisans were able to take their services to locations where there were no restrictions of movement. It is therefore likely that the COVID-19 pandemic did not affect the activities of artisans as it did on the activities of conventional buying and selling businesses. However, what is not yet clear to the researchers is the extent to which COVID-19 pandemic lock-down influenced the economic activities of artisans within Benin metropolis; hence the need for this study.

Purpose of the Study

The main purpose of the study was to determine the influence of COVID-19 pandemic on the socio-economic activities of some selected artisans in Benin metropolis, Edo State. Specifically, the study determined:

1. the extent to which covid-19 pandemic influenced the socio-economic activities of motor vehicles mechanics in Benin metropolis;

2. the extent to which covid-I9 pandemic influenced the socio-economic activities of building services providers in Benin metropolis;
3. the extent to which covid-19 pandemic influenced the socio-economic activities of electrical and electronic appliances repairers in Benin metropolis;
4. the extent to which covid-19 pandemic influenced the socio-economic activities of hair stylists in Benin metropolis.

Research Questions

The following research questions guided the study.

1. To what extent did covid-19 pandemic influence the socio-economic activities of motor vehicles mechanics in Benin metropolis?
2. To what extent did the covid-19 pandemic influence the socio-economic activities of building services providers in Benin metropolis?
3. To what extent did the covid-19 pandemic influence the socio-economic activities of electrical and electronic appliances repairers in Benin metropolis?
4. To what extent did covid-19 pandemic influence the socio-economic activities of hair stylists in Benin metropolis?

Methodology

The study adopted the ex-post facto research design to investigate the influence of COVID-19 pandemic on socioeconomic activities of some selected artisans in Nigeria. This design was considered appropriate because the event of lock-down has already taken place and cannot be manipulated.

The population of this study consists of 2,840 technicians within Benin metropolis. This includes Motor Vehicle Mechanics, building services providers, electrical and electronic appliances repairers and hair stylists.

The sample size consists of 284 technicians in Benin metropolis. This represents 10% of the population of the study. Proportionate sampling technique was used to select the sample size of the study. That is 10 percent of every category of artisans were selected.

Research Instrument

Data used for the study were collected with a structured interview. The interview schedule was designed with 24 item statements to suit all artisans listed. Each item statement has response indicating frequencies of patronage per week before the pandemic lock down and during the pandemic lock down. The responses were rated seven times a week such that each response to each item was recorded over seven.

The instrument was validated by three experts in the department of Vocational and Technical Education, Faculty of Education University of Benin. Their suggestions were incorporated into the final draft of the instrument.

A test-retest reliability method was used to ascertain the reliability of the research instrument. The instrument was administered twice for a pilot study which involved a total of 20 artisans who were part of the population but not the sample. Pearson Product Moment Correlation Coefficient (PPMCC) statistics was used to calculate the r-value and it yielded 0.69.

The researchers administered the instrument personally together with four research assistants who were properly briefed on how to conduct the interview. The exercise lasted for five days. It was one hundred percent return rate.

Method of Data Analysis

The data collected from the respondents were organized into tables. The responses to each item statement was converted to mean value. Therefore, there were mean values for each item statement before and during COVID-19 pandemic lock down. The mean difference for each item was also estimated. If the mean difference is of positive value, it means that COVID-19 lock down had a positive influence on the socio-economic activities of artisans in Benin metropolis. And, the COVID-19 lock down had a negative influence on the economic activities of artisans in Benin metropolis if the mean difference is of negative value.

Results

The results of the study are presented as follows

Research Question One: To what extent did covid-19 pandemic influence the socio-economic activities of motor vehicles mechanics in Benin metropolis?

Table 1: Mean responses on the extent to which COVID-19 pandemic influenced the socio-economic activities of motor vehicles and generator mechanics.

S/N	Interview Questions	Mean Before Lockdown	Mean During Lockdown	Mean Difference	Remark
1.	How many times did you come to the workshop in a week?	28.00	22.00	-6.00	Negative
2.	What was the rate of patronage weekly?	26.32	32.84	6.52	Positive
3.	What was your average income in a week?	25.20	36.00	10.80	Positive
4.	How many repairs did you make in a week?	28.00	32.88	4.88	Positive
5.	What was business generally like?	22.00	30.24	8.24	Positive
	Grand mean	25.91	30.79	4.88	Positive

Table 1 shows the mean difference in the socio-economic activities of motor vehicles and generator repairers before and during the covid-19 lock down. Item 1 had a mean difference of -6.00 in favour of before lock down and was recorded as negative effect while items 2, 3, 4 and 5 had a mean difference of 6.52, 10.80, 4.88 and 8.24 respectively. This implies that the COVID-19 pandemic did not influence motor vehicle and generator mechanics positively. This means that COVID-19 pandemic affected the socio-economic activities of motor vehicles and generator mechanics positively.

Research Question Two: To what extent did covid-I9 pandemic influence the Socio-economic activities of building services and repair providers in Benin metropolis?

Table 2: Mean distribution of responses on the extent to which covid-19 pandemic Influenced the socio-economic activities of building services and repair providers

S/N	Interview Questions	Mean Before Lockdown	Mean During Lockdown	Mean Difference	Remark
1	How many times was your services requested?	5.50	5.00	-.50	Negative
2	How many repairs did you carry out in a week?	7.81	5.21	-.26	Negative
3	What was the rate of patronage in a week	8.00	7.41	-.59	Negative
4	How many new clients did you receive in a week	8.00	6.00	-2.00	Negative
5	What was your average income in a week?	9.00	6.23	-2.77	Negative
	Grand mean	7.66	5.97	-1.69	Negative

Data in Table 2, revealed that items 1,2,3,4 and 5 have mean differences of .50, -2.6, -0.59, -2.00 and -2.77 respectively. It implies that socio-economics activities were better before the lockdown than during the lock down. This means that the extent to which covid-19 pandemic influenced the socio-economic activities of building services and repair providers negatively in Benin metropolis.

Research Question Three: To what extent did covid-19 pandemic influence the socio-economic activities of electrical and electronic appliances repairers in Benin metropolis.

Table 3: Mean distribution of responses on the extent to which covid-19 pandemic influenced the socio-economic activities of electrical and electronic appliances repairers

S/N	Interview Questions	Mean Before Lockdown	Mean During Lockdown	Mean Difference	Remark
1	How many times did you open shop in a week?	7.66	7.00	-.66	Negative
2	How many repairs did you carry out in a week?	5.50	8.00	2.50	Positive
3	What was the rate of patronage in a week	6.10	9.00	2.90	Positive
4	How many new clients did you receive in a week	6.10	8.54	2.44	Positive
5	What was your average income in a week?	5.00	8.10	3.10	Positive
	Grand mean	6.07	8.13	2.06	Positive

Data in Table 3 shows the mean difference in the socio-economic activities of electrical and electronic appliances repairers before and during the covid-19 lock down. It can therefore be seen that item 1, have a mean difference 0.66 in favour of before pandemic lock down while items 2, 3, 4 and 5 have mean differences of 2.50, 2.9, 2.44 and 3.10 respectively in favour of during pandemic lock down. This means that covid-19 pandemic influenced the socio-economic activities of electrical and electronic appliances repairers positively in Benin metropolis.

Research Question Four: To what extent did covid-19 pandemic influence the socio-economic activities of hair stylists in Benin metropolis?

Table 4: Mean distribution of responses of the extent to which covid-19 pandemic affect the socio-economic activities of hair stylists.

S/N	Interview Questions	Mean Before Lockdown	Mean During Lockdown	Mean Difference	Remark
1	How many times did you come to the workshop in a week?	8.80	4.11	-4.69	Negative
2	What was the rate of patronage daily?	7.15	3.00	-4.15	Negative
3	What was your average income in a week?	6.83	3.76	-3.55	Negative
4	How many new clients did you receive weekly	7.55	3.00	-4.55	Negative
5	How can you rate the challenges encountered in your business daily?	6.00	2.56	-3.44	Negative
	Grand mean	7.27	2.56	-4.71	Negative

Table 4 reveals the mean difference in the socio-economic activities of hair stylists before and during the COVID-19 pandemic lock down. It can be seen that items 1, 2, 3, 4 and 5 have mean differences of -4.69, -4.15, -3.07, -4.55 and -3.44 respectively, thereby giving the impression that hair stylists had poor patronage during the lock down. This means that the covid-19 pandemic influenced the socio-economic activities of hair stylists negatively.

Discussion of Findings

The findings revealed that covid-19 pandemic influenced the socio-economic activities of motor vehicles mechanics positively. This means that motor vehicle mechanics were still actively going about their businesses and even had more jobs during the period of the lock-down due to COVID- 19. This finding was corroborated by the study of Fernandes (2021) who found that motor vehicle mechanics were busier during the covid 19 lock-down period than they were before that time. The author explained that staying at home afforded people the opportunity to engage the services of vehicle repairers to critically examine the condition of their vehicles.

It also was revealed from the findings that covid-19 pandemic lockdown influenced the socio-economic activities of building services and repair providers negatively. This finding supported the findings of the work of Adegboye, Adekunle, and Gayawan, (2021) who reported that the activities of building services providers were put on hold due to the fear of been infected by covid 19 virus because the job involved many people working together. However, Baldwin and Tomiura (2020) contradicted this finding in their report that house maintenance works were not affected by the lock down as the services of artisans were needed during the pandemic lockdown.

Again, the finding revealed that covid-19 pandemic influenced the socio-economic activities of electrical and electronic appliances repairer positively. In relation to this finding, Fernandes (2021) stated that the activities of repairers of electronic and electrical appliances during the lock down was significantly different from what it used to be before the period. That is more persons repaired their damage electrical appliances during the lock down probably to enable them listen to radio news broadcast and watch television during their stay at home.

Covid-19 pandemic affected the socio-economic activities of hair stylists negatively. In support of this finding, Baldwin and Tomiura (2021), found that hair stylist and beauticians were negatively affected by the lockdown. This was probably due to the fact that people had become enlightened about the mode of transmission of the covid 19 virus and avoided close contact with those outside their homes. This finding was also buttressed by Bermeo and Bartels (2014) who posited that in situations of global emergencies, people turn to trusted hands and those within their enclaves for whatever assistance they can get.

Conclusion

It is clear from the findings of the study that despite the perceived and expected negative effect of Covid-19 pandemic lock down on business activities in Nigeria, some artisans were not totally affected economically. In other words, while many business owners and employees experienced lack and hardship because they could not continue with their jobs, the artisans were very much engaged with activities that yielded income for them. This is not to say that artisans did not experience lack or financial challenges, but that they were more financially stable than other business owners and many individuals who were totally dependent on salaries.

Recommendations

The following recommendations are made based on the findings and conclusion.

1. There is need to expose youths to skill acquisition programmes in order for them to be self-dependent.
2. Employees who solely depend on salaries should be encouraged to establish viable and sustainable businesses as additional sources of income for sure sustainability.
3. Artisans should be provided with soft loans so as to enable them expand their business coverage and enable them to accommodate more apprentices.

4. Citizens of Nigeria should engage themselves in skill acquisition irrespective of their conventional occupation for sustainable means of lively hood.

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Effect of Jigsaw Cooperative Instructional Strategy on Students' Acquisition of Mathematics Process Skills

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ABSTRACT

The study investigated the effect of Jigsaw Cooperative Instructional Strategy on students' acquisition of Mathematics process skills in Senior Secondary Schools in Delta State, Nigeria. Four (4) research questions were raised, hypothesized and tested at 0.05 alpha level of significance. Quasi-experimental non-equivalent pretest, posttest, non- randomized control group design was used. The population of the study was 3716 students. The sample for study consisted of 114(0ne hundred and fourteen); the experimental group consists of 66(sixty six) students which comprised 28 boys and 38 girls while the control group comprised 48: 21male and 27 female. Data collected through Mathematics Achievement Test (MAT) were analyzed and interpreted using descriptive statistics: mean, standard deviation and inferential statistics: t-test and Analysis of Covariance (ANCOVA). The findings of the study revealed that the strategy recast acquisition of Mathematics process skills in Geometry among students. Therefore, based on the finding of the study, the following recommendations were made: Mathematics teachers should be encouraged to adopt the strategy to teach selected topics like Geometry to enhance students' active participation during lessons for better understanding and students should be given the opportunity to develop various skills through the use of strategy.

KEY WORDS: Jigsaw Cooperative Instructional Strategy, Acquisition, Mathematics Process Skills

Introduction

In pursuance of national goals and aspirations, the secondary school education system was endowed with several subjects among which is Mathematics. This was done with the government understanding; that the overall development, growth and transformation of most nations of the world were greatly guided, influenced and dependent on Mathematics education, its principles and applications. .Nigeria as a developing nation cannot under estimate the role of Mathematics if she truly wants to move forward as a nation. Mathematics is the bedrock of national development and a subject without no nation can move forward scientifically and technologically (Alutu & Eraikhuemen, 2004). Sumbabi and Bassey (2013) posited that Mathematics is an intellectually stimulating subject, a bed rock of science and technology and a link to the study of subjects like medicine, physics, chemistry and courses in engineering and earth sciences. And supporting this further, Onah, (2015) opined that without Mathematics, there is no science; without science, there is no modern technology, and without modern technology, there is no modern society. The views of Alutu and Eraikhuemen, Sumbabi and Bassey and Onah imply that there could be no real and meaningful development scientifically and technologically without a corresponding development in Mathematics education.

This exceptional and prominent position accorded the subject Mathematics among other school subjects is as a result of its role in the educational system and life in general. For instance, Mathematics gives the learner creative reasoning ability; Mathematical skills and models are readily used in industries, electronics, medicine and telecommunication and others fields. Again, most striking human discoveries of our time were made possible through the use and application of Mathematics ideas and principles. These show that Mathematics is very needful, not just only as a school subject to be taught and learnt in order for the individuals to become productive members of the society but its knowledge serves as a basis or requirement for the study or advancement of other fields of studies like Accountancy, Computer Science, Chemistry, Education, Engineering, Medicine and the Sciences. (Nation Policy of Education, 2013). This is the reason why many Mathematics educators and researchers, among others, have in recent times focused their research on finding better and improved ways of promoting the teaching and learning of Mathematics to increase achievements of students academically. Today in Nigeria, at least, credit pass grade in Mathematics is currently required by all tertiary institutions from all students for admission.

However, despite the importance of Mathematics to the society, there has been persistent poor performance in the subject. The May/June West African Examination Council (WAEC) results [2018, 2019, 20120, 2022] show that more than 50% of the candidates who took part in senior secondary certificate examination (SSCE) yearly got P7, P8 and even F9 grades, these results are indications that there are problems in the teaching and learning of Mathematics. The poor achievement obtained yearly at West African Examination Council (WAEC) results imply that students continually have learning difficulties in Mathematics. The evidences from these results suggest that Mathematics classrooms may not be providing students with adequate and enabling environment sufficient to enhance good achievement in school Mathematics.

But Geometry seems to top the list of areas and topics in Mathematics predominately mentioned among others where candidates continually have difficulties (Eraikhuemen, Odafe & Omoifo, 2018). And majority of candidates who sit for the examinations completely avoid questions in Geometry and even the few that attempt questions in

Geometry do poorly in it; this is an indication that there is a problem in the teaching and learning of Geometry in Mathematics amidst others. Hence, the focus of this study was on some aspects of Geometry: chord property, circle Theorems, trigonometry and bearing. There seem to be difficult contents for many students and even teachers themselves to fully comprehend. Confirming this, Ali, Bhagawati and Sarmah (2014) opined that the teaching of Geometry is problematic because it requires knowledgeable and competent teachers. And as a follow up to the problem of teaching and learning of Geometry and other topics in Mathematics to enhance better achievement; the Chief Examiner for many years continually suggested among others that teachers should be encouraged to use method of teaching that are practicable and teachers as well as candidates are to put in more effort in the teaching and learning of Geometry. These suggestions are indications that the methods of teaching Mathematics lessons and its associated approaches seem to be faulty. But Geometry is a vibrant and exciting part of Mathematics and a key to understanding our world through concrete experiences with geometric figures and relationship (Sumbabi & Bassey, 2013).

The present Mathematics Curriculum was designed to enable the learners actively cultivate the understanding and application of Mathematics skills and concepts necessary to thrive in the ever changing technological world. More so, help learners develop the essential elements of problem solving, communication, reasoning, and connection among others. These Mathematics skills and essential elements are the process skills for learning and understanding ideas and concepts in Mathematics and were simply regarded as Mathematics Process Skills (MPS) in the study. The MPS include the following: Problem solving, Communicating, Reasoning and proving, Reflecting, Connecting, Representing and Computational strategies. These MPS are intertwined like the Jigsaw puzzle, depending on each. And the topics taught include: Chord property, Circle theorems, Trigonometry and Bearing (NERDC, 2007)..

Literature, and in fact practicing Mathematics teachers' views have shown that the most widely used method is the teacher centered lecture method of "talk and chalk"; this has always been the traditional method of teaching the subject in our secondary schools. In this method teacher works some examples on the board and students copy such worked examples into their exercise book; this is usually followed by students being given some work to solve based on the worked examples either in class or as take home assignment. Under this teaching method teachers "tell" students about Mathematics ideas and this result in poor communication of the topic of the day to the students. This method only leads to rote memorization and majority of students finds it difficult to understand mathematical concepts that way. (Omoifo, 2012).

The lecture method seems to be ineffective and deficient of what it takes to make good teaching and learning of all topics in Mathematics in our secondary schools; for the teaching and learning of Mathematics can only be result driven when students are willing to learn and teachers are well disposed to using appropriate methods and resources in teaching their students. This orientation of "result driven" coupled with the willingness of students to learn and teacher well disposed to using appropriate methods and resources in teaching their students seems to be lacking in the teaching strategy embedded in the lecture method.

On this note therefore, it been necessary to look at the secondary school Mathematics programe to see what had been done to remedy the situation of poor achievement already existing in the nation's Mathematics

teaching and learning at this stage. Therefore, the search for alternative strategies which can lead to better performance and help achieve the national goals and objectives from existing literature is in great necessity. From literature, the researcher found some qualities in Jigsaw Cooperative Instructional Strategy (JCIS) that can help in solving students' problem in Mathematics and Geometry in particular. JCIS is used to develop the skills and expertise needed to participate effectively in group activities which also focuses on listening, speaking, co-operation, reflection, and problem solving skills in the students (Hakkarainen, 2012).

However, one may ask "could JCIS be an appropriate strategy to remedy the problem of teaching and learning of Mathematics in our public secondary schools? This strategy has been found efficient in bringing positive change in some school subjects like Basic Science, Agricultural Science, Biology, Chemistry and Physics, rather than Mathematics (Al-Qaisi, 2015). Nevertheless, exploiting the vantages of the JCIS could serve as an antidote to the prevailing problem in Mathematics in the country.

The JCIS is a cooperative learning strategy with a class of learners divided into groups and having a specific task allocated to the various groups. Each learner is assigned a given task in the initial formed groups and furthermore, those with the same task are brought together to form what is known as the expert groups. In the expert groups, all groups members with the same task come together to discuss their task and take their decision. JCIS in the teaching of Mathematics would be a shift in focus from the mathematical content to the mathematical learning environments. JCIS is learner-centred involving hands-on mathematical activities. The learner is free to explore the environment and gather useful knowledge by him/her self with little or no aid rather than the teacher been seen as a reservoir which will dish out its content to the learner.

In Nigeria, it is pertinent to observe that classes in our present day public secondary schools are large. Thus, students of different sex and cognitive ability levels constitute such classes (Mankilik & Umaru, 2011). Therefore, learning should be such that will promote students in their various cognitive abilities; for the cognitive ability levels range from high, average and low among male and female in the classroom setting. These variations sometimes affect the way students learning and understand; but in all, students need active learning that can promote high achievement regardless of their sex and cognitive ability to help them acquire the Mathematics process skills for future use.

Acquisition of Mathematical skills is the real essence of teaching and learning Mathematics at the secondary school educational system. Acquisition, according to Oxford Advanced Learner's Dictionary (2015) is the act of getting something, especially knowledge, a skill. Mathematics process skill acquisition is the ability to learn or acquire skills; usually, skill acquisition involves the development of new practices of ways of doing things better. In the classroom, all students should be exposed to these fundamentals early enough since these would be needed throughout life. Therefore the researchers' reviewed related literature on the effects of Jigsaw Cooperative Instructional Strategy compared with the traditional lecture method on students' achievement in secondary schools to aid acquisition of the MPS so as to boost students' achievement in the subject. In particular, empirical studies had shown that JCIS helped in improving students' performance among which are Timayi (2016) who examined the effect of Jigsaw IV Cooperative Learning Strategy (J4CIS) on interest and academic performance of secondary school students in Geometry in Kaduna State, Nigeria. A total

sample of 144 students comprising 72 each from two different schools were used. The results obtained shows that there was significance difference in performance in favour of students exposed to J4CIS, compared to the conventional lecture method. Al-Qaisi (2015) aimed to identify the effect of Jigsaw cooperative Instructional strategy compared to the traditional way in the achievement of physics and scientific processes for the students of the first middle grade in Fatima Zahra school for girls of Al-Anbar General Directorate of Education. The study sample consisted of 62 female students: students for section A and 31 students for section B in addition to those who failed the course and who were statistically excluded to ensure equivalence due to their additional experiences. The study showed that using JCIS in teaching physics led to the superiority of the experimental group on the control group in achievement and scientific operations. Also, Capar and Tarim (2015) reported that Cooperative Learning was a more successful method than traditional method with regard to both achievement and attitude, in the study of efficacy of cooperative learning method on Mathematics achievement and attitude.

Furthermore, Gull and Shehzad (2015) on the use of Cooperative Learning in Mathematics, aimed at university the effects of Cooperative Learning on students' academic achievement. The researcher used the quasi experiment design, with pretest - posttest to compare the mean test scores. The results indicated that there was a significant difference between scores of the experimental group before and after intervention. In the same vein, Farzaneh and Nejadansari (2014) conducted a study on students' attitudes towards Cooperative Learning for teaching comprehension. The outcome showed that the participants generally indicated enthusiasm towards supporting the implementation of Cooperative strategies in teaching and learning. In addition, Orprayoon (2014) examined the effects of Cooperative Learning on learning achievement and group working behaviour of junior students in modern French literature course. The analysis of Pretest and Posttest scores showed Cooperative Learning method raised significantly the students' learning achievement at 0.01 statistical levels.

Similarly, Takallou and Veisi (2013) studied cooperative learning and noted a significant effect on students' reading comprehension as both the high and low achievers in the experimental group expressed positive attitudes towards cooperative learning. Closely related was the research carried out by (Oludipe, Ojediran & Odueake, 2013) who investigated the effectiveness of Cooperative Learning strategy on Nigerian junior secondary students' attitude towards learning basic science. The data analysis indicated that among other there were significant main effects of treatment on students' attitude towards Basic Science. Slavin (2013) conducted a study on effects of cooperative learning and embedded multimedia on Mathematics learning in key stage 2 final report. The results indicated that there was positive effect of cooperative learning in Mathematics in other countries.

In addition, using Mathematics as a parameter, Zakaria, Solfitri, Daud and Abidin (2013) studied the effect cooperative learning on secondary school students' Mathematics achievement. The study involved 61 form three students divided into two groups; one consisted of 30 students in the control group while 31 students were in the treatment group. The results revealed that there was a significant difference of mean in Mathematics students' achievement between the Cooperative Group and the Traditional Group. Also, the content analysis data showed that students in the Cooperative Group were able to increase their understanding and develop their self- confidence. In addition, Mbacho (2013) carried out a study on the

effects of Jigsaw Cooperative Learning Strategy on students' achievement in secondary school Mathematics in Laikipia East District, Kenya; using a sample size of 160 students. After data analysis, result shows that learners taught using JCIS performed better than those taught using Conventional learning method. On the other hand, Mohammadjani and Tonkaboni (2012) undertook a comparative study between the effect of cooperative learning teaching method and lecture teaching method on students' learning and satisfaction levels. The study used the fourth grade elementary school students which consisted of 120 students (60 females and 60 male). The results showed that the cooperative learning teaching method has a higher effect on students learning than the lecture teaching method. Also, female students had higher satisfaction in learning levels in cooperative learning teaching method than their male counterparts. And still in Mathematics discipline, Lavasani and Khandan, (2011) examined the effect of Cooperative Learning on Mathematics anxiety and help seeking behaviour. The researchers reported that Cooperative Learning method in comparison with the Traditional Group decreased Mathematics anxiety in students significantly and avoidance component ($p>0.05$) but increased their help seeking behaviour. The study utilized 40 students from two schools randomly selected and termed them as experiment and control groups.

Statement of the Problem

Evidences from reviewed literature revealed that effective teaching of Mathematics had been hindered by a lot of factors among which are attitude of students to learn, lack of sufficient Mathematics teachers, poor background of students in Mathematics, lack of Mathematics laboratory, inadequate instructional materials and teachers use of ineffective methods and strategies in teaching various topics. These opinions were reiterated by Fatade, Mogari and Abayomi (2013) who stated that much of failure in school Mathematics is associated with a tradition of teaching that is inappropriate to the way most students learn. They explained this further more by saying that the traditional method of teaching Mathematics has been found to be very defective and full of many inadequacies that do not allow students to actively construct their own Mathematics knowledge. Hence, the problem of poor achievement in Mathematics still persists despite all efforts by the government of Nigeria to solve the problem of the teaching and learning of Mathematics in the country.

Therefore, the need for better strategies that can improve students' performance in Mathematics should be of uttermost concern to all stakeholders. Thus, teachers need to shift from the traditional lecture method to a learner-centered strategy. The researchers had found some qualities in Jigsaw cooperative instructional strategy that could help to remedy the problem of teaching and learning Geometry in our public secondary schools. This strategy have been found efficient in bringing positive change in some school subjects like Basic Science, Agricultural Science, Biology, Chemistry and Physics, rather than Mathematics (Al-Qaisi, 2015). Hence, exploiting the vantages of the Jigsaw cooperative instructional strategy could serve as antidotes to our problem in Mathematics: teaching and learning of Geometry.

Research Questions

The following questions were raised to guide the study:

1. What is the difference in the mean acquisition of Mathematics process skills scores of students taught Geometry through Jigsaw Cooperative Instructional Strategy and lecture method?

2. What is the difference in the mean acquisition of Mathematics Process Skills scores of male and female students taught geometry through JCIS?

3. What is the difference in the acquisition of Mathematics Process Skills mean scores between high and low ability students taught geometry through JCIS?

4. What is the interaction effect of Instructional strategies, Ability level and Sex on Mathematics students' acquisition of Mathematics Process Skills?

Hypotheses

All four (4) research questions were hypothesised thus:

1. There is no significant difference in the mean acquisition of Mathematics Process Skills scores of students taught Geometry through JCIS and those taught with lecture method.
2. There is no significant difference in the mean acquisition of Mathematics Process Skills scores of male and female students taught Geometry through JCIS.
3. There is no significant difference in the acquisition of Mathematics Process Skills mean scores between high and low ability students taught Geometry through JCIS.
4. There is no significant interaction effect of Instructional strategies, Ability level and sex on students on acquisition of Mathematics Process Skills?

Methodology

This study adopted the quasi-experimental research design, using the non–randomized equivalent pretest, posttest, control group design. Intact classes were used and the experimental group was exposed to JCIS, while the control group was taught using Lecture Method. The population for the study consists of three thousand seven hundred and sixteen (3716) Senior Secondary Schools two (SS II) Mathematics students in eighteen (18) co-educational public senior secondary schools in Warri South Local Government Areas of Delta State. But only seventeen (17) senior secondary schools two (SS II) Mathematics students were used.

The sample size for this study consists of 114 senior secondary school two (SS II) Mathematics students, made of 48 boys and 66 girls. The experimental group consists of 66 students which comprises of 28 boys and 38 girls while the control group consists of 48 which comprises of 21 boys and 27 girls. Two senior secondary schools were randomly selected through purposive sampling technique for the study. An intact class each was used in each school. Pretest was given before treatment began for a period of four (4) weeks. At the end of the period spent for treatment, a Posttest was carried out to assess students' achievement. The experimental group received treatment conducted using Jigsaw Cooperative Instructional Strategy for four (4) weeks while the conventional Lecture Method was used for the control group. In each week, there were four (4) periods (two double periods) lasting 40 minutes per period at the regular school time table for the teaching selected topics in Geometry with Mathematics process skills as the objectives at the end of each lesson. The independent variables of the study are the Jigsaw Cooperative Instructional Strategy and Conventional Lecture Method while the dependent variable was students' acquisition of Mathematics Process Skills as measured by the students' MAT scores.

The instrument used for data collection in the study was the MAT developed by the researchers. The MAT items were constructed based on four topics in Geometry as contained in the senior secondary education Mathematics curriculum for SS II. It consisted of 30 multiple choice objective test items with five response options (A to D) from which the students were asked to choose the right answer, to test their acquisition of Mathematics process skills using a table of specification thus: Problem solving seven (7) items, Communicating four (4) items, Reasoning and proving five (5) items, Reflecting four (4) items, Connecting four (4) items, Representing three (3) items, and Computational strategies three (3).

In order to ensure validity of the instrument two Mathematics curriculum experts and one experienced senior secondary school Mathematics teacher were used. They scrutinized the items for clarity of expression, plausibility, suitability and appropriateness to the level of the students. Their corrections were effected in the final copy of the instrument.

The reliability of the MAT was determined using Kuder- Richardson formula 21 Statistics. One intact class of fifty seven (57) students in a public senior secondary school two (SS II) in Warri South, Delta State who were not part of main study were used. The scores obtained were used to determine the coefficient of internal consistency; the reliability of the instrument was found to be 0.78; this was high enough for the instrument to be used for the study.

The data collected from students' Pretest and Posttest scores using Mathematics Achievement Test were analyzed and interpreted using descriptive statistics: mean and standard deviation to answer the research questions 1 to 4 while inferential statistics was used to test the hypotheses 1 to 4 for significant differences; The Independent Samples Test (t-test) was used to test $H0_2$ and $H0_3$ while Analysis of Covariance (ANCOVA) were used to test $H0_1$ and $H0_4$. All four hypotheses were tested at 0.05 alpha level of significance.

Results: The data analysis for research questions and hypotheses were carried out using mean, standard deviation, t-test and Analysis of Covariance.

HO_1: There is no significant difference in the acquisition of MPS between students taught Geometry through JCIS and those taught with Lecture Method.

Table 1: Summary of Descriptive Statistics of Acquisition of Mathematics Process Skills.

GROUP	N	Pretest Mean	SD	Posttest Mean	SD	Mean gain
Experimental	66	7.79	3.242	11.05	3.523	3.26
Control	48	6.44	2.305	6.38	2.420	- 0.06

The data in Table 1 show students in the experimental group (JCIS) got a mean score of 7.79 and a standard deviation of 3.242 in pretest, a mean score of 11.05 and a standard deviation 3.523 at posttest, making a pretest-posttest mean gain of 3.26. While the students in the control group (Lecture method) got a mean score of 6.44 and a standard deviation of 2.305 in pretest, a mean score of 6.38 and a standard deviation 2.420 at posttest, making a pretest-posttest mean gain of – 0.06. The JCIS group performed better than their Lecture group counterparts. To conclude on whether or not the observed pretest and posttest mean differences are significant or not, ANCOVA statistics was utilized as in Table 2.

Table 2: One-Way Analysis of Covariance (ANCOVA) of Mathematics Students' Acquisition of Mathematics Process Skills

Dependent Variable: PosttestExpCon

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	704.439[a]	2	352.220	39.738	.000
Intercept	648.162	1	648.162	73.127	.000
PretestExpCon	98.264	1	98.264	11.086	.001
Method	472.101	1	472.101	53.263	.000
Error	983.850	111	8.864		
Total	11085.000	114			
Corrected Total	1688.289	113			

Table 2 shows the ANCOVA analysis of Mathematics students' acquisition of MPS in experimental and control groups at pretest and posttest. The results indicate that $F_{(2, 114)} = 53.263$, $p = .000$ which is significant at 0.05 alpha level of significance. Therefore, the null hypothesis of no significant difference is not retained.

HO_2: There is no significant difference in the acquisition of MPS between male and female students taught Geometry in the Experimental Group.

Table 3: Summary of Descriptive Statistics of Male and Female Mathematics Students' Acquisition of MPS in the Experimental Group.

Sex	N	Pretest Mean	SD	Posttest Mean	SD	Mean gain
Male	28	8.75	3.748	11.54	3.805	2.29
Female	38	7.00	2.630	10.45	2.993	3.45

The data in Table 3 show that the male got a mean score of 8.75 and a standard deviation of 3.748 in pretest, a mean score of 11.54 and a standard deviation 3.805 at posttest, making a pretest-posttest mean gain of 2.29. While the female students got 7.00 and a standard deviation of 2.630 in pretest, a mean score of 10.45 and a standard deviation 2.993 at posttest, making a pretest-posttest mean gain of 3.45 the female in experimental group performed better than male counterparts with mean gain (2.29) at Posttest. To determine if the difference in the main gain is significant, t-test for independent samples was used as presented in table 4.

Table 4: Summary of Independent Samples t-test of Male and Female Mathematics Students' Acquisition of MPS in the Experimental Group.

Sex	N	Mean	SD	t	Sig(2 tail)
Male	28	11.54	3.805		
				1.301	.198
Female	38	10. 45	2.993		

Table 4 shows result of calculated t-value of 1.301 and $p = 0.198 > 0.05$ alpha level of significance. The null hypothesis of no significance is retained. This implies that there was no significant difference in the acquisition of Mathematics process skills in Geometry taught using Jigsaw cooperative instructional strategy based on sex.

HO_3: There is no significant difference in the acquisition of MPS between high and low ability students taught geometry through Jigsaw cooperative and control instructional Strategy at Posttest.

Table 5: Summary of Descriptive Statistics of High and Low Mathematics Students' Acquisition of MPS in the Experimental group.

Ability level	N	Pretest Mean	SD	Posttest gain Mean	SD	Mean
High	29	10.79	2.194	12.38	3.479	1.59
Low	37	5.43	1.501	10.00	3.232	4.57

Table 5 shows that High Ability level got a mean score of 10.79 and a standard deviation of 2.194 in pretest, a mean score of 12.38 and a standard deviation 3.479 at posttest, making a pretest-posttest mean gain of 1.59. While Low Ability level got a mean score of 5.43 and a standard deviation of 1.501 in pretest, a mean score of 10.00 and a standard deviation 3.232 at posttest, making a pretest-posttest mean gain of 4.57. The Low Ability level students with mean gain of 4.57 in the experimental group performed better than High Ability level with mean gain of 1.59. To determine if the difference in the main gain is significant, t-test for independent samples was used as presented in table 6.

Table 6: Summary of Independent Samples t-test of High Ability level and Low Ability level of Mathematics Students' Acquisition of MPS in the Experimental Group.

Ability level	N	Mean	SD	t	Sig(2 tail)
High	29	12.38	3.479	2.871	.006
Low	37	10. 00	3.232		

Table 6 shows result of calculated t-value of 2.871 and $p = 0.006 > 0.05$ alpha level. The null hypothesis of no significance is retained. This implies that there was no significance difference in the posttest mean score of students' acquisition of MPS in experimental groups based on ability level.

HO_4: There is no significant interaction effect of Instructional strategies, Ability level and sex of Mathematics students on acquisition of MPS at posttest.

Table 7: Summary of Descriptive Statistics of interaction effect of Instructional strategies, Ability level and sex of SS II Mathematics students' acquisition of MPS at Posttest.

Strategy	Sex	Ability level	Number	Pretest Mean	SD	Posttest Mean	SD	Mean Gain
JCIS	Male	High	15	11.53	2.748	12.73	3.615	1.20
		Low	12	5.50	1.446	10.00	3.790	4.50
	Female	High	14	10.00	0.961	11.93	3.339	1.93
		Low	25	5.40	1.555	9.88	2.818	4.48
Lecture Method	Male	High	3	10.33	1.528	7.67	.577	-2.66
		Low	18	5.44	2.007	6.61	2.570	1.17
	Female	High	4	10.25	1.500	7.50	1.291	-2.75
		Low	23	6.04	1.430	6.04	2.705	0.00

Table 7 presents the descriptive statistics of interaction effect of Instructional strategies, Sex and Ability level of students on acquisition of MPS. The result showed that Male high ability level students in the Jigsaw cooperative got a mean score of 11.53 and a standard deviation of 2.748 in pretest, a mean score of 12.73 and a standard deviation 3.615 at posttest; making a mean gain of 1.20. The male, low ability level students in the Jigsaw cooperative got a mean score of 5.50 and a standard deviation of 1.446 in pretest, a mean score of 10.00 and a standard deviation 3.790 at posttest; making a mean gain of 4.50. The Female high ability level students in the Jigsaw cooperative got a mean score of 10.00 and a standard deviation of 0.961 in pretest, a mean score of 11.93 and a standard deviation 3.339 at posttest; making a mean gain of 1.93. And the Female low ability level students in the Jigsaw cooperative got a mean score of 5.45 and a standard deviation of 1.555 in pretest, a mean score of 9.88 and a standard deviation 2.818 at posttest; making a mean gain of 4.48. The Male high ability level students in the Lecture method got a mean score of 10.33 and a standard deviation of 1.528 in pretest, a mean score of 7.67 and a standard deviation .577 at posttest; making a mean gain of - 2.66. The Male low ability level students in the Lecture method got a mean score of 5.44 and a standard deviation of 2.007 in pretest, a mean score of 6.61 and a standard deviation 2.570 at posttest; making a mean gain of 1.17. The Female high ability level students in the Lecture method got a mean score of 10.25 and a standard deviation of 1.500 in pretest, a mean score of 7.50 and a standard deviation 1.291 at posttest; making a mean gain of – 2.75. And the Female low ability level students in the Lecture method got a mean score of 6.04 and a standard deviation of 1.430 in pretest, a mean score of 6.04 and a standard deviation 2.705 at posttest; making a mean gain of 0.00. JCIS group Male Low ability level did better than High ability level. Also, the Female Low ability level equally did better than High ability level at Posttest. For the Control group, Male Low ability level outperformed the High ability level. Also, the Female Low ability level did better than the High ability level at Posttest. ANCOVA was used to conclude observed mean differences of the experimental and control groups as presented in table 8.

Table 8: Summary of Analysis of Covariance (ANCOVA) of interaction effect of Instructional strategies, sex and Ability level of students on the acquisition of MPS.

Dependent Variable: PosttestExpCon

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1154.914[a]	8	144.364	28.419	.000
Intercept	595.850	1	595.850	117.299	.000
PretestExpCon	58.317	1	58.317	11.480	.001
Method	16.884	1	16.884	3.324	.071
Sex	.773	1	.773	.152	.697
Abilitylevel	337.212	1	337.212	66.383	.000
Method * Sex	9.777	1	9.777	1.925	.168
Method * Abilitylevel	5.771	1	5.771	1.136	.289
Sex * Abilitylevel	5.717	1	5.717	1.126	.291
Meth*Sex*Abilitylevel	4.343	1	4.343	.855	.357
Error	533.375	105	5.080		
Total	11085.000	114			
Corrected Total	1688.289	113			

a. R Squared = .684 (Adjusted R Squared = .660)

Table 8 presents the ANCOVA of an $F_{(1, 114)} = .855$ and $p = 0.357 > 0.05$ alpha level of significance. Therefore null hypothesis of no significance difference is retained. There is no significant interaction effect of Instructional strategies, sex and Ability level on students' acquisition of MPS.

Discussion of Results

This study investigated the effect of JCIS on the acquisition of MPS on Senior Secondary School Mathematics Students in Delta State. The conventional lecture method had been the method of Mathematics instructions from many studies and from many classroom teachers' experiences.

The finding of this study, from hypothesis one (HO_1) presented in tables 1 and 2 revealed that students from the experimental group exposed to JCIS performed significantly better than those from the control group exposed to the lecture instruction method. However, there was significant difference in the acquisition of MPS between students taught Geometry through JCIS and those with lecture method in favour of the experimental group. By the implication of this result, Mathematics teachers should adopt Jigsaw Cooperative Instructional Strategy in the classrooms which is students' centred activity based innovatory strategy instead the traditional lecture method. It is not enough to just come to the class to teach; the teacher must be conscious of the method to use to deliver the lesson of the day; for the teaching method a teacher uses is of great influence on the performance of the students positively or negatively.

The finding of results from hypothesis two (HO_2) presented in tables 3 and 4 showed male students in the Experimental group did better than their female counterparts. Also, for the Control group, the males did better than the females at posttest. Nevertheless, There was no significant difference in the acquisition of MPS between Male and Female students taught Geometry. This means sex does not have any influence in the study carried out; the instructional strategies used for treatment are not sex biased. The result confirms the finding of Adigun (2015) who reported that, male students outperformed the female counterpart and negates the works of Okoye, (2012) that females perform better than males. More so, Jigsaw cooperative instructional strategy as shown by the result of this study can promote high achievement of both boys and girls than that of the Lecture method and as such should be encouraged.

The finding of results from hypothesis three (HO_3) presented in tables 5 and 6 showed High and Low Ability levels of students in the experimental group exposed to the JCIS and that of control group exposed to the LM. The result revealed a p-value greater than the alpha level of significance; therefore null hypothesis of no significance difference is not rejected. There was no significance between the high and low ability levels. The treatment given the experimental group enabled both High and Low abilities to learn regardless of their ability levels

And lastly, the finding from hypothesis four (HO_4) presented in tables 7 and 8 on the interaction effect of Instructional strategies, Sex and Ability level of SS II students on acquisition of MPS. The finding revealed no significant interaction effect of Instructional Strategy, Sex and Ability level on students' on acquisition of MPS. Therefore, the null hypothesis of no significance difference is not rejected. This is an indication that the effect of Instructional strategies on students achievement based on Sex and Ability level of students are the same hence no interaction effect between Instructional strategies, Sex and Ability level of students. .

Conclusion

The finding of the study revealed that there was significant effect of JCIS on the acquisition of MPS by Senior Secondary School II students when compared with the conventional lecture method. Therefore, based on the findings of the study, the instructional strategy adopted by the researchers improved greatly students' performance in the acquisition the MPS since the students were more engaged in activities than is obtainable in the conventional traditional lecture method.

It is not enough to just come to the class to teach; the teacher must be conscious of the method to use to deliver the lesson of the day; for the teacher method of teaching can influence achievement of the students either positively or negatively.

Recommendations

The following are recommended, based on the major finding of the study:

1. Mathematics teachers should be encouraged to adopt JCIS to teach selected topics like Geometry to enhance students' active participation for better understanding content.
2. Students should be given opportunities to develop skills through the use of JCIS. This is a student' centred activity based learning that will expose them to self-discoveries that will enhance their productivity.
3. Professional development for Mathematics teachers on Jigsaw cooperative instructional strategies in form workshops, seminars, conferences and other in-service training on Geometry in the secondary schools should be done by the government.
4. Government should build larger classroom that can accommodate JCIS practices.

Contribution to knowledge

The significance of this research cannot be overstated. It expands the repertoire of instructional strategies available to Mathematics educators, offering additional tools to enhance the effectiveness of teaching and learning. By bolstering students' acquisition capabilities, the study aims to elevate academic achievements. It constitutes a valuable addition to the body of literature on Mathematics education in secondary schools, aligning with global efforts to enhance students' performance. Moreover, the research highlights the potential of Jigsaw cooperative instructional strategy (JCIS) in fostering critical thinking and nurturing creative ideas in students.

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The Need for Mathematics Education in Addressing Insecurity in Nigeria

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Abstract

The role of mathematics education is critical to the attainment of a state of security in the Nigerian society. This is because, without a strong basic foundation in mathematics, creating and maintaining a secured society is unlikely. This is emphasised in a document released by the office of the National Security Adviser (NSA) for the National Security Strategy, 2019. It was highlighted clearly that security is the cornerstone of development and progress in a free society and that security is a guarantee of the wellbeing of citizens and stability of the state. Also tracing the history of developed countries such as America, they have arrived at their developed levels after suffering from series of wars. Those wars were won with scheming strategies in which mathematical knowledge form the basis, because the service of great mathematical minds were employed to analyse movements, proportions, trajectories, implications (economic, population, etc.) as well as development of calculating and war machines with accuracy and precisions, among other things. This paper therefore justifies the need for mathematics education in addressing insecurity in Nigeria as it x-rays the major mathematics skills needed to build security conscious individuals and concludes as an eye opener to the fact that mathematics remains a functional field of study embedded with necessary prerequisite skills needed for confronting rising insecurity issues and other challenges in the society.

INTRODUCTION

Insecurity, in the broad sense encapsulates a wide spectrum as it could be applied to various areas of life. Insecurity is the absence of security; and security has been defined as freedom from danger and anxiety. Also, insecurity has the explanation of a product of the bestiality of man. (Adebowale, 2014). It results from the failure of government to maintain security and provide effectively for the welfare of the people.

The problem of insecurity in Nigeria is of serious concern to a conscious citizen as it now progresses without a comprehensible

process. Insecurity in Nigeria is a recurring phenomenon of escalating problems which are very obvious across all parts of the country. Nigeria, a country in the west coast of Africa is currently faced with diverse and sovereignty-threatening security challenges. The country is positioned at number 14 in the list of 20 most vulnerable states to fail in the world (Yaminu, 2021) partly due to the series of security challenges weakening her fabrics of unity, peace and progress.

The south-west of Nigeria suffers from insecurity issues such as herder-farmer conflicts, kidnapping, cybercrime, armed robbery, domestic crime, ritual killings and banditry. The south-east has its own share of ritual killings, kidnapping, commercial crime, secessionist agitation, herder-farmer clashes, attacks by unknown gunmen and banditry. The south is threatened by militancy, kidnapping, and environmental agitation. (Samuel,2014). The north-east has been subjected to humanitarian crisis, subsequent to the insurgence of the Boko Haram and the north-west is a haven for illegal mining, ethnoreligious killings and banditry.

Instances of kidnapping include a January 10,2011 case of the wife and three children of Nollywood's ace comedian, John Okafor popularly known as *Mr. Ibu* who were kidnapped right in front of his house and a ransom of fifty million naira was demanded (Amatus in Umukoro,2014). Also, late 2012 witnessed the kidnapping of a notable actress, Nkiru Syvalnus and Kenneth Okoye, the first runner-up of Mr. Nigeria 2010 with a ransom of one hundred million naira demanded (vanguard online,2012). The implication of all the aforementioned scenarios include threat to the nascent democracy, abuse and infringements on fundamental human rights of citizens, loss of investments opportunities due to capital flight and wanton destruction of property and infrastructure.

The primary role of a government to secure lives and properties of the citizens is thereby truncated when there is insecurity in the land. In a bid to finding solutions, mathematics is perceived as a discipline that has huge roles to play. One of the essences of teaching and learning mathematics is to serve as a tool needed to raise responsible citizens and not terrorists. If mathematics education is well-developed, improved and adequately managed, it can lead to the acquisition of mathematical literacy skills which can help in achieving security purposes.

Therefore, the paper shall trace the root of insecurity in Nigeria, identify the consequences of insecurity in Nigeria then, consider the objectives of mathematics education in Nigeria, as well as the corresponding perspective of mathematics to insecurity. Also, analysis of mathematics skills which are necessary for tackling insecurity challenges shall be done. This will lead to examining the impacts of mathematical skills on national security in order to draw a conclusion and present appropriate recommendations.

TRACING THE ROOT OF INSECURITY IN NIGERIA

Six years after independence, Nigeria experienced a coup which can be taken as being responsible for the insecurity experienced today in Nigeria. The consequence was that distrust among various ethnic groups in the country emanated. The Igbos persistently feel marginalised in the Nigerian government and the militants living in the east continuously attack government security agencies, government infrastructure and installations, as well as oil exploration installations of foreign multinational companies. Also, the Niger Delta militancy developed in kidnapping for ransom. Herdsmen continuously trespass the farmlands in the south with their herds,

thereby causing clashes between local farmers and the herdsmen. Lives of southern farmers are not safe from the brutal acts of the herdsmen in raping the female farmers and killing the male ones. (Samuel,2014).

Around the year 2000, Islamic missionaries with extremist orientation as Al Qaeda and the Islamic State set foot on some parts of northern Nigeria's soil. The inspiration persists to give birth to Boko Haram in 2009 while the sect later sworn allegiance to the Islamic state. It is not a gain saying to submit that the government has not done well to contain the insurgency due to political greed which pushes them to employing and manipulating the sect. Hence, room for expansion of insurgency is widely created. The existing unemployment, poor education and lingering poverty in the society among the Nigerian youths also gave a strong hold for the perpetration of various forms of insecurity acts.

THE CONSEQUENCES OF INSECURITY IN NIGERIA

The consequences of insecurity in Nigeria cut across all facets of the country, ranging from agriculture, economy, telecommunication and to education, just to mention a few. Furthermore, there is migration of people from the north-east area to other safer states, terrorism and insurgency activities, fear of the unknown and reduced revenue of the government. (https://emerald.com,17 May,2022). As of 2020, over $40.6billion worth of foreign investments were redirected from the Nigerian economy as a result of insecurity according to the Global Terrorism Index. In 2021, as compiled by the Institute for Economics and Peace, Nigeria was ranked 146th out of 163 countries with a score of 2.712 reflecting a poor Gross Domestic Product(GDP). According to Business Day, rising violence in the country cost Nigeria 11% of its Gross Domestic Product(GDP) with ₦119 billion. Similarly, projects worth ₦12 trillion were abandoned across Nigeria due to insecurity challenges according to Town Talk solutions. (Samuel,2022).

Telecommunication companies are also affected. For instance, the Mobile Telecommunication Network (MTN) projected a possible disruption in service provided due to rising insecurity challenges. (Funmilayo,2023). In education the country has recently come under significant threat due to the increased number of mass kidnappings of students from schools. This is a new strategy adopted by terrorists and bandit groups. Kidnappings in schools have become a great disincentive for both parents and students alike, for enrolling in schools, opting to stay at home in order to ensure their safety. Today, Nigeria has one of world's highest numbers of out-of-school children,13.2 million, according to the United Nations Children's Fund(UNICEF). A wave of school kidnappings has worsened the situation, with some state governments closing boarding schools in their states until security is guaranteed. For instance, between December2020 - June 2021, over 1000 students and staff have been kidnapped in 9 school abductions reported in the North West Zone. (Yaminu,2021). For instance, very recently, on September 22, 2024, gunmen invaded the Federal University Gusau in Zamfara State and Kidnapped 24 female students. Security forces reportedly rescued thirteen students, but 11 remain in captivity. Less than two weeks later, on October 4, same year, suspected terrorists attacked the Federal University in Katsina and kidnapped five female students. (Business day.ng, 2023).

In terms of food insecurity, the situation has been aggravated by the activities of bandits and herdsmen/farmers crisis. The displacement of farming communities as a result of insecurity is associated with a rise in

food and nutrition insecurity due to non-availability of food. (Yaminu,2023). Therefore, food insecurity is inimical to national security. Nigeria ranked 8th among the top 10 countries with the highest level of terrorism in the world. The Global Terrorism Index(GTI) 2023 assessed terrorism impact in 163 countries. With a score of 8.065, Nigeria has a terrorism impact that is very high.

10 countries most impacted by Terrorism in the Global Terrorism Index(GPI) 2023

S/N	Country	Total death since 2007('000)
1	Afghanistan	18,500
2	Burkina Faso	3,515
3	Somalia	9,057
4	Mali	3,442
5	Syria	6,048
6	Iraq	36,551
7	Pakistan	14,920
8	Nigeria	10,768
9	Myanmar	1,036
10	Niger	1,842

Table: Dataphyte. Source GPI2023. Created with datawrapper.

Also, in sub-Saharan Africa, Nigeria was ranked 3rd among the five countries with the highest number of internally displaced persons(IDPs) in 2022 with an estimate of 3.6 million IDPs resulting from violence and restiveness, 1.9 million of which are from Borno in the Northeast region. (Funmilayo,2023).

These issues of insecurity challenges had implications for job creation and economic prosperity as purchasing power declined. Nigeria is now regarded as the world's poverty capital and has an estimated 91million people living in extreme poverty which is projected to reach 106.6 million by 2030.

The consequences are numerous and devastating. Hence, the need to find solutions. Thus, this work proffers a solution through careful and judicious exploitation of mathematics education.

OBJECTIVES OF MATHEMATICS EDUCATION IN NIGERIA.

Heralding the objectives of mathematics education will facilitate an exposition to the possibility of mathematics education in solving the problems of insecurity in the country.

The objectives of mathematics education in Nigeria according to Adedeyo (2010) include: (i) to lay a solid foundation for the concept of numeracy and scientific thinking ;(ii) to develop in the child the ability to adapt to his changing environment ;(iii) to give the child opportunity for developing manipulative skills that will enable him to function effectively in the society within the limits of his capacity and (iv) to prepare the child for higher education.

These objectives are in line with the broad aims of secondary school education as contained in the National Policy on Education (FRN,2013). All the objectives stated above are really needed in addressing insecurity in the country. The first one for instance is a necessary criterion for checking insecurity. Mathematics teaches a person how to think logically and approach problems in analogical and creative ways. Mathematicians apply their problem solving and data analysis to solve problems in a wide variety of fields (Lovitt & Clarke,2011). This includes information security, medical research, sports statistics, among others. Mathematics education is for resolving most security and environmental problems Nigeria is facing, because it

develops analytical skills and the ability to work in a problem-solving environment. Mathematicians use high level mathematics and technology to develop new mathematical principles and solve real-world problems. (Abubakar, 2014). The ability to think logically and scientifically which can be inculcated by mathematics education is necessary for checking insecurity in the nation. Realising the role of mathematics education as a key to national security, the permanent secretary, Ministry of Defence, Ibrahim (2023), has called for more efforts to endear children's interest in mathematics: "Mathematics is the foundation of Science, Technology, Engineering and Mathematics (STEM) fields, and it is crucial to our Nation's security and prosperity" (Punch,27th March 2023.Retrieved from chrome). Kana expressed his pride in the role of the Armed Forces Schools in fostering academic excellence amongst students. This pronouncement of the permanent secretary is a reflection of uncompromised level of mathematics in addressing insecurity issues in Nigeria.

CORRESPONDING PERSPECTIVE OF MATHEMATICS TO INSECURITY

In a submission to the United States Congress, on the aftermath of the attack of September 11,2001 at the World Trade Center towers, Farrer in Gallagher and Schmicking (2014), emphasised the need for critical skills in Mathematics, Engineering, Information and communication Technology to enable the federal Bureau of Investigation (FBI) to exploit digital evidence and the technologies that collect, convey or process digital information about the nation's security. To complement the above emphasis, Schartz (2014) further pointed out that the United States National Security Agency hired approximately 50 highly qualified mathematicians yearly to enhance its operational work. Mathematics is therefore seen as the language of science and technology (Ugbebor,2009). Otunu-Ogbisi and Ukpebor, (2009), see mathematics as an effective tool for solving crime and security problems. It in believed that their submissions were borne out of their discoveries of relevance and efficiency of mathematics in crime and insecurity issues.

When Russia launched the first space satellite, Sputnik in 1957, the reaction of America Congress was the improvement of the quality of mathematics education for American youths. This buttresses the consciousness of America of the security of the nation and its citizenry by improving the quality of mathematics education in the states. America believed that the improvement of their mathematics and science education is the best possible way to catch up with USSR (now Russia). It will be interesting to know that the education reform in America then, spurned many great nations (such as Britain) to carry out education reforms. This can be seen through conferences such as Rehovot Conference in Israel (1960), Endicott house conference in Dedham, in Massachusetts (1961). In fact, Africa as a whole subscribed to the process of mathematics education reform through programmes such as Entebbe mathematics in Kenya which is an Africa Mathematics Programme.

MATHEMATICS SKILLS

Exposition will now be done to some of the mathematical skills which when effectively employed will provide solutions to the lingering problem of insecurity in Nigeria.

1. Problem solving skills: This is the highest level of learning according to the psychologist, Gagne (1963). These skills make a person to be relevant in any situation since human beings exist in an environment full of challenges with the weaker ones always looking up to the stronger ones for help. Problem solving cannot be taken away from

mathematics. Such skills manifest from posing questions, analyzing, translating and illustrating results, drawing diagrams, using trials and error, applying rules of logic, recognizing relevant facts and subjecting conclusion to scrutiny.

2. Operation Research is an interdisciplinary branch of mathematics which uses mathematical methods to arrive at optional decisions to problems in maximizing benefits and profits as well as minimizing costs and losses. The eventual intention behind using Operation Research is to elicit a best possible solution to a problem mathematically, which can improve or optimize the performance of the security system.

3. **Using mathematics for prediction:** Elementary notions of probability to determine likelihood of future events and identify immediate past experience that does not affect the likelihood of future events: using mathematics to help make predictions places an individual or organization in a favourable level of preparedness. This lofty skill ensures prediction and preparedness for any security challenge.

4. Appropriate computational skills: Addition, subtraction, multiplication and division with the whole numbers, decimals and simple fractions; complicated computations will usually be done with a calculator. Knowledge of simple digit number facts and mental arithmetic; use of percentages should be developed and maintained. The translation of this skill into the real life, especially in the area of insecurity, will result to precision in security measure. Alertness to radicality of result from calculating devices is an essential skill necessary to inbuild a sense of awareness as it looms in the society. This involves weather changes, economic changes and human-interest correlation analysis.

5. Statistical representation: This involves reading, interpreting and constructing tables, charts and graphs**,** putting information into manageable and meaningful terms and using conclusion with simple tables, maps, charts and graphs are strategic and systematic training skills which translate into real life situations to tackle security challenges through statistical collection of data, analysis and deduction of relative, appreciable and applicable solutions in form of conclusion.

6. Computer Knowledge: Understanding what computer can/cannot do. Mathematicians with their training in logical and precise thinking are highly prized in this field. The knowledge of computer traced back to abacus, ready reckoner, difference machine, Electronic Numerical Integrator And Computer (ENIAC) is proof that the knowledge of mathematics in inventing the aforementioned earliest computers which have metamorphosed to the present 5th generation computer remains applicable to solving insecurity challenges. The Closed Circuit Television (CCTV) camera installations, phone and car tracking systems among other things are various application of computer knowledge in providing adequate security measures.

5. Geometry: concepts of points, lines, plane, parallel, perpendicular, basic properties of simple geometric figure with emphasis on measurement on problem solving; recognizing similarities and differences among objects can also translate to understanding topographical and geographical terrains**.** Measurement of distance, weight, time capacity, temperature and angles; calculating simple areas, volumes; using both metric and customary system with appropriate tools. All these are needed for determining the capacity and area of security measure required and the amount realizable.

6. Estimation and approximation: Technique for estimating quantity, length,

distance, weight, etc.; knowing when result is precise enough will be useful for security purposes at hand.

THE IMPACTS OF MATHEMATICAL SKILLS ON NATIONAL SECURITY

The impact of mathematical skills in a nation's security can be highlighted as follows

1- **Wavelet Transformation (Signal Intelligence)**: This is a new technique which is very important in all types of signal transmission and it is based on transmission of a series of numbers. Wavelet analysis is an exciting new method which applies principles of mathematics and physics in solving difficult civil and security problems. Some applications of wavelets are powerful statistical tool which can be used for a wide range of applications such as signal processing; data compression; wave propagation; image processing; pattern recognition; detection of aircraft and submarines; fingerprint for detecting the properties of quick variation of values. It is also used in internet traffic description for designing the services size; industrial supervision of gear-wheel; and computer graphics and multi-fractal analysis.

Wavelets process complex information at different positions and scales and reconstructs them with high precision. (Zakariya & Barwa, 2013).

2-**Financial security**

According to Abubakar, Charles-Ogan and Albert (2014), financial security involves financial instrument which is a tradable asset of any kind, either cash, evidence of an ownership interest in an entity or a contractual right to receive or deliver cash or any other financial instrument. Mathematics skills such as counting and budgeting are needed for personal financial security. Also, skills such as identification of numbers and correct valuation of money are needed for easy assessing of Automated Teller Machine (ATM) cards and detection of fraud respectively. In the banks, savings, assets and liabilities, and bonds are valued using numbers. Loans, overdrafts and Commission on Transaction (COT) are given out using simple or compound interest rates.

Also, mathematical skills consistency is required when for example a share price is taken and stochastic calculus is used to obtain the corresponding value of derivatives of the stock.

3 - **Economic security**

Economic security is measured using economic indices to measure the economic wellbeing of a nation. Mathematical skills are utilized to measure these indices. One primary indicator used to gauge the economic health of a country is the Gross Domestic Product (GDP). A negative GDP is a sign of recession which signifies unhealthiness while a positive GDP implies healthiness. Other economic indicators that require mathematics skills are: Human Capital Index (HCT), Education Index (EI), Mean Years of Schooling Index (MYSI), Expected Years of School Index (EYSI), Income Index (II) and Consumer Price index which is used to measure reflection ultimately, the aspects of ratio, percentages, ordinal counting and algebra of numbers are essential mathematics to be used to interpret the economy of any nation.

4 - Cryptography (Data security)

This makes use of Number Theory (Modular Arithmetic) and concept of Prime Number, and is the science of using mathematics to encrypt and decrypt data. Data security is a chief security concern when it comes to transmission of computer passwords, electronic ecommerce, private conversations and Automatic Teller machine (ATM) cards (Jiang, 2013). Cryptography is the practice of

hiding information, converting some secret information to a non-readable text. It enables one to store sensitive information or transmit it across insecure networks (like the internet) so that it cannot be read by anyone except the right person(s). Applications of cryptography include military information and intelligence, electronic commerce, bank and payments and electronic building access. It is one of the cornerstones of internet security (Zakariyya & Barwa, 2013).

CONCLUSION

Mathematics is a basis for advancements and developments. America resorted to improving the quality of their mathematics education in order to meet up with technological advancement among the countries in the world especially Russia. Saudi Arabia had invited mathematicians, statisticians and economists to provide a way out when they were in crisis of economic recession. Japan once gathered mathematicians to help and redefine the basis of her technological and scientific advancement. Almost all useful products from advanced countries are usually with a mathematical label. This justifies a claim that a drug cannot be synthesized until its mathematical code/model is found. All these are underlying facts that mathematics can be put to function in all ramifications and should be seriously taken as being needed in tackling insecurity in Nigeria. Hence, Nigeria should go beyond the scope of just teaching mathematics for grades but work towards its applicability especially in the area of insecurity in the country.

RECOMMENDATIONS

Insecurity is an occurrence which makes it very impossible for progress to thrive in a society, as it endangers lives and properties of the people in the society affected. Upon the discovery of this crucial problem, then it becomes imperative and demanding to find a solution to the nemesis. In a bid to do this, acquisition of mathematics skills through mathematics education has been identified as a potential armour needed to be armed with. Such skills pose to be potent enough to tackle insecurity challenges in the country given the objectives attainable from mathematics education.

Therefore, the following submissions would be made in form of recommendations on the needed measures to be put in place to make the proclamation a reality.

1. Mathematics teachers and instructors should consider it a point of responsibility to be armed with teaching strategies required in the teaching of mathematics skills to meet up with security challenges.
2. To encourage critical and logical thinking, a sizable number of mathematics graduates should be included in the security workforce of the country.
3. Given its importance in addressing crime and security issues, government at all levels should keep offering functional mathematics education at all levels.
4. It becomes a wakeup call to mathematicians and government to carry out more rigorous work/study on how mathematics could be effectively utilized to address security issues in the country.
5. Mathematics oriented individuals should also be considered for variety of employment in the country.

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Teachers Perceived Preparedness in Integrating Digital Technology in the Teaching of Mathematics in Edo South Senatorial District, Edo State, Nigeria

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ABSTRACT

Recent conceptualizations of the knowledge and skills teachers need to successfully navigate the ever increasing digitally-rich Mathematics classrooms have been based on technologically pedagogical content knowledge (TACK) domains. This study therefore employed the survey research design to examine teachers' perceived preparedness in integrating digital technology in the teaching of Mathematics in Edo South Senatorial District, Edo State, Nigeria, based on technological knowledge, pedagogical knowledge and content knowledge. The stratified random sampling technique was used to select 210 secondary school Mathematics teachers made of 70 and 140 from public and private schools respectively. A-37 item structured questionnaire titled "Mathematics Teachers Preparedness on Integrating Digital Technology (MTPIDT) was used to collect data. The reliability coefficient of the MTPIDT was 0.71 using Cronbach Alpha statistic. The data were analysed using percentages, mean, standard deviation and independent t-test statistics. The findings revealed that out of the 22 technologies listed, at least 50% of the respondents agreed that 8 digital technologies aid the preparedness of mathematics teachers in teaching mathematics. The respondents highly perceived the integration of Technological Knowledge, Pedagogical Knowledge and Content Knowledge in teaching mathematics. However, there was a low level of preparing Mathematics teachers to integrating digital technology in teaching Mathematics while undergoing their Teacher Education programmes. It is recommended that Mathematics teachers should undergo training and retraining to prepare them on how to effectively integrate Technological Pedagogical Content Knowledge (TPACK) in teaching and learning Mathematics.

Keywords: Teachers' Preparedness; Integrating Digital Technologies; Technological Pedagogical Content Knowledge (TACK); Teaching of Mathematics.

INTRODUCTION

In Nigeria, the National Policy on Information and Communication Technologies (ICT) in Education (Federal Ministry of Education, 2019) acknowledges technology's pivotal role in enhancing teaching, learning, and educational administration to foster research and development and meet global standards. The following is a summary of the relevant objectives taken from the Nigeria's National Policy on ICT Education: to facilitate the teaching and learning process; to promote problem solving, critical thinking and innovative skills; to promote life-long learning and advanced knowledge; to enhance various teaching/learning strategies required to meet the needs of the population; to enhance universal access to information; and to widen access to education and the range of Instructional options and opportunities for anywhere, any-time, any-pace and any-path learning. The policy provides guidelines to support digital technology integration in education for all stakeholders, with the potential of embracing technology that can transform the teaching and learning of mathematics in schools and enhance teachers and students' mathematical knowledge, skills and proficiencies. The policy recognizes the importance of preparing teachers to meet the ICT knowledge and skills requirements, and to assess Mathematics teachers' preparedness to implement this policy and integrate digital technology in teaching Mathematics.

The prevailing conceptualizations of teacher knowledge are beginning to reflect the knowledge and skills teachers and students need to successfully navigate in the ocean of available information and knowledge (Brown, 2005) in the increasing digitally-rich mathematical classrooms, with the addition of knowledge domains such as technological pedagogical content knowledge (TACK) (Guerrero, 2010. The TACK framework expands on Shulman's (1987) conceptualization of pedagogical content knowledge " to describe how teachers' understanding of technologies and pedagogical content knowledge interact with one another to produce effective teaching with technology" (Koehler & Mishra, 2008, p. 12). This article presents TPACK framework in Mathematics to include Technological Knowledge (TK), Pedagogical Knowledge (PK) and Content knowledge (CK). The Technological Knowledge (TK) component refers to the knowledge about the standard technologies which enables teachers to understand information technology, apply it properly, identify useful technologies, and continually adapt to changes in technology. Pedagogical Knowledge (PK) refers to the knowledge about the general principles of instruction, processes and practices or methods of teaching. It includes knowledge about classroom management skills, teaching strategies, evaluation techniques, and the nature of target audience specific to the application of technology in the mathematics classroom. Content knowledge (CK) refers to the knowledge about the subject matter that is to be learned or taught. This focuses on how the teacher can use technology to make the subject matter in both length and breadth more comprehensible and accessible to students (Mishra & Koehler, 2006; Koehler & Mishra, 2008; Guerrero, 2010). Finally, TACK therefore refers to the mathematics knowledge that emerges from the understanding of an interaction of content, pedagogy, and technology knowledge to support and improve mathematics teaching and learning.

Mathematics teachers therefore need to understand how to blend technology, pedagogy, and content in teaching a particular Mathematics topic. In other words, for Mathematics teachers to integrate technology in ways that are meaningful and productive, they should possess the intersection of technological, pedagogical and content

knowledge (Niess, 2009). Thus, according to Guerrero (2010), Mathematics continues to evolve as a body of knowledge as technology influences "what we know, how we know it, what we teach, and how we teach it" (p. 133). TPACK empowers the Mathematics teachers to create richer learning experiences, surpassing mere technological proficiency, to be better equipped to select and integrate digital tools that will foster meaningful engagements and achievements in mathematics. Hence, Nigeria Mathematics teachers should be prepared to acquire the digital knowledge, skills and experiences needed to incorporate technology in the context of teaching and learning Mathematics.

The preparedness of Mathematics teachers to integrate technology into Mathematics classroom has been a critical challenge faced with major decisions on how to present the information, what technology resource to utilize, which content to teach using technology resource and also how to plan for the standard lesson and time. Proper application of digital tools changes how mathematics is taught by allowing teachers and students to focus on deep conceptual understanding over rote procedural skills through problem solving, reasoning, and decision making. This could have considerable impact on the development and expansion of new and existing mathematical concepts. For example, dynamic software applications, such as PowerPoint, geometer's sketchpad, Mathalicious, sympy, shanlax or geogebra make the application of core mathematical concepts tangible and interactive for students. Digital technology such as interactive whiteboard, smart board, desktop publishing software, Computer Algebra System(CAS), Learning Management System (LMS), Virtual Learning Environment (VLEs), television, and WhatsApp provide visual images of mathematics ideas, and facilitate organizing, analyzing, and interpreting data (National Council of Teachers of Mathematics (NCTM), 2011). However, some teachers maintain an unwelcoming attitude towards the adaptation of technology as they consider it irrelevant for their use in teaching because of its changing and opaque nature compared to other traditional pedagogical approaches (Ramorola, 2013). Already, Nigeria is on the wrong side of the international digital divide, as it has not made significant effort to implement the integration of ICT into secondary school curriculum. A great deal of Instructional and administrative work in secondary schools in Nigeria is still carried out manually. Consequently, Nigeria teachers currently face the challenges to integrate technology into teaching Mathematics due to low capacity-building

of teachers in technology, lack of regular review and updating of existing information technology curricula, lack of infrastructure in schools, lack of constant power supply and lack of inclusive equitable quality education in the system (Aduwa-Ogiegbean & Iyamu, 2005; Adefunke, Ayodele & Olufemi, 2014; Akogwu, Abugu, Okeke & Umaluku, 2019).

Adebowale and Dare (2012) investigated in Oyo state the level of awareness of 200 primary and secondary school teachers invited for a capacity building workshop on ICT of Nigeria's educational policy on ICT as well as its possible influence on the use of ICT for classroom teaching and learning. The study found only 14.9% of the respondents possessed a high level of awareness of the Nigeria's educational policy on ICT. Further investigation in this study revealed that there was a significant difference in the availability of computer hardware and software in public and private schools as private schools were better equipped than public schools. Public schools in this context are schools owned, administered and control by the Local, State or National governments of Nigeria; while private schools, on the other

hand, are owned and funded by either individuals or private bodies/groups (Federal Republic of Nigeria, 2013)

Adefunke, Ayodele and Olufemi (2014) assessed the implementation of National computer education curriculum in Nigeria primary schools. Data were collected by means of a 4-point Likert like scale questionnaire from 200 primary school computer teachers: 116 males and 84 females, and 100 teachers each from public and private schools, in twelve local government areas in Oyo state, Nigeria. The results showed that 81%of the teachers could operate computer successfully, 84% of them could also identify and explain basic computer components. The results further showed that 43.5% indicated insufficient knowledge of using variety of computer software, 59% could not solve general software and hardware problems and 75% could not use computer to create graphics. While the results showed no significant difference between the level of competence (knowledge and skills) of male and female teachers, it showed a significant difference in the availability of computer hardware and software in public and private schools in favour of private schools. These results revealed that while majority of the teachers were well informed in basic computer knowledge almost half of them were deficient in computer operations using software. These have negative implications for the effective implementation of the curriculum as teachers lack the basic knowledge and skills in information and communication technology (ICT) which could translate to the inability of teachers to integrate digital technologies in teaching and learning mathematics in schools.

In 2018, the state of Edo, Nigeria, launched Edo-BEST@Home, a mobile-based remote learning programme that extends the pre-existing Edo Basic Education Sector Transformation (Edo-BEST programme, a Public-Private Partnership (PPP) between the Edo State Basic Education Board, the World Bank, and Bridge International Academics (Munoz-Najer, 2020). To foster effective use of the educational resources provided and to ensure learning, Edo-BEST@Home programme focused on four key aspects: first, providing engaging programming focused on content aligned to the curriculum; second, constant support from teachers and parents to students; third, formative assessment in the form of interactive quizzes; and fourth, on-going support to teachers through virtual coaching. The programme includes interactive audio lessons, digital Self-study activity packets that are distributed through WhatsApp and online, digital storybooks, mobile interactive quizzes, learning guides for parents, and virtual classrooms that enable interaction between teachers and students. The Edo-BEST@Home programme became handy for use as education response plan to COVID-19 as the coronavirus crises led schools and universities to rapid transition to a distance-learning mode via digital tools and resources that ensured education continuity for all using technology and provided support to teachers, students and their families. The Edo-BEST@Home programme focused primarily at the primary and junior secondary levels with little efforts on the senior secondary school level. Therefore, with the Edo-BEST@Home initiative and the coming in place of the National Policy on Information and Communication Technologies (ICT) in Education (Federal Ministry of Education, 2019), there is the need to assess secondary school mathematics teachers preparedness in integrating digital technologies in mathematics teaching in Edo South Senatorial District, Edo State, Nigeria.

PURPOSE OF THE STUDY

This study investigated perceived teachers' preparedness in integrating digital technology in teaching Mathematics in Edo South Senatorial District, Edo State, Nigeria. Specifically, the study assessed:

1. The digital technologies which aid the preparedness of Mathematics teachers in teaching Mathematics.
2. The level of Mathematics teachers' technological, pedagogical and content knowledge in integrating digital technology into teaching Mathematics.
3. The level of Mathematics teachers' preparedness in integrating digital technology into teaching Mathematics.
4. The difference between the knowledge of public and private school Mathematics teachers in the use of TPACK in integrating digital technology in teaching Mathematics.

STATEMENT OF THE PROBLEM

The preparedness of Mathematics teachers to integrate technology into Mathematics classroom has been a critical challenge faced with major decisions on how to present the information, what technology resource to utilize, which content to teach using technology resource, and also how to plan for the standard lesson and time. Some teachers maintain an unwelcoming attitude towards the adaptation of technology as they consider it irrelevant for their use in teaching because of its changing and opaque nature compared to other traditional pedagogical approaches (Ramorola, 2013). It is of the conception held by teachers that Nigeria probably faces the challenges to integrate technology into teaching Mathematics.

Advancing technology prompts research on effective technology integration in teaching and learning mathematics. The presence of technology such as computer, television, handheld devices, radio, etc. in Edo State, Nigeria, schools does not necessarily imply digital technology integration in education. There are some schools which opt to place computers in laboratories, rather than to use it to enhance students learning. Besides these, many Nigeria Mathematics teachers are used to the chalk and talk method of instructions as they might never have been taught with digital technology, or perhaps have never used digital technologies in their teaching because they received limited training without the use of digital technologies in learning Mathematics (Amosun, Falade & Falade, 2015).

The absence of technological tools in Mathematics classrooms in Nigeria can hinder students' ability to explore and understand mathematical concepts and limit their access to information and resources that can enhance problem-solving skills. Currently there is a growing emphasis on integrating technological, pedagogical, and content knowledge (TPACK) in the field of education. The preparedness and knowledge of Mathematics teachers play a vital role in integrating technology in teaching Mathematics in the classroom. However, how teachers learned their subject matter is not necessarily the way their students will need to be taught in the 21st century. Learning Mathematics (subject matter) with technology is different from learning to teach Mathematics with technology. The major questions are: what knowledge does Mathematics teachers need to integrate technology in teaching Mathematics in the classroom? What technologies are available to aid the preparedness of Nigeria Mathematics teachers in integrating digital technology in teaching Mathematics in the classroom? Hence, this study assessed teachers' perceived preparedness in integrating digital technologies in teaching Mathematics in

secondary schools in Edo South Senatorial District, Edo State, Nigeria.

RESEARCH QUESTIONS

The following research questions were raised to guide the study:

1. What digital technologies aid the preparedness of Mathematics teachers in teaching Mathematics?
2. What is the level of teachers' technological, pedagogical and content knowledge (TACK) in integrating digital technology in teaching Mathematics?
3. What is the level of Mathematics teachers' preparedness in integrating digital technology in teaching Mathematics?
4. What is the difference between the knowledge of public and private school mathematics teachers in the use of TPACK in integrating digital technology in teaching Mathematics?

HYPOTHESIS

The following null hypothesis was formulated and tested at the 0.05 level of significance:

1. There is no significant difference between the knowledge of public and private school mathematics teachers in the use of TACK in integrating digital technology in teaching Mathematics.

METHODOLOGY

The study adopted the survey research design to assess the perceived preparedness of teachers in integrating digital technology in teaching Mathematics in Edo South Senatorial District, Edo State, Nigeria. The population of schools was made up of 70 and 150 public and private schools, respectively. The population of the secondary school mathematics teachers was 959 with 179 and 780 from public and private schools, respectively. The simple random sampling technique was used to select 105 schools made of 35 public schools and 70 private schools. Two Mathematics teachers were selected from each school which gave a sample of 70 and 140 mathematics teachers from public and private secondary schools respectively. The sample size of 210 secondary school Mathematics teachers was used in this study.

The instrument for this study was a-37 item structured questionnaire titled "Mathematics Teachers' Preparedness on Integrating Digital Technology (MTPIDT). The MTPIDT instrument has three parts. The first part elicited participants' demographic information on school type (public or private. The second part included 22 items to measure the digital technology tools that can aid the preparedness of Mathematics teachers in integrating digital technology in teaching Mathematics. This has a scale of Yes or No against each item. The third part measures TACK knowledge on technology knowledge (TK), content knowledge (CK), and pedagogical knowledge (PK) on level of teacher's preparedness with 22 items. This third part used a five-point Likert-type scale of Strongly Agree (SA), Agree (A), undecided(U), Disagree (D) and Strongly Disagree (SA). The scale was scored 5, 4, 3, 2, and 1 for SA, A, U, D and SD, respectively. The MTPIDT instrument was validated and a Cronbach Alpha statistic reliability coefficient of 0.71 was obtained

for the third part.

Research question one was answered using frequency count and percentage. Research questions two and three were answered using mean and standard deviation. A mean of 3.0 was set as the decision rule: when the mean of the responses to an item is greater than or equal to 3.0 the level of

knowledge is high, otherwise it is low. Hypothesis one was tested using the t-test statistic at the 0.05 level of significance.

RESULTS

Research Question One

What digital technologies aid the preparedness of Mathematics teachers in teaching Mathematics?

Table 1: Teachers' Responses on the Digital Technologies that Aid the Preparedness in Teaching Mathematics (N = 210)

S/N	Digital Technologies	Yes		No	
		Freq.	Percent (%)	Freq.	Percent (%)
1.	Software application such as PowerPoint or Prezi	158	75	52	25
2.	Geometer's sketchpad	35	17	175	83
3.	Geogebra	35	17	175	83
4.	Database	88	42	122	58
5.	Spreadsheet	122	58	88	42
6.	Smartboard	52	25	158	75
7.	Interactive whiteboard/Projectors	122	58	88	42
8.	Desktop Publishing Software	52	25	158	75
9.	Computer Algebra System (CAS)	52	25	158	75
10.	Graphing calculator	52	25	158	75
11.	Cabri or Tinkerplot/Fathom	17	8	193	92
12.	Social Media such as; WhatsApp	158	75	52	25
13.	YouTube	105	50	105	50
14.	Word Processing	69	33	141	67
15.	Learning Management System (LMS)	69	33	141	67
16.	Virtual Learning Environments (VLEs)	88	42	122	58
17.	Programmable Toys	35	17	175	83
18.	Television (TV)	105	50	105	50
19.	Blogs or Podcast	69	33	141	67
20.	Dynamic software such as: Mathalicious, Sympy, Shanlax	35	17	175	83
21.	Video clips	105	50	105	50
22.	Internet facilities	141	67	69	33

Research question one sought to examine the technologies available to aid the preparedness of Mathematics teachers in teaching Mathematics. Out of the 22 items listed, at least 50% of the respondents agreed that 8 technologies aid the preparedness of mathematics teachers in teaching mathematics. The technologies are PowerPoint or Prezi, smartboard, Desktop publishing software, WhatsApp, YouTube, Television, Video Clips and Internet Facilities. The respondents' agreement were least in the following technologies: Programmable toys (17%) and Mathalicious/Sympy/ Shanlax (17%) and Cabri or Tinkerplot/Fathom (8%).

Research Question Two

What is the level of teachers' technological, pedagogical and content knowledge (TPACK) in integrating digital technology in teaching Mathematics?

Table 2: Mean and Standard Deviation of the Level of Teachers' Technological, Pedagogical and Content Knowledge in integrating digital technology in teaching Mathematics (N = 210).

	$\bar{X}$	SD	Decision
Technological Knowledge (TK)			
1. I understand a lot of different digital technologies to use to teach specific Mathematics contents.	4.00	O.70	High
2. I can easily learn different new digital technologies in teaching Mathematics.	4.33	0.47	High
3. PowerPoint, geometer sketchpad, Learning Management System and others can explain how to adapt lessons to Improve student learning.	4.08	0.27	High
4. I have the technical skills needed using digital technology in teaching Mathematics.	3.50	1.12	High
5. I have the ability to use hardware and software to solve learning problems in Mathematics.	3.75	0.83	High
Grand Total	**3.93**	**0.33**	**High**

	$\bar{X}$	SD	Decision
Pedagogical Knowledge (PK)			
1. I can assess students' performance in a classroom with digital technology using Collaborative method and others in teaching Mathematics.	3.87	0.88	High
2. I can adapt my teaching styles with digital technology to different learners in teaching Mathematics.	2.89	1.33	Law
3. Collaborative learning, Direct instruction/inquiry learning and Problem solving /project based learning can be used as a wide range of teaching approaches in digital technology classroom setting in teaching Mathematics.	4.19	0.87	High
4. I can explain the use of direct instruction and collaborative methods to enhance students learning by integration of digital technologies.	3.21	0.97	High
5. I understand how to organize and maintain classroom management in teaching Mathematics.	3.97	0.95	High
Grand Total	**3.63**	**0.19**	**High**
Content Knowledge (CK)			
1. I can explain how to use Learning Management System to plan lessons, teach lessons and keep track of students' progress.	3.10	1.41	High
2. GeoGebra can be used to plot graphs such as $y = 5x + 3$.	3.98	1.08	High

3.	I understand how to use Interactive whiteboard/projector to show students the (images) sector, arc, tangent and perpendicular of a circle.	3.40	1.30	High
4.	Geometer's Sketchpad can aid Mathematics teaching for exploring Euclidean Geometry.	3.88	0.94	High
5.	I can solve fractions such as $(4\frac{1}{11} \div (-\frac{3}{4} + \frac{1}{8})$ using Geogebra Software.	3.71	1.13	High
Grant Total		**3.61**	**0.19**	**High**

Cut-off Mean=3.00

Table 2 revealed participants' Technological, Pedagogical and Content knowledge (TPACK) level in integrating digital technology in teaching Mathematics. For the level of teachers' Technological Knowledge(TK), the respondents' knowledge (Grand Mean = 3.93; SD=0 33) is high. The respondents perceived Content Knowledge(CK) (Grand mean= 3.61, SD= 0.19) is also high. Furthermore, the respondents' knowledge of Pedagogical Knowledge (Grand mean=3.63, SD=0.19) is high, but for the item on the application of teaching styles with digital technology to different learners in mathematics, it is low (Mean =2.89, SD=1.33).

Research Question Three

What is the level of Mathematics teachers' preparedness in integrating digital technology in teaching Mathematics?

Table 3: Mean and Standard Deviation of the level of Mathematics teachers' preparedness in integrating digital technology in teaching Mathematics (N = 210)

S/N	Items	$\bar{X}$	SD	Decision
1	My teacher education program prepared me to use technology tools for teaching Mathematics.	2.88	1.21	Low
2	I am trained on how to teach Mathematics with digital technologies.	2.74	1.42	Low
3	My teacher education program included courses that are related to technology integration in teaching Mathematics.	2.98	1.26	Low
4	My lecturers appropriately modelled combining content, technologies and teaching approaches in their teaching.	2.85	1.26	Low
5	My teacher education program gave me the opportunity to practice teaching Mathematics with technology.	2.91	1.32	Low
6	My education preparation program introduced me to select appropriate digital technology tools to specific content areas in teaching Mathematics.	2.91	0.88	Low
7	My education preparation program introduced me to design lessons using digital technologies to meet the needs of students learning Mathematics.	2.80	1.11	Low

Grand Total	**2.87**	**0.17**	**Low**

Cut-off Mean=3.00

Table 3 revealed that the score (Grand mean= 2.87, SD=0.17) of the participants is below the cut-off mean score of 3.0. This indicates that there is low level of Mathematics teachers' preparedness in integrating digital technology in teaching Mathematics while undergoing their Teacher Education programmes.

Hypothesis One

HO1: There is no significant difference between the knowledge of public and private school Mathematics teachers in the use of TPACK in integrating digital technology in teaching Mathematics.

Table 4: T-test on public and private school Mathematics teachers in the use of TPACK in integrating digital technology in teaching Mathematics

School type	N	$\bar{X}$	SD	t – Cal	Df	Sig. (2-tailed)	Decision
Public	70	18.41	5.88	0.49	208	0.63	HO_1 Accepted
Private	140	18.01	5.5				

Table 4 showed that there is no significant difference in the knowledge of public and private school Mathematics teachers in the perceived use of TPACK in integrating digital technology in teaching Mathematics, as null hypothesis is accepted (P= 0.63>0.05).

DISCUSSION

This study examined teachers' perceived preparedness in integrating digital technology in teaching Mathematics in Edo South Senatorial District, Edo State, Nigeria. On the technologies available to aid the preparedness of mathematics teachers in teaching mathematics, the findings revealed that Social Media(WhatsApp), Software applications (PowerPoint or Prezi), Internet facilities, Spreadsheet, Interactive Whiteboard/Projectors, TV, Video clips and YouTube were perceived by 50% and above of the respondents as technologies that can support mathematics teaching. However, there were some digital technologies that had less than 50% agreement among respondents, indicating lower awareness or usage. These technologies include Geometer's sketchpad, Geogebra, Database, Smartboard, Desktop publishing software, Computer Algebra System (CAS), Graphing Calculator, Cabri or Tinkerplot/Fathom, Word Processing, Learning Management System(LMS), Victual Learning Environment (VLEs), Programmable toys, Toys, Blogs or Podcasts, and Dynamic software like Malicious, Sympy and Shanlax. Out of the 22 technologies examined in this study, at least 50% of the respondents agreed that 8 technologies aid the preparedness of mathematics teachers in teaching mathematics. The low percentage of knowledge of digital technologies that can make and support the exploration of core mathematical concepts tangible and interactive for students, may have resulted from lack of awareness of country's educational policy on ICT (Adewale & Dare, 2012; Federal Ministry of Education, 2019). The low agreement of respondents on the application of certain digital technologies calls for additional training of in-service teachers of knowledge of computer hardware and software, and digital technologies that can be integrated into school mathematics teaching and learning. This is consistent with Mishra and Koehler's (2009), Guerrero (2010) and Govender, Potberg and Vester (2018) declarations that technological knowledge is related to a teacher's ability to use hardware and software to solve Mathematics learning problems

The study found that there was a high level of teachers' perceived technological knowledge, content knowledge and pedagogical knowledge in integrating digital technologies in teaching mathematics. These findings indicated that the majority of Mathematics teachers believed that a lot of different digital technologies can be used to teach specific Mathematics contents. This inherently supported Jang and Tsai (2013) who reported that teachers should have a broad knowledge base on the subject matter so as to retrieve and teach contents in logical and

organized ways. These findings are in support of the Technological Pedagogical Content Knowledge (TACK) framework which connects technology to curriculum content and specific pedagogical approaches and describes how teachers' understandings of these three knowledge bases can interact with one another to produce effective discipline-based teaching with educational technologies National Council of Teachers of Mathematics, 2011; Guerrero, 2010, Shin, Koehler, Mishra, Schmidt, Baran & Thompson, 2009; Koehler & Mishra, 2008; Mishra & Koehler, 2006).

The findings also showed that teachers' preparedness in integrating digital technology in teaching Mathematics was below average. This indicates a low level of Mathematics teachers' education on integration of technologies in teaching and learning Mathematics. This suggests need for more training programs specifically focused on Mathematics teachers' education to effectively integrate digital technologies in their teaching practice. This finding agrees with Niess and her colleagues (2003) claims that Mathematics teachers need to be trained and learn how to teach with digital technologies (TPACK) in order to effectively integrate digital technologies in their teaching practice. This aligned with UNESCO (2023), who presented specific technology competencies that teachers should acquire at the college to be able to integrate technology in teaching in the most appropriate way. The findings revealed that Mathematics teachers can easily learn different new digital technologies in teaching Mathematics if they are well trained and prepared for instruction in school mathematics using TACK.

Furthermore, the study found that there was no significant difference in the knowledge of public and private school Mathematics teachers in integrating digital technology in teaching Mathematics. This is indicating that school type does not influence Mathematics teachers in integrating digital technology in teaching Mathematics. The presence of computer hardware and software (Adefunke, Ayodele & Olufemi, 2014) and digital technologies in schools does not necessarily translate to significant influence in the integration of digital technologies by public and private schools' mathematics teachers in Edo State, Nigeria. Therefore, the Edo-BEST@Home programme, where the Edo State government provided some digital technologies to public school teachers and students for teaching and learning, has brought no clear difference in the integration of digital technologies by mathematics teachers in both public and private schools in the State.

CONCLUSION AND RECOMMENDATIONS

Based on the findings, it can be concluded that very few digital technologies are perceived by majority of the mathematics teachers as being able to aid their preparedness in teaching mathematics. The perceived level of teachers' technological, pedagogical and content Knowledge (TACK) in integrating digital technologies in teaching mathematics is high. The low level of preparedness (readiness) among mathematics teachers to effectively integrate digital technologies into their teaching practices, suggests little or no inclusion of TPACK in Mathematics teachers' education and professional development programmes. Furthermore, school type does not influence teachers' perceived integration of technology in teaching mathematics in schools across Edo South Senatorial District, Edo State, Nigeria. Therefore, the following recommendations are made:

1. Teacher education programmes should incorporate training on how to select appropriate digital technology tools that align with specific content areas in Mathematics teaching. Teachers should be equipped with the

knowledge and skills to effectively integrate digital technologies into their instructional practices in a content-specific manner.

2. Seminars/workshops should be organized for in-service Mathematics teachers on the available digital technology tools that can aid instruction in specific
3. Mathematics topics. In-service teachers should be provided with the opportunities to learn about and experiment with the various digital technologies that can enhance their Mathematics teaching practices.
4. Educators can leverage technology to provide professional development opportunities for Mathematics teachers, such as online courses through webinars and Zoom, to enhance their digital literacy skills, pedagogical strategies, and content knowledge related to integrating technology in Mathematics instruction.

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Effect of Two Instructional Methods and Prior Knowledge on Social Studies Students' Academic Performance in Delta State

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ABSTRACT

This study was on the effect of two instructional methods and prior knowledge on Social Studies students' academic performance in Delta State. The aim of this paper is to determine the effect of student's prior knowledge, discussion and demonstration methods of instruction on the academic performance of Social Studies students. The study was guided by three (3) research hypotheses. Literature review was hinged on the theory of constructivist learning propounded by Dewey (1996). The theory stated that learning is child centered which allows the learner to explore his environment and construct his own knowledge from learning materials and experience. The study design was quasi-experimental 2×2×2 randomized pre-test posttest control group design. The sample consists of 309 students in the upper Basic 2 which was 20% of the target population of the study. The instrument used was the standardized instrument: "Social Studies Performance Test" (SSPT) used by students during the Basic Education Certificate Examination conducted by the Delta State Government under the Ministry of Basic and Secondary Education in 2022.A prior knowledge test was administered on the participants to determine its interaction effects when exposed to instructional methods on academic performance in Social Studies. Data collected were analyzed using T-test, Analysis of Covariance (ANCOVA) at 0.05 alpha level and Scheffe Comparison Post hoc analysis. The researcher taught the two experimental groups using demonstration and discussion methods while those in the control group were taught with the conventional lecture method. The following findings were made: there was significant mean effect between demonstration and discussion methods on students' academic performance in Social Studies, there was significant mean effect between low and high prior knowledge of students on academic performance in Social Studies; there was significant

interaction effect between instructional methods and prior knowledge on academic performance in Social Studies. Based on these results, it was recommended that regular refresher courses and professional workshops should be organized for Social Studies Teachers to update their knowledge on the application of discussion method of teaching the subject in secondary schools. Teachers should tap from students' prior knowledge by starting their lesson from known to the unknown as the surest way of improving academic performance in Social Studies. The principals should create an enabling environment for teaching of Social Studies and the government should enforce through supervision the use of discussion method to teach Social Studies in Schools.
Keywords: Prior knowledge, instructional methods, Social Studies, students' academic performance.

Introduction

Social Studies which is the study of man's interaction with his environment was introduced into the school curriculum in Nigeria with the aim of producing citizens who are reflective in thinking, analytical, scientifically-minded and enquiry conscious in addressing societal problems. Ahmad (2009) described Social Studies as the subject capable of developing values, spirit of national unity, nation building, critical and analytical thinking abilities in children with the hope of enabling them to contribute in solving societal problems (when they become adults) as well as keeping pace with global demands.

The principal aim of Social Studies at all educational levels is made possible through various teaching methods used to impact Social Studies knowledge. Osakwe and Itedjere (2005) observed that student-centered method is what the learners do, such as discussion method, project method, inquiry and role-playing among others. While the teacher-centered method is exactly what the teacher does in order to bring about learning such as lecture and demonstration. These two types of teaching and learning methods are capable of improving learning achievements among students. Social Studies teaching is a complex process of co-operation and communication between the teacher and the learner. It is a clear means by which students are assisted to acquire new skills, values, attitudes, appreciations, knowledge and understanding (Edinyang, 2001).

Group discussion is a method of learning where both the teacher and learners are engaged in thinking together through which points of view are evaluated. Issues raised and solutions are sought based on consensus as related to the study in question. The solutions are subjected to further examination and group analysis under the guidance of the teacher. The teacher or group leader chosen by the teacher regulates the activities of the discussion group. This method allows for free participation of all learners during class discussions in which the teacher has to guide and moderate all activities and receive feedbacks. The observation by Kobrin and Shaw (2007) points to the fact that group discussion or sub-group learning enhances students' performance in the classroom teaching-learning process. Irrespective of how this method has thrived in developed nations, its introduction into the Nigerian system of education has not been sufficiently encouraged. To achieve meaningful learning, the teacher needs to perform activities that would enhance team spirit in classroom engagements and exchanges such that the learner should be at the center of instruction. This implies that the learners are to be actively involved in the teaching learning process, this is to ensure that the objectives of Social Studies in training potentials for independent survival and acquisition of skills for national development are realized. Student centered

instruction does not mean absolute extrication of Social Studies teachers from the teaching learning process.

Teacher-centered methods are also known as traditional methods where teachers are at the center of classroom activities which include giving explanation and leading discussion (Ahmed & Aziz, 2009). A teacher-centered method is behaviorist in nature and the teacher-directed learning follows the constructivist approach which involves careful and meticulous planning of the curriculum and purposeful instructional procedure employed by the teacher. Adeyemi (2008) notes that lecture, which is a common method does not stimulate students' innovation, inquiry and scientific thinking but rather encourages student to cram facts that can easily be forgotten. Ayot and Patel (1992) on their part observed the relevance of the utilization of demonstration method of instruction for encouraging the learning of students in school subjects, including Social Studies. This view is supported by Dweck and Leggett (1988) noting that when students are exposed to demonstration method it will fast track their cognitive development, ability to think through a problem and enable them to carry out independent thinking in a bid to solving identified problem. Demonstration method is that method of teaching in which the teacher involves students and gets them to handle materials. It applies to practical instruction the teacher uses to facilitate understanding with real objects on the topics taught. It is a means of showing learners how to do things themselves or demonstrate skills through mass practice and testing or follow up where the teacher assesses learners' performance. Horace (2007) defines prior knowledge quite simply as the knowledge one already has about a subject. Prior knowledge influences how the teacher and students interact with the learning materials as individuals and as a group. It is the proper entry point for instruction in a Social Studies class which builds on what is already known, it is a major factor in comprehension. Thus, the teacher deploys instructional skills by drawing on meaningful analogy to illustrate concepts or processes which provide an organizational structure for understanding new materials that may be more appropriate to deepen understanding than the students' prior constructs. When teachers link new information to the students' prior knowledge, they activate the students 'interest and curiosity and infuse instruction with a sense of purpose. Prior knowledge is an important step in the learning process, it is a major factor in comprehension, it satisfies the mind's enormous curiosity and hunger for discovery, challenge and novelty; creating an opportunity to challenge students to leverage on their collective experiences as basis for new learning. It provides an immediate evaluation of students' proficiencies, competencies and readiness to learn from the teacher. This will enable the teacher to understand how to improve the weak and encourage strong students in the class. While the weak are remediated, the highly intelligent are rewarded.

According to Igba (2009) and Ayodeji (2009) students have continued to achieve poorly in Social Studies examination. Students' and achievements in junior secondary school Social Studies also affect their interest and performance in related courses like Geography, law, and Sociology at the senior secondary school level; and above all makes them unable to apply desirable social and citizenship skills to their daily challenges of living.

The implication of the above scenario is that things are not right with Social studies. The reason for this failure may be that the subject is not well programmed and taught to the students. In support of this assertion Mbakwem (2005) states that the ability of Social Studies to realize the lofty goal

expected of it rests on methodology approach to the subject which embodies all in terms of the adequate selection and appropriate utilization of Social Studies instructional methods in the classroom. Against this backdrop, it is necessary that the choice of instructional method consider its suitability of all categories of students in the classroom. The initial impression of people about the effectiveness of Social Studies teaching in secondary schools as a result of poor instructional delivery system vis-à-vis students' performance necessitated the need to investigate the effect of instructional methods and prior knowledge on Social Studies teaching and learning in the school.

Theoretical Framework

The study is based on the theory of constructivist learning propounded by Dewey (1996). Constructivism is the philosophical and scientific position that knowledge construction is based on personal experiences and the continual testing of hypotheses. In a constructivist classroom, learning is perceived as an active not a passive process, where knowledge is constructed not acquired. Students construct their own meaning by building on their previous knowledge and experience. New ideas and experiences are matched against existing knowledge, and the learner constructs new or adapted rule to make sense of the world. The basic tenet of constructivism is that students learn by doing rather than by observing. Students bring prior knowledge in a learning situation in which they must critique and re-evaluate their understanding of it. Constructivism gives students ownership of what they learn, since learning is based on students' questions and explorations, and often the students participate in designing the assessments as well.

Purpose of the study

The purpose of this research therefore focuses on the effect of instructional methods and prior knowledge on Social Studies students' academic performance in Delta State. Specifically, this study sought to:

1. determine the mean effect between demonstration and group discussion methods on students' academic performance in Delta State;
2. find out whether low and high prior knowledge of students affected academic performance in Social Studies; and
3. determine the interaction effects among instructional methods and prior knowledge on academic performance of Social Studies students.

Hypotheses

The following hypotheses were formulated to guide the study:

1. There is no significant mean effect between demonstration and group discussion methods on students' academic performance in Social Studies.
2. There is no significant mean effect between low and high prior knowledge of students on academic performance in Social Studies.
3. There is no significant interaction effect between instructional methods and prior knowledge on academic performance in Social Studies.

Methodology:

This study adopted a quasi-experimental design involving the pre-test and post-test of treatment and control groups. It also used a factorial design that consists of 2x2x2 randomized pretest posttest control group design such that the instructional strategy has two dimensions – demonstration and group discussion methods, prior knowledge with two levels of high and low; and academic performance of high and low. The principles behind this is relatively simple and involved the use of intact classes made up of two treatment groups and a control group. The ultimate difference was that one group that is, the control group was not administered the treatment. The population of the study was 1547 Social Studies students in upper basic 11 (State universal Basic Education Board, 2020, Asaba). The State is made up of 25 local government areas stratified along three senatorial districts with 462 schools. Delta Central has 8 local government areas with 181 schools, Delta North with 9 local government areas comprising of 168 schools and Delta South made up of 8 local government areas with 113 schools respectively. The sample size was 309 Social Studies students from the upper Basic school 11. The selection considered a fair representation of participants from the three senatorial districts. Each local government area produced one school each for the investigation. This made it a total of 3 schools from 3 LGA in the three senatorial districts in the state. The sample was drawn using simple random sampling technique involving balloting system. The instrument of data collection for this study was a standardized instrument "Social Studies Performance Test" (SSPT) used by the Delta State Ministry of Basic Education Certificate examination in June, 2022.The second instrument was a prior Knowledge Test consisting of 25 question items used to measure the effect of students' low and high prior knowledge in relation to their academic performance. The researcher developed a lesson note centered on six (6) major topics drawn from items on the standardized instrument that were treated for six (6) weeks during the experimentation with the experimental groups and control group at the designated school locations. The validities were obtained by three experts from Delta State University Abraka, and Pearson (r) statistics was used to ascertain its reliability at 0.77 co-efficient. The hypotheses were tested using t-test, Analysis of Covariance (ANCOVA) and Scheffe multiple Comparison Post Hoc analysis.

Hypothesis 1

There is no significant mean effect between demonstration and discussion methods on students' academic performance in Social Studies.

Table 1: Analysis of Covariance summary indicating three instructional methods (Demonstration, Group discussion and Lecture methods)

Dependent Variable: Posttest

Source	Type 111 sum of Square	DF	Mean Square	F	Significance
Intercept hypothesis	99080.479	1	99080.497	71.955	.011
Error	2950.822	2.143	1376.985[a]		
Pre-test hypothesis	45.247	1	45.247	869	.352
Error	15880.423	305	52.067[b]		
Group hypothesis	25945.385	2	12972.693	249.154	.000
Error	15880.423	305	52.067[b]		

●P<.05, critical f value = 3.02

The observed F value is 249.15 and the critical F value is 3.02.The observed F value is greater than the critical F value. Hence, the null hypothesis is rejected. There is a significant effect between demonstration, discussion and Lecture method on students' academic performance in Social Studies.

In order to find the direction of difference, a Post Hoc analysis was used. The Scheffe Multiple Range Test is appropriate for the analysis.

Table 2: Scheffe Multiple Range Test between discussion, demonstration and Lecture methods on students' academic performance.

Posttest Scheffe

(I)Groups	(J)Groups	Mean Difference (I – J)	Std Error	Sig	95% Confidence Interval	
					Lower Bound	Upper Bound
Discussion Method	Demonstration Method	18.06786	1.00527	.ooo	15.5952	20.54
	Conventional Method	29.35922	1.00527	.ooo	26.8865	31.85
Demonstration Method	Discussion Method	-18.06796	1.00527	.ooo	-20.5407	-15.59
	Discussion Method	11.29126	1.00527	.ooo	8.8185	13.76
Control group (conventional Lecture)	Discussion Method	-29.35922	1.00527	.ooo	-31.8320	-26.88
	Demonstration Method	-11.29126	1.00527	.ooo	-13.7640	-8.81

●The mean difference is significant at the 0.05 level.

Table 1 result revealed that there is a significant difference between students taught with discussion method (X = 78.19) and the conventional Lecture method (X =48.84).Also, there is a significant difference between students taught with discussion method (X =78.19) and those taught with demonstration method (X =60.13).There is a significant difference between students taught with demonstration method (X =60.12) and the Lecture method (X=48.84).Students exposed to the discussion method performed better than those taught with demonstration and Lecture methods. Those taught with demonstration method performed better than those taught with Lecture method.

Hypothesis 2

There is no significant mean effect between low and high prior knowledge of students on academic performance in Social Studies.

Table 3: t-test analysis between students prior knowledge on academic performance in Social Studies.

Group	**N**	**Mean**	**SD**	**DF**	**t-cal value**	**t-crit value**	**Remarks**
Low prior knowledge	264	61.55	13.86				
High prior knowledge	45	**67.29**	**14.56**	307	-2.55	1.96	Rejected null hypothesis

●P <.05

Table 2 shows that the observed t-value is -2.55 and the critical t-value is 1.96.The observed t-value is greater than the critical t-value, therefore the null hypothesis is rejected. There is a significant difference between students with low and high prior knowledge on students' academic performance in Social Studies.

Hypothesis 3:

There is no significant interaction effect between instructional methods and prior knowledge on academic performance in Social Studies.

Table 4: ANCOVA summary table for the interaction effects between instructional methods and prior knowledge on the academic performance of students in Social Studies

Source	Type 111 sum of square	Df	Mean Square	F	Significance
Intercept hypothesis	86992.144	1	86992.144	55.141	.017
Error	3222.557	2.043	1577.643[a]		
Pre-test hypothesis	35.649	1	35.649	693	.406
Error	15538.618	302	51.542[b]		
Group hypothesis	17224.679	2	8612.340	56.139	.013
Error	339.063	2.210	153.410[c]		
Prior hypothesis	9.954	1	9.954	.061	.827
Error	339.809	2.083	163.134[d]		
Group prior hypothesis	341.494	2	170.747	3.319	.038
Error	15538.618	302	51.452[b]		

●P<.05; f critical value = 3.02

Table 4 reveals that the observed F value of 3.32 is greater than the critical value of 3.02.Therefore the null hypothesis is rejected. There is a significant interaction effect between instructional methods and prior knowledge on academic performance in Social Studies.

Discussion of Findings

According to the findings of the study, there was significant mean effect of treatment (Discussion, demonstration and lecture methods) on students' academic performance in Social Studies methods. Comparatively, by implication the study revealed that students exposed to the discussion method performed better than those taught with demonstration and lecture methods respectively. Renek and Matthew (2004) reported that students taught with discussion method had a better performance compared to those taught with demonstration methods. They were of the view that discussion method encourages students' active class participation to evaluate events, topics or results; to clarify the basis for their judgment and become aware of other points of view. Also, the findings of this study gave credence to the works of Abdu-Raheem (2010) which advocated the use of discussion method as an effective mode of instruction that would fast track attainment of the aims and objectives of teaching Social Studies in secondary schools. Perhaps, this could be as a result of the fact that discussion method helps to sustain curiosity and participatory role of students' classroom group discussions. In addition, the work of Uhumuavbi and Mamudu (2009) exposed the deficiencies of demonstration method wherein they remarked that demonstration method is mostly widely used for acquisition of practical skills involving practical illustrations and laboratory equipment, hence would yield better performance when used in teaching subjects such as science, technical and vocational education. Mkpa (2009) advocated that teachers should desist from using lecture method since they do not give students opportunity to explore, think or to interact. They tend to make students the Gulliver receivers of knowledge. Lecture method being teacher-centered encourages an authoritarian classroom and limits students' participation in teaching and learning process (White, 2000).

The findings of this study revealed that there was a significant mean effect between low and high prior knowledge of students on academic performance in Social Studies. The students with high prior knowledge performed better than those with low prior knowledge. This findings is in agreement with Ukadike (2006) who averred that the presence of high prior knowledge enhances students' performance in Social Studies. This is also supported by the study of Horace (2007) on the spiraling effect of prior knowledge on accounting studies. He reported that sufficient prior knowledge of students on a topic makes new learning meaningful and result-oriented. Allington and Cunnington (2010) in their works lend credence to this submission that the prior knowledge level of students determines their academic performance in comprehension class. This findings is at variance with the study by Okebukola (2006) which argued that prior knowledge level of students could be subjected to distortions, misconceptions and prejudices thus may hinder learning of new concepts.

Finally, another finding in this study indicates that there was an interaction effects between instructional methods and prior knowledge on the academic performance in Social Studies. Therefore, this finding serves as statistical evidence that suggest that the effect of instructional methods depends on students' prior knowledge in Social Studies. This view negates the finding of Beier and Ackerman (2005) which observed that instructional methods and prior knowledge had no significant interaction effect on academic performance. Hence, the study has shown that instructional methods and prior knowledge were sensitive to treatment.

Conclusion

The teacher has a central role in the implementation of Social Studies curricula at various stages of the education experience. Therefore, enhancing the academic performance of Social Studies students is of paramount importance to the teacher as well as the school. As canvassed in this study, the effective utilization of discussion method of instruction would not only promote participatory learning environment but will also encourage team spirit, critical thinking and upscale the students' academic performance. The school curriculum implementation model should address issues of learning goals, learning performance, social interaction that takes place in the classroom between teacher/students and subject-matter; and students' collaboration during the teaching and learning processes. This will guide the teacher in the selection of instructional materials/methods, and will enable him/her to be able to recognize the learners' entry/prior knowledge before facing them with new topical issues of learning. It was inferred that prior misconceptions of subject content could compromise the effective result of instructional methods thereby affecting students' comprehension level. By implication, it behooves the class teacher to understand the learners' prior knowledge base to avoid knowledge misconceptions.

Recommendations

The following recommendations were made:

1. Teachers should use discussion method to impart knowledge to students to enable them participate actively in the lesson, interact with instructional materials and classmates.
2. In order to fully utilize the potentials inherent in prior knowledge, teachers should focus not only on what the students know but also on how well they know since prior knowledge enhances academic performance.
3. The use of instructional methods in the school should take into consideration learning which flows from known to unknown, simple to complex, facts to ideas, concrete to abstract etc. in order to enable students construct their own knowledge and transfer such to real life situations.

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Herders- Farmers' Clashes and Secondary Education in Benue and Nasarawa States, Nigeria

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Abstract

This study investigated the influence of herdsmen-farmers' clashes on secondary education in Benue and Nasarawa States, Nigeria. Three research questions guided the study. This research adopted a mixed-methods approach. All the farmers, herders, and 5,110 teachers in the 297 government-approved secondary schools in Benue State and the 245 government-approved secondary schools in Nasarawa State made up the population. The study used a multi-stage sampling technique. The "Herdsmen/farmers Clashes and Educational Development Questionnaire (HFCEDQ)" and the "Herdsmen/farmers Clashes and Educational Development Interview Guide" were used to collect the data. Descriptive statistical analysis of frequency counts, percentages, and charts was used to analyze the data. The qualitative data were subjected to content analysis. The study found that there was negative influence of herdsmen-farmers' clashes on students' enrolment. Students' enrolment between 2011 and 2021 was very low, specifically 52.9% low and this was attributed to the increase and continuing herders and farmers' clashes in Benue and Nasarawa States. The study also identified the remote causes and preventive measures to the clashes in the two States in order to ensure students' access to education in Benue and Nasarawa States. This will among others, guarantee and strengthen the right to education in the context of achieving the United Nations Sustainable Development Goals-4 (SDGs-4). It recommended among others: reconstruction, resettlement and compensation of displaced farmers and herders. Setting up peace, enlightenment and reconciliation committee. Establishment of ranches. Urgent domestication of the African Great Green Wall Initiative and maintenance of reasonable and effective law enforcement presence in the affected areas.

Keywords: Influence, Herdsmen, Farmers, Enrolment, Utilization of Infrastructure, Secondary Education

Introduction

The struggle for the survival and security of commercial livelihoods in the Sahel and West Africa has been complicated by population growth, expansion of small arms and light weapons (SALW), ecological remediation, disruption of conditions for the resolution of

land-water conflicts and an increase in the total number of agricultural producers. In many African civilizations this has damaged the bonds that bind shepherds and peasants. Nigeria is the country with the highest rate of violence between farmers and shepherds, but it also occurs in Mali, Burkina Faso, Chad, Senegal, Cameroon and Ivory Coast. Numerous factors with multiple causes, including resource scarcity in the face of growing desire, retaliatory violence, global warming, and others, can lead to such disputes. In the Nigeria scenario, there is no doubt that these disputes have a disintegrating impact as they disrupt the unity of the nation. For Nigerians to learn to value the values that unite them, rather than the values that divide the nation, the need to reshuffle values and rebuild past ties between farmers and shepherds becomes vital (Oghuvbu and Oghuvbu, 2020).

Nigerian states, including Benue, Plateau and Nasarawa in the north-central area, Kaduna, Zamfara and Katsina in the northwest, and Adamawa and Taraba in the northeast, have all been affected by the violence between farmers and herders. Deaths have occurred in these states and there are no signs that hostilities will resolve anytime soon. The disputes between farmers and herders, which have now acquired a criminal component, are comparable to the Boko Haram uprising in their effects on Nigeria based on their current scale. Reports indicated that Fulani herders were the fourth bloodiest group in the world in 2017 (Global Terrorism Index, 2017). However, profiling that the clashes were caused by Fulani herders divided the identities of shepherds and farmers and caused misinterpretations due to a lack of in-depth research. Currently, farmers and shepherds are often described as non-Fulani in the literature on the peasant-shepherd conflict.

Various observers have gone to the degree of categorization of farmers such as Christians and shepherds such as Muslims (Kwaja and Breathing-A-Aihin, 2018), which could lead to religious conflicts. In the past, farmers and shepherds existed side by side in peaceful coexistence and both gave important economic contributions to the country (Bagu and Smith, 2017). Consequently, reaching significant national progress depends on the peace between the two parts involved. It is important to emphasize that there are regional variations in the probability of the comparison of engines. The unusual slaughterhouses in the middle belt (Staten Benue and Nasarawa, the North -East (States of Adamawa and Taraba) and parts of the Kaduna state can be attributed to the farm and conflict of shepherd. On the other hand, conflicts between farmers and herders in Katsina State have never been so violent as in recent times.

Newspaper reports of several events involving herders and farmers in permanent settlements indicate that the dispute has killed more than 60,000 people since 2001, making it more deadly than the infamous Boko Haram uprising. However, it is difficult to obtain an exact number of victims of the herder-farmer conflict in Nigeria due to the lack of a committed data set. According to a BBC report, the clashes alone claimed the lives of nearly 50,000 people between 2001 and 2004 in the states of Benue, Kaduna, Nassarawa and Plateau in the Middle Belt. Tragically, women and children were responsible for around 35,000 of these deaths (Nwosu, 2017; Kwaja and Ademola-Adelehin, 2018). In four Nigerian States - Benue, Kaduna, Nassarawa and Plateau - another study calculated the economic impact of pastoral-nomadic disputes and found that it cost more than $ 14 billion annually in terms of property loss, damage to agricultural products and problem management. of herders-farmers. The education system could also be hit by the clashes. Indeed, the rate at which children can lag behind in education due to the herders-farmers' problem is quite alarming and, if not addressed properly, could lead to a national

education clashes. Although there has been previous research on the conflicts between herders and farmers in Nigeria, not much research has been done on education.

Benue State and several other States in the geographical area were occupied by pastoralists as pastures for cattle. Undoubtedly, such a takeover would be devastating to the region's education system. Indeed, university programs in the region have been suspended due to the escalation of the conflict. Schools at all levels - primary, secondary and higher - are significantly affected. Between January and April 2018, approximately 30,000 primary school students in the southern geopolitical zone of Nasarawa State missed classes (Oota, 2018). In the local government areas of Agatu, Logo and Guma of Benue, a large number of public institutions were destroyed by alleged murderous shepherds between December 2016 and December 2018, causing children to abandon or learn in repugnant situations (Duru, 2018). The Vice-Chancellor of the University of Ilorin, Prof. Suleyman Abdulkareem, said herders contaminated the university's dam with pesticides in February 2018 (Editorial, New-Telegraph, 2018).

Secondary education is available especially for children aged 11 to 17 (FRN, 2013). Secondary education aims to prepare students for a successful life in society and for those who are interested and able to make it for higher education. For this reason, secondary education offers students who do not pursue higher education a way to survive and integrate into society, and also serves as a bridge between primary education and higher education. In the Nigerian context, secondary education is the foundation or raw material provider for expected future labor resources. One of its goals is to ensure that all primary school students, regardless of gender, social class, religion or ethnicity, receive quality education. Also, it gives students the tools they need to thrive in the modern, technologically advanced world. It is vital to the country as it provides the mid-level labor needed to sustain and grow the economy. Enrolment, or simply the number of children enrolled in all school systems in the country, is a way of assessing the educational opportunities of a population.

Teachers and school heads in these localities face great challenges due to the constant loss of property and lives. Suleiman (2016) noted that when herders and farmers' clashes, educational infrastructure, including classrooms, offices, books and other relevant documents, suffer significant damage or destruction. In remote places, schools are often razed to the ground. For this reason, students find it difficult to continue their academic activities for an extended period of time as they move their families to safer places. In some of the State-affected areas, the massacre is also leading to a drop in school enrolment. The decrease in enrolment is also a consequence of the psychological and emotional problems that anxiety causes in individuals (Okwori and Angenyi, 2019).

Any attack on schools could have detrimental effects on the country's long-term growth. The attacks, murders and destruction of educational institutions seem to have no end in sight. The herders-farmers' clashes in Benue and Nasarawa States seems to have devastating effects on enrolment. The government, that is obliged by the constitution to find a solution, may not be able to do so in a way that would help restore public trust and normality in the education system. This troubling position served as the basis for this empirical study, which was justified.

Statement of the Problem

One reason for the conflict between herders and farmers is that nomads are forced to approach the Middle Belt and South in search of greener grass and water for their animals due to the control of land for agriculture and grazing, the severe drought conditions of

vegetative soils and water shortage in northern Nigeria. During their travels, itinerant shepherds live in small towns with lush flora and water, such as the Benue Valley. Herders have been criticized by farmers for invading private property, damaging their crops and poisoning their main aquatic environment. On the other hand, herders accuse farmers of poisoning, killing or even stealing their animals, especially livestock, and obstructing their grazing paths. Several other Nigerian towns have been affected by the dispute between herders and farmers, which has also affected the expansion and progress of the country.

The education sector has suffered from increased competition for the land and the plants that grow on it. Indeed, academic activities may have been suspended for a long time. Many public school buildings are frequently attacked and destroyed, forcing thousands of students to relocate. As a result of their actions, more than 20,000 school children have found refuge in several camps for internally displaced people. The number of students enrolled in these schools may be affected by this scenario. While there has been previous research into the conflicts between herders and farmers in Nigeria, not much research has been done on education. The aim of this research is to close the knowledge gaps in education. The aim of this research was to statistically investigate the influence of the herders-farmers' clashes for secondary education in Nigeria, with a specific focus on the States of Nasarawa and Benue.

Research Questions

This study was guided by the following research questions:

1) What are the remote causes of herders-farmers' clashes in Benue and Nasarawa States?

2) What is the influence of herders-farmers' clashes on enrolment between 2011-2021 in secondary schools in Benue and Nasarawa States?

3) What are the possible ways to prevent herders-farmers' clashes in Benue and Nasarawa States?

Literature Review

Farmers and herders have been at odds with each other since 2011. Farmers and herders previously coexisted peacefully in Nigeria, with only a few small disagreements that did not turn into violence and did not cause casualties (Doyin, 2017). On September 30, 2012, in the local government of Isoko North, Delta State, Benjamin Chegue, the Director of Human Resources Management, was shot dead. Since then, the killings related to the skirmishes between farmers and herders have continued in all States.

In January 2013, the nomadic herders invaded settlements in Nasarawa State, killing ten women and displacing more than 5,000 residents. About 33 people were killed in a renewed attack in November 2014 in a small number of communities in Nasarawa State. Fulani terrorists are accused of killing at least 1,229 people in Nigeria in 2014, according to the latest Global Terrorism Index, which ranks African nations as the third most fearful nations in the world. Over 7,000 deaths in Nigeria were attributed to Fulani jihadists and the Boko Haram terrorist organization in 2014. Although Boko Haram leads Nigeria's terrorism narrative, very little is said about killings and kidnappings by Fulani herdsmen (Ndubuisi, 2018).

The year 2016 saw more killings of militant herdsmen. In February 2016, a conflict between herders and farmers in Benue State resulted in the deaths of 40 additional people, the displacement of nearly 2,000 and the critical injuries of more than 100. After the attack, herders expelled about 7,000 residents from six villages in the Agatu Local Government Area of Benue State. The

population claimed little military or security presence despite regular killings by herders. Numerous houses were set on fire and more than 200 people were killed. At least 30 people were killed in a second attack on Agatu by violent herders in April 2016 (Ndubuisi, 2018). Another violent attack, the South Kaduna massacre in 2016, was described by some non-governmental organizations as a genocide against the South Kaduna natives. According to the Catholic Archdiocese of Kafanchan, violence in the Southern areas of Kaduna has claimed and helped save 808 lives. To date, 53 communities have been attacked, with 57 victims. The killers, according to Governor Nasir El Rufai, were Fulani farmers from abroad who avenged previous attacks on them and their livestock. According to Mr. Yakubu, 4 local government areas were attacked, resulting in the death of 808 people, the destruction of 1422 homes, 16 churches, 19 shops and 1 primary school. The Miyetti Allah Cattle Breeders Association claims that up to 6,000 cattle have died as a result of the clashes in southern Kaduna (Uroko, 2018). According to forecasts by the National Emergency Management Agency, the 2017 clashes in southern Kaduna resulted in the death of 204 people. Months of conflict have raged between Fulani herders and indigenous farmers in southern Kaduna. Until recently, 92 Nigerians were reported to have been killed by Fulani herdsmen in Benue and other Nigerian States. Violence by nomadic Fulani herders has already been documented in the Southern States of the country, including Enugu, Ekiti and Ondo.

On March 25, 2014, the herders killed around 60 people in the local governments of Gwer and Agatu in the State of Benue. A few days later, a violent clash broke out between young Tiv and alleged Fulani herders in the local government area of Guma, in the state, killing about 55 people. According to reports, intense firefights in the locked-up city lasted for many hours, forcing women and children to seek refuge in neighboring villages and Makurdi (Ojawale, 2014). However, in early 2016, specifically in February, two people died and 19 were reported missing in Abbi, Uzo-Uwani local government area, Enugu State. Many homes and motorcycles were also damaged. In addition, on 25 April 2016, 46 people died and another 14 were seriously injured in Nimbo, in the Uzo-Uwani municipal administration area, in the State of Enugu. These patients were treated at Bishop Shanahan Hospital and Royal Cross Hospital in Nsukka. A Roman Catholic church called Christ Holy Catholic Church and 11 houses were burned by mercenaries. Farmers in the States of Nasarawa, Adamawa, Ogun, Delta and Cross River have often been involved in feuds with Fulani herders that have often resulted in significant losses on both sides (Sun Newspaper, 2015). However, the most disturbing feature of the current scenario is the looting, rape, murder and kidnapping perpetrated by the so-called Fulani herders. Daily Newspaper articles describe how these shepherds deliberately attack several towns and homes with high-tech assault rifles such as AK-47.

With such ruthless dedication, one wonders where these guns come from if not wealthy herders with influential connections in the country. Another possibility is that the Fulani wanted to forcibly convert all of Nigeria to Islam, as the radical Fulani Islamists in Northern Nigeria did in 1804 under the command structure of Shehu Uthman Dan Fodio. Answers to the issues of rape, robbery and kidnapping for ransom of women are urgently needed. The situation around Chief Olu Falae's farm has come to a head in recent years with the kidnapping of Chief Olu Falae, the former Federation Government Secretary, by suspected herdsmen. The herders, who had previously written to the Anglican Bishop of Jos, ridiculing his ability and courage to run a ranch despite not being of Fulani descent, looted him and prevented him from tending of

his herd of cattle on his access farm. During an interview with a private television channel, Chief Falae lamented the seriousness of Nigeria's drift towards ethno-religious extremism and even went so far as to ask permission to open a beef farm. He was interested to know if this was the only Fulani wildlife sanctuary and national park where cattle were herded and penned (Ezeonwuka and Igwe, 2016). All these elements endanger the stability of Nigeria.

Influence of Herders-Farmers' Clashes on Students' Enrolment in Schools

The number of pupils / students who are enrolled in a school in a given period is called school enrolment. Obi further stated that enrolment determines the sustainability of a school; where membership increases, there is hope for stability; where admission decreases, the school may close over time. In Nigeria, primary and secondary school enrolments are split into male and female students. In a purely male school only boys are enrolled, in a purely female school only pupils are enrolled. According to Oguche (2011), school enrolments can be positive or negative. It is positive when membership increases and negative when membership decreases. Positive school enrolment is desired by all participants in the education sector as it promises stability and leads to the achievement of specific educational goals.

For more than three years, the researcher has observed a sustained decline in school enrolment in the State of Benue, Nigeria, which appears to be the result of clashes between the herders and farmers in some of the region's main settlements and marketable cities the affected local government areas were threatened and people fled for their lives. This tragedy has effected school enrolment, the quality of education and the development of education during this period. The federal government of Nigeria, as well as the governments of the States of Benue, Nasarawa, Plateau, Kaduna and Taraba, have attempted to ensure that peace returns to the areas and that displaced people return from the camps to their homes, but this seems not to have achieved the desired results.

There is public outcry and fear in Nigeria as school admissions continue to deteriorate. This drop in enrolment is influencing the growth of educational importance in Nigeria. School enrollment has been a topic of discussion that researchers may have overlooked, but it has now become a factor to consider in terms of educational growth. For more than two decades, most of the country's rural areas have seen a steady decline in the number of school-age children (Obi, 2001). According to the Benue State Emergency Management Agency (SEMA), approximately 80,450 children are currently being housed in eight camps for internally displaced persons (IDPs) set up by the Benue State Government to house survivors of Fulani cattle invasions in the state. The LGEA Primary School, Daudu Camp, hosts 10,871 children, while the LGEA Primary School, Ugba Camp, hosts 7,569 children. The occupation of school buildings by displaced people has complicated teaching and learning in the affected areas.

Methodology

Research Design

This research design adopted for the study was the mixed-methods approach. The term "mixed method design" refers to a research that employs both qualitative and quantitative approaches or methodologies to gather and analyze data, incorporate the results, and draw conclusion. **Population**

The study population comprised all the herdsmen, farmers, 5,110 teachers in 297 government approved secondary schools in Benue State and 6,156 teachers in the 245 government approved secondary schools in Nasarawa State.

Sample and Sampling Technique

Three hundred (300) respondents (teachers and principals) were chosen using a random selection procedure. Twenty-five (25) responders from each sampled school using balloting without replacement. In each State, five (5) oral interviews with teachers, community leaders, herders, and farmers were also used. The study used a multi-stage sampling technique. In the initial phase, four local governments from the states of Benue and Nasarawa (Logo, Guma, Keana, and Obi) were chosen for the study using the purposive sampling technique. Six (6) secondary schools were chosen at random from each state in the second stage, resulting in a total of 12 secondary schools.

Research Instruments

Data were collected using a structured questionnaire titled "Herdsmen/Farmers Clashes and Educational Development Questionnaire (HFCEDQ)" and Herdsmen/Farmers Clashes and Educational Development Interview Guide.

Data Analysis

The data were analyzed using descriptive statistical analysis of frequency counts, percentages and graphs. Content analysis was used for the qualitative data.

Findings and Discussion

Research question one which investigated the remote causes of herders and farmers' clashes in Benue and Nasarawa states was analyzed with content analysis of the key informant interviews conducted on selected stakeholders such as herders, farmers, principals and community leaders as presented below;

"Historically, the clashes you are seeing here is a Jihad between Christians and Muslims. Politically inclusive, the Muslims are intending by all means to rule over the affairs of this country in all ramifications. They propose to appoint all leaders starting from the President at the Federal level down to the State Governors in all the states of the federation. This also includes the appointment of traditional rulers/ households. Their sole aim is to conquer and dominate and take over the whole country. They want to convert the country into an Islamic state. These clashes is not only affecting Benue and Nasarawa States alone. The clashes, if not well handled will engulf the whole country in no distant time, due to the arrangement. No one is safe anywhere in Nigeria. That is just the truth. Let us stop pretending." ***1st Principal, Benue State.***

"The remote causes of herders-farmers' clashes in Benue and Nasarawa States started after the clashes between the Eggon and other tribes in Nasarawa state. In Benue state, the main cause of the clashes that worsened the situation was when the Benue State House of Assembly legislated a law on anti-open grazing. The Fulanis felt that the government was driving them away from the State. The law escalated their anger, resulting to massive killing and destruction of lives and property, including school.". ***1st Principal, Nasarawa State.***

"

"The remote causes of the herders-farmers' clashes in my understanding is lack of control of the animals by the herders. Sometimes, they get overwhelmed. There are situations where they leave a very large number of cows with the small children. These children lack the capacity and strength to control the cows. This resulted to them entering into farmlands and destroying them. As you know, no farmer will stay and watch animals to destroy their crops. The herdsmen also don't obey law and order. These are the causes of the clashes." ***Community Leader, Nasarawa State.***

"The remote causes of clashes between herders and farmers in Benue and Nasarawa States in my opinion are lack of mutual understanding between the herders and

farmers in Benue and Nasarawa States. It is surprising that the herders and farmers over the years were living very cordially. There is however the lack of understanding between them in the last few years causing violent clashes here and there. There is also the problem of over-population and climatic issues. Lack of control over the large number of herds to be grazed is another cause of the clashes. Transfer of aggression between the parties is another remote cause of the clashes." ***Community Leader, Benue State.***

"In my understanding of the clashes between herders and farmers in Benue and Nasarawa states, the remote causes of the clashes have some historical, political and economic factors. However, I would cut the long story short to state that the factors responsible for the clashes include; climate change, which is pushing the herders and reducing pasture in the far northern states which has brought their high concentration in the middle belt and southern Nigeria. There is also the factor of institutional failure on the part of the federal government. Cultural differences and population explosion have also contributed to the clashes. The herdsmen also complain of livestock theft which can also not be overlooked. The destruction of farms by herders is however the remote cause of the clashes as far as I know." ***Farmer, Nasarawa State.***

"The remote causes of the clashes between we the farmers are herders here in Benue and Nasarawa States is that the Fulani herdsmen wants to forcefully take over our farm lands. The government at the federal level is backing them so they feel they can do whatever they want with impunity. Their forceful encroachment and destruction of our farm lands and crops is the major cause of the clashes. The issue of over population, climate change and lack of control by under aged herders is another issue. There is competition over natural resources between herders and farmers. This total disrespect for the anti-open grazing law also worsened the situation." ***Farmer, Benue State.***

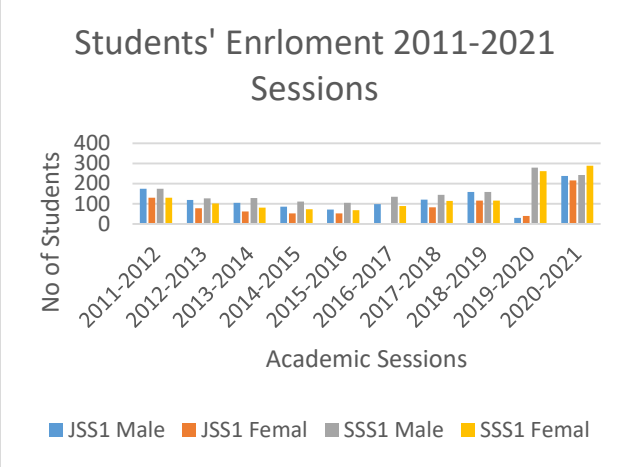
"The remote causes of our clashes with farmers in Benue and Nasarawa States is that the farmers consider us as strangers. They don't have regard for us and our animals. They cultivate crops everywhere without consideration to reserve some spaces for us to feed the animals. The animals need water and grasses but unfortunately, the farmers have no regard for us and our means of livelihood. There is also lack of mutual respect and understanding between the herdsmen and farmers in Benue and Nasarawa States. The anti-open grazing law in Benue State is also another factor because the law is aimed at sending us away from Benue State. The Benue State government passed the law without providing the ranches for us to graze our animals. How then do they expect us to graze our animals in that kind of situation? Also, the issue of stealing our animals is another factor. The Fulani man has so much value for his animals. Therefore, if you take or steal the animal from us, there will be reaction." ***1st Herdsman.***

"The remote causes of the clashes between herders and farmers in Benue and Nasarawa states is basically centered on selfishness on the part of the farmers. They cultivate crops everywhere leaving no single breathing space for our animals. If there is a little mistake and the animals encroach into their farmlands, they take laws into their hands instead of reporting us to the 'Ardo.' There are no ranches and grazing reserves for us to graze and it means that we have to move our animals to where they would graze and also drink water. Increase in the number of cows is another cause of the clashes. Other causes are environmental conditions, desertification in the far north and soil deterioration" ***2nd Herdsman.***

The content analysis from the key informants' interviews with principals, community leaders, farmers and herders in Benue and Nasarawa States indicated the remote causes of the clashes between herders and farmers as shown above.

Research question two which examined the influence of the herders and farmers' clashes on enrolment between 2011-2021 in secondary schools in Benue and Nasarawa states was analyzed with Secondary data collected from Nasarawa State Ministry of Education as presented in Figure 1.

Figure 1: Summary of Secondary School Enrolment from 2011 to 2021



***Source**: Nasarawa State Ministry of Education, Nigeria*

Data collected from Nasarawa State Ministry of Education as presented in Figure 1 revealed that there was a reduction in enrolment of both junior and senior secondary students from 303 in the 2011/2012 session, to 196 for junior secondary students and 228 for senior secondary students in 2012/2013 session and it further reduced to 166 for junior secondary students and 208 for senior secondary students in 2013/2014 session. Also, it was 137 for junior secondary students and 194 for senior secondary students in the 2014/2015 session and 123 for junior secondary students, and 171 for senior secondary students in 2015/2016. However, there was a slight increase in 2016/2017, to 173 junior secondary students and 223 for senior secondary students, the increase in enrolment continued in 2017/2018, to 202 for junior secondary students and 257 for senior secondary students, and also in 2018/2019, it increased to 274 for junior secondary students and 274 for senior secondary students. There was an all-time reduction in enrolment of junior secondary students to 70, on the contrary, senior secondary students increased to 541 students in 2019/2020. However, there was an all-time leap in enrolment in 2020/2021 both for junior secondary school with 453 students and senior secondary school with 531 students. The reduction in enrolment was largely due to herders-farmers' clashes and specifically COVID-19 pandemic restrictions for 2019/2020 session. The general implication of this data is that the herders-farmers' clashes negatively influenced students' enrolment in Benue and Nasarawa States.

Research question three which ascertain the possible ways to prevent herders and farmers' clashes in Benue and Nasarawa states was analyzed with content analysis of the key informant interviews conducted with selected stakeholders such as herders, farmers, principals, and community leaders and presented below.

"To me, this issue of the clashes cannot be prevented at the local and state level. I believe it is the international community that will intervene in the clashes to put a stop to it." ***1st Principal, Benue State.***

"The possible way to prevent the herders-farmers' clashes in Benue and Nasarawa States is to provide the herdsmen with adequate environment where they can get enough grasses to feed their animals. In addition, they should be allowed to graze their animals freely in Benue State. In essence, the House of Assembly should have a second look

at the anti-open grazing law. The killings are too much." ***Ist Principal, Nasarawa State.***

"The possible solutions to the clashes, to me is for the herders and farmers to understand themselves and live harmoniously as brothers and sisters. Secondly, the government should check the influx of foreigners at the northern borders. Most of them come into the country with sinister motives. The government should also organize sensitization and enlightenment campaigns on peaceful living for farmers and herders" ***2nd Principal, Nasarawa State.***

"The anti-open grazing law should be adopted in all the states of the federation. Offenders or violators of the law should be made to face severe consequences. In addition, ranches should be established in all the states of the federation." ***2nd Principal, Benue State.***

"The federal government should create ranches in all the states in Nigeria. They can do that and ask the herders to pay certain amount of money to stay and graze their animals. There should be a peace committee to interface with the farmers and herders in order to bring a lasting peace between them." ***Community Leader, Nasarawa State.***

"The possible ways to prevent herders and farmers' clashes in Benue and Nasarawa States included: sensitization/ awareness on the importance of peaceful coexistence between herders and farmers. There should be laws enacted by the legislative bodies on the offenders (both herders and farmers). Ranches should also be established in order to minimize animals' encroachment on peoples' farmlands. Also, underaged herders should be prohibited from grazing animals." ***Community Leader, Benue State.***

"There should be laws in the country guiding the operations of the herders. The law should also specify in very clear terms the punishment for those who violate it. There should be ranches in all the states to enable the herders ranch their animals. Also, there is need for the government to organize sensitization campaigns on peaceful co-existence between the herders and farmers. Arrest and prosecution of armed herders. In addition, all the states in Nigeria should make laws prohibiting open grazing." ***Farmer, Nasarawa State.***

"The possible ways to prevent herders-farmers' clashes in Benue and Nasarawa States included respect for the anti-open grazing law of the Benue State government. Two, the herders should control their animals to avoid encroaching and destroying our farm lands. Three, the federal government should immediately establish ranches in all the States of the Federation. In addition, the government should fast-track the rebuilding of schools, hospitals, Police stations, personal houses and resettlement of internally displaced persons. Under-aged children should be stopped from carrying the animals around. Farmers should also learn to live peacefully with the herdsmen. The herdsmen with sophisticated arms should immediately be arrested and prosecuted by the government." ***Farmer, Benue State.***

"To me, I think the possible ways of preventing the clashes between herders and farmers included: through dialogue and negotiation between the herders and farmers. The government should create ranches for herdsmen or open up the grazing routes. Abolition of the anti-open grazing laws currently operating in some States in Nigeria. There should also be compensation to both the herders and farmers for the losses we have suffered. Arrest and prosecution of armed herders and farmers. They should established in each state in Nigeria a permanent forum for herders and farmers to interact and discuss mutually as brothers and sisters." ***1st***

Herdsman.

"There should be awareness for mutual living between the farmers and herders. Government should establish ranches for the herders to stop them from moving from one place to another. The government should also do everything possible to stop illegal possession of arms and ammunitions. Cattle rustlers should be arrested and prosecuted." ***2nd Herdsman.***

The content analysis from the key informants' interviews as shown above with principals, community leaders, farmers and herders in Benue and Nasarawa States showed that the possible solutions to the clashes between herders and farmers in the two states.

Summary

This study investigated how the herdsmen-farmers' clashes influenced secondary education in the Nigerian states of Nasarawa and Benue. The study found that there was negative influence of herdsmen-farmers' clashes on students' enrolment. The study also identified the remote causes and preventive measures to the clashes in the two States in order to ensure children's access to education in Benue and Nasarawa States. This will among others, guarantee and strengthen the right to education in the context of achieving the United Nations Sustainable Development Goals-4 (SDGs-4).

Conclusion

Based on the findings of the study, it could be concluded that the clashes between herders and farmers have negative influence on secondary education in Benue and Nasarawa States, specifically, in the area of students' enrolment in secondary schools.

Recommendations

The following recommendations were made:

1) Reconstruction, resettlement and compensation of displaced farmers and herders: The Federal and State governments should urgently reconstruct public buildings destroyed by the herders-farmers' clashes, including public secondary schools, hospital, homes and other infrastructures damaged in the study areas.
2) Setting up peace, enlightenment and reconciliation committees: The Federal government should immediately set up this committee comprising of both herders and farmers to enlighten both parties on the need for mutual understanding and communal living.
3) Establishment of ranches: The Federal government should as a matter of urgency establish cattle ranches in the States that embrace the ranching system in order to stop the transhumance of livestock by herders.
4) Urgent domestication of the African Great Green Wall Initiative: The Federal government should urgently fast track the process of growing trees in order to push back the Sahara and create fertile land in the far Northern region. This will help to address climate change-induced scarcity of natural resources and create a revitalized ecosystem that would serve as haven for herders and farmers alike in Nigeria.
5) Nationwide adoption and implementation of anti-open grazing law: The governments of Benue and Taraba states have already given a workable template as solution to farmers-herders clashes through the enactment of anti-open grazing, prohibition and ranches establishment law. The Federal government of Nigeria should as a matter of urgency ensure a nationwide adoption and implementation of the law.
6) The Federal government of Nigeria should fast track an institutional framework aimed at remodeling global

best practices of herders-farmers' relations as obtainable in other countries like Ethiopia, Niger, China, Brazil, Chad, where there are institutionalized and functional mechanisms for pre-empting and resolving conflicts between herders and farmers to enable them to live in peace.

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Assessment of Principals' Administrative Effectiveness in Public Secondary Schools in Ilorin West Local Government Area, Kwara State, Nigeria

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Abstract

The study assessed principals' administrative effectiveness in public secondary schools in Ilorin West Local Government Area, Kwara State, Nigeria. It adopted the descriptive research design of correlation type. Two thousand one hundred and sixty-five teachers in all the 44 schools in the area formed the study population. Twenty-two schools were randomly selected while 20 teachers were also randomly selected from each of the sampled schools, to make a sample of 240. The measures of principals' administrative effectiveness are discipline, supervision of instruction and school plant maintenance. The "Principals' Administrative Effectiveness Questionnaire" was used to gather information from the respondents. The instrument was validated by experts and with the use of Cronbach's Alpha, it found reliability coefficient of 0.79. Mean and Standard Deviation were used to answer the research questions. The findings of the study revealed among other things, that the level of principals' administrative effectiveness was average. The study concluded that public secondary school principals should intensify efforts in carrying out supervision of instruction, ensuring school discipline and maintaining school plant in order to boost their administrative effectiveness.

Keywords: Principals, Administrative Effectiveness, Supervision, School Plant, Discipline

Introduction

The position of a principal is an integral part of the secondary school system. The principal is saddled with the duty of planning, organising, directing, controlling, and coordinating activities of the school, in order to achieve effectiveness. The manner in which a principal discharges all these responsibilities, determines how effective his or her administration would be in the aspects of discipline, supervision of instruction and school plant maintenance. Principals' administrative effectiveness is a concept which houses some variables. It involves how a principal is able to achieve the desired results on school discipline, supervision, teacher motivation, teachers' job performance, school plant maintenance, school-community relations, among others. According to Manafa (2020), administrative effectiveness refers to the output of what a school manager achieves. This depicts the ability of a school principal to maximally utilize both human and material resources available to the organization in order to actualize the stated goals. Olaifa, et al. (2020) stated that the success of a secondary school, to a large extent, is predicated upon the administrative effectiveness of her principal. Some schools fail to achieve their stated goals, as a result of the ineffectiveness of the principals' administration. Principals' effectiveness is a great pillar necessary for aiding student learning and teacher development, bringing about teachers' creativity and curiosity, and assisting them to imagine new possibilities for teaching and learning. The findings of the study conducted by Ekundayo and Kolawole (2013) showed that the administrative effectiveness of principals of secondary schools include staff motivation, effective conduct of student assessment, supervision of teaching-learning process, conflict management; keeping up-to-date record for students and recreational facilities provision for both staff and students, holding of staff meetings and showing for the concern welfare of teachers. Akinfolarin (2017) maintaines that administrative effectiveness can be determined via the principals' extent of accountability, improvement of curriculum, monitoring, effective resources management, timely discharge of duties, improvement of school performance, appropriate delegation of tasks and constant meeting of targets. Olaifa, et al. (2020) opined that administrative effectiveness of a principal is reflected in his or her ability to support learning, foster creativity and curiosity in teachers, help them to imagine new possibilities for teaching and learning, improve capacity of teachers and support innovation. Supervision of instruction is a crucial aspect of every principal's tasks in a school. As the head, a school principal is expected to carry out effective supervision of instruction, in order to determine the areas of strengths and weaknesses of teachers, with the aim of enhancing effectiveness in the discharge of their official duties. Supervision of instruction is viewed as the process by which a principal oversees the discharge of teachers' official duties in classroom, for the purpose of facilitating improvement in teaching and learning process. Usman (2015) believed that supervision gives teachers the opportunities to be groomed through critical study of instructional process and classroom interactions with experienced teachers, in order to perform their official duties in line with the teaching professional codes of conduct. Nwagwu (2014) posited that supervision of instruction is needed in school system to help improve teachers' skills, create a good atmosphere for dynamism and interactions between the supervisor and the supervisee, thereby facilitating effective teaching and learning process. Oke (2016) explained that supervision of instruction is an avenue for boosting teachers' professional growth, to facilitate their better understanding and effective performance of all professional

tasks. Fisher (2018) stated that supervision of instruction helps in stimulating teachers towards exploring new instructional strategies for the enhancement of improvement in teaching and learning. Zepeda (2017) maintained that supervision of instruction means the process of assisting teachers to improve their instructional abilities, in order to facilitate effective teaching and learning. Ekundayo, et al. (2013) emphasised that supervision of instruction is specifically designed to directly influence teachers' behaviour in such a way that would boost student learning and realization of the school goals. Through effective supervision, principals would be able to reinforce and instill in teachers, teaching practices that would aid effective student learning. Usman (2015) stated that through supervision of instruction, teachers' professional growth is expected to be enhanced, there could be improvement in their techniques of teaching in the classroom and improvement in democratic interactions between the principal and them could be actualized.

School discipline is another way through which administrative effectiveness of principals could be determined. Discipline has to do with the compliance of both teachers and students to the established rules and regulations guiding the school. Manza and BulamaKobbe (2013) saw discipline as the ability of staff and students to have self-control, maintain orderliness, obey and respect laid down rules and regulations in a school. Inability of teachers and students to abide by the school rules and regulations is regarded as indiscipline, which is the direct opposite of discipline. Therefore, an undisciplined teacher or student is likely to cause same damage by infringing upon the school rules and regulations at will. Odebode (2020) maintained that disciplined students are the ones who conform to the school rules and regulations by wearing acceptable uniform and who totally shun stealing, smoking, truancy, verbal and physical aggression, lateness, disrespect for school authorities, truancy, smoking, and drinking of alcoholic substances. Ayeerun (2021) viewed discipline as the practice of training people to comply with rules and orders; and giving them punishment if they do not. It is very imperative for schools to ensure that students are disciplined so as to give them proper training during the transactional period from child-hood to adult-hood. By the time they gain full maturity, they are fully prepared for life socially, sexually, emotionally, intellectually, morally and economically. According to Kwamta, et al. (2021), indiscipline of students and teachers could cause a lot of harm in schools. Undisciplined teachers or students are likely to misbehave and hinder their peers from doing what is expected of them at the right time. A study conducted by Gutuza and Mapolisa (2015) found indiscipline acts among students in secondary schools include late coming as well as love affairs, abuse of drugs, bunking lessons, peer pressure, bullying and fighting. Odebode (2019) submitted that factors constituting the challenges to school discipline, among others, have been centred on the idea of democracy with strong emphasis on the right of individuals, media influence and the increase in technological development. Not only that, the factors which are challenging the secondary school discipline in Nigeria also include peer influence, poor leadership, family background of teachers and students, community influence, poor government attention to education, employment of wrong people into the teaching profession, technological and media influence. The findings of Christine and Daniel (2016) revealed that in order to improve discipline among students, there is need for school principals to periodically educate them on the causes and aftermath of indiscipline, organise guidance programmes for students, give reward for discipline as well as punishment for

indiscipline, provide mentoring and life skills for students and integrate them into the school recreational programmes.

Gitome, Katola and Nyabwari (2013) believed that discipline connotes more than adhering to rules and regulations; it encompasses the teachers and learners' ability to fathom what is good or bad. Eshetu (2014) asserted that discipline is very fundamental to successful teaching and learning in schools and has to be subject of concern for the principals, teachers and students. Njoroge and Nyabuto (2014) asserted that school discipline is important to the improvement of students' academic performance. Daramola (2016) emphasised that discipline among teachers in public secondary schools in Nigeria has been facing some problems. This is evident in the fact that some teachers abscond from schools, go to school late, bully students, engage in immoral acts with students and steal school properties. According to Ali, et al. (2014), disobedience, lateness, truancy, dirtiness, being quarrelsome, use of abusive or foul languages, rudeness, gangstarism or cultism), destruction of school property, poor attitude to learning, immoral behaviour, drug abuse, stealing, lateness, truancy, dirtiness, gangstarism, being quarrelsome, use of abusive or foul languages, rudeness and cultism are forms of the indiscipline acts among students in schools. All these need to be adequately checked, to boost the school discipline.

School plant refers to the non-human resources needed in educational institutions, in addition to human resource, for the realisation of the stated goals. The plant encompasses structures such as laboratories, libraries, workshops, space, classrooms, offices, toilets and instructional materials. In an educational institution, it is one thing to have school plant available, but it is another thing entirely to ensure the plant are well maintained. School plant maintenance means the process of ensuring that school plant are kept in their original state or close to it, through adequate care which would make them to be always fit for use and enhance effective teaching and learning. Eboatu and Agogbua (2018) defined school plant as all the educational facilities provided in educational institutions to enhance successful implementation of educational programmes. These comprise physical and material resources such as, school buildings, machines, school sites, laboratories, white boards and equipment. Obasi and Asodike (2014) elucidated school plant as all those factors which cover the school structures, materials resources, as well as the overall school locations, in addition to other fixtures both movable and non-movable ones which are needed for effective teaching and learning. According to the Federal Republic of Nigeria (2013), the goals of Nigerian educational system are to make Nigeria a free and democratic society; a great and dynamic economy; a just and egalitarian society; a land full of bright opportunities for all citizens; and a united, strong and self-reliant nation. However, for these goals to be accomplished, effective management of school plant has to be given thorough priority. Weli and Chiokwa (2021) posited that plant maintenance connotes the care provided for the school plant to allow them adequately support the schools' success. The way the school plant is maintained determines the life span. Amanchukwu and Olube (2015) maintained that for the school goals to be achieved, effective maintenance of school plant has to be done by the school principals through the utilization of professional knowledge, expertise and skill at the right time. Unfortunately, poor maintenance culture in the use of the school plant constitutes a serious problem facing Nigerian educational system. Oleforo and Maxwell (2015) posited that since teachers and students' conduct are seen as an extended physical environment that surrounds them in schools, the plant needs to be properly

maintained to provide a stabilizing force for teachers and students emotionally and academically. Amanchukwu and Ololube (2015) stressed that in Nigerian public secondary schools, there is need for effective maintenance of available plant to continually render the services for which they are provided. Usen (2016) asserted that it is the responsibility of the managers to ensure maximum maintenance of space and facilities in schools in such a way that the established goals are achieved to the fullest height. Provision of school facilities alone does not ensure quality education; rather, proper maintenance procedure has to be put in place.

Based on the information gathered by the researchers in some public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria, principals' administrative effectiveness seems not encouraging enough to facilitate effective realisation of the school goals. In some of these schools, indiscipline acts have been alarming, as some teachers have little or no respect for the teaching profession as well as for school rules and regulations. The dresses of some teachers do not portray that of people who should be regarded as teachers. Absconding, lateness, student bullying and lateness are habitual acts of some teachers; as lateness, truancy, gambling, drug abuse, fighting and use of foul languages are also common among students. Not only that, the school plant are not well-maintained as some school walls are defaced, computers are moribund, chairs and tables are faulty, school buildings are dilapidated and the environment is bushy. In addition to this, some teachers haphazardly impart knowledge to students. There is totally abandon or partially use of instructional materials to support their teaching, pay poor attention to classroom management and same of them do not prepare lesson plan for lessons, due to ineffective supervision of instruction by the principals. Many researchers have carried out studies related to this present study. For instance, Usman (2015) investigated the impact of instructional supervision on academic performance of secondary school students in Nasarawa State. Akinfolarin (2017) examined time management strategies as a panacea for principals' administrative effectiveness in secondary schools in Enugu state, Nigeria. Akinyemi and Ajayi (2020) conducted a study on time management and administrative effectiveness among secondary school principals in Ekiti State. Garba (2020) examined assessment of school facilities maintenance in Nigeria for the effectiveness of teaching process (A case study of North-eastern public secondary schools). However, none of the above studies dwelt on the assessment of principals' administrative effectiveness in public secondary schools in Ilorin West Local Government, Kwara state, Nigeria; hence, this is the gap which this study filled. The objectives of the study were to assess the level the principals' administrative effectiveness in public secondary schools in Ilorin West Local Government, Kwara state, Nigeria; determine the level of principals' administrative effectiveness in supervision in public secondary schools in Ilorin West Local Government, Kwara state, Nigeria; investigate the level of principals' administrative effectiveness in school discipline in public secondary schools in Ilorin West Local Government, Kwara state, Nigeria; and assess the level of principals' administrative effectiveness in school plant maintenance in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria. From the objectives, the following research questions were raised:

i. What is the level the principals' administrative effectiveness in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria?

ii. What is the level of principals' administrative effectiveness in supervision in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria?
iii. What is the level of principals' administrative effectiveness in school discipline in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria?
iv. What is the level of principals' administrative effectiveness in school plant maintenance in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria?

Methodology

The study examined principals' administrative effectiveness in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria. It adopted the descriptive research design of survey type. Two thousand one hundred and sixty-five teachers in the 44 public secondary schools in the area constituted the population for the study. Random sampling technique was used to select 22 schools which represented 50%, out of the 44 in the area. This number was chosen because the researcher intended to use half of the school population for the study. Twenty teachers were randomly selected from each of the sampled schools, to make a sample of 240. The instrument captioned "Principals' Administrative Effectiveness Questionnaire" was used to gather information from the respondents. The instrument was based on three sub-variables (supervision, discipline & school plant maintenance) and each had eight items. Likert rating scale of Strongly Agree (SA) rated 4 points; Agree (A) scored points 3; Disagree (D) allotted 2 points; and Strongly Agree (SA) rated 1 point was used for the instrument. The instrument was validated by four experts in the Faculty of Education, University of Ilorin, Ilorin, Nigeria. Reliability was ascertained with the use of Cronbach's Alpha and a coefficient of 0.79. was found. Mean and Standard Deviation were used to answer the raised research questions and the mean scores from 0.00-1.33 was considered low, 1.34- 2.66 was regarded as average, while 2.67-400 was rated high. All the 240 copies of questionnaire distributed were retrieved and used for analysis.

Results and Discussion

Mean and Standard Deviation were used to answer all the research questions.

Research Question One: *What is level the principals' administrative effectiveness in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria?*

Table 1

Level of Principals' Administrative Effectiveness

S/N	Items **In my school, the principal:**	N	Mean	SD	Decision
1.	Supervision of instruction	240	1.61	.63	Low
2.	School discipline	240	2.29	.81	Average
3.	School plant maintenance	240	2.15	.85	Average
	Grand mean		**2.02**		**Average**

From Table 1, the supervision of instruction had a mean score of 1.61 and as such is regarded as low; while items 2 and 3 had mean scores of 2.29 and 1.15 and as such are considered average. Therefore, with the grand mean score of 2.02, the level of principals' administrative effectiveness is declared average. This implies that the level of administrative effectiveness is neither now low high, but needed improvement to make it to be high and so as to enhance actualisation of the school goals. This finding agrees with the finding of Paul (2018) that administrative effectiveness of principals in public secondary schools in Lokoja Local Government, Kogi State, Nigeria was moderate. The finding agrees with the finding of Ololade (2020) which showed that the level of principals' administrative effectiveness was average in public secondary schools in Kebbi State, Nigeria.

Research Question Two: *What is the level of principals' administrative effectiveness in supervision of instruction in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria?*

Table 2

Level of Principals' Administrative Effectiveness in Supervision of Instruction

S/N	Items	N	Mean	SD	Decision
	In my school, the principal:				
1.	carries out supervision of instruction	240	1.39	.62	Average
2.	gives teachers feedback on what he has observed during classroom visitation	240	1.18	.32	Low
3.	checks how teachers utilise instructional materials	240	1.24	.51	Low
4.	checks teachers' lesson plans and make the corrections where necessary	240	1.28	.44	Low
5.	goes round the classrooms, to understand punctuality of teachers for the lessons	240	1.51	.95	Low
6.	observes the manner in which teachers manage classrooms to achieve adequate classroom control	240	2.21	.74	Average
7.	monitor how teachers evaluate students	240	2.19	.82	Average
8.	compares teachers' lesson plans with the scheme of work	240	1.88	.67	Average
	Grand Mean	**1.61**			**Low**

From Table 2, items 1, 6, 7 and 8 had mean scores of 1.39, 2.21, 2.19 and 1.88 respectively and as such declared average; while items 2, 3, 4 and 5 had mean scores of 1.18, 1.24, 1.28 and 1,51 respectively and as such adjudged low. Hence, with the grand mean score of 1.61, the level of principals' administrative effectiveness in supervision of instruction in public secondary schools was considered low. This means that the level at which the principals supervise instruction was far from an appreciable level. This situation could give teachers the opportunity to haphazardly perform their official duties in classroom; hence, ineffective realisation of the school goals. This finding disagrees with the finding of Ololade (2020) which revealed that the level of principals' administrative effectiveness was moderate in public secondary schools in Kebbi State, Nigeria. This finding supports the submission of Arnold (2020) that supervision of instruction in public secondary schools in Nsukka education zone, Enugu state, Nigeria has been low and could be posing a serious challenge to instructional delivery and academic performance of students.

Research Question Three: *What is the level of principals' administrative effectiveness in school discipline in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria?*

Table 3

Level of Principals' Administrative Effectiveness in School Discipline

S/N	Items	N	Mean	SD	Decision
	In my school, the principal:				
1.	ensures that any student who involves in truancy is given punishment	240	1.02	.44	Low
2.	constitutes an effective disciplinary committee to see to any case of indiscipline in school	240	1.41	.68	Average
3.	reports any teacher who involves is any severe indiscipline act to the appropriate authority in Ministry of Education	240	2.51	.91	Average
4.	does not allow teachers to dress indecently	240	2.72	.85	High
5.	Punishes any student who comes to school late	240	2.91	.60	High
6.	effectively enforces the school rules and regulations on teachers and students	240	3.33	1.26	High
7.	regularly comes to school at the right time, to serve as a good example for other school members	240	3.18	1.15	High
8.	properly partners with members of host community to help curb case of absconding among teachers	240	1.25	.73	Low
	Grand Mean	**2.29**			**Average**

As revealed from Table 3, items 1 and 8 had mean scores of 1.02 and 1.25 respectively and as such regarded as low; items 2, 3and 8 had mean scores of 1.41 and 2.51 respectively and as such rated average; while items 4, 5, 6 and 7 had mean scores of 2.72, 2.91, 3.33 and 3.18 and as such adjudged high. Hence, with grand mean score of 2.29, the level of principals' administrative effectiveness was considered average. This means that discipline in schools has not been on the expected level (high) and this might be affecting actualisation of the purpose for which the schools are established. This finding confirms the submission of Kwamta, et al. (2021) that the menace of indiscipline has been at alarming rate in public secondary schools in Maiduguri Metropolitan Council of Borno State. This finding is not in tandem with the position of Odebode (2020) which emphasised that indiscipline has been high in public secondary schools. This confirms administrative effectiveness of principals in school discipline has not been high.

Research Question Four: *What is the level of principals' administrative effectiveness in school plant maintenance in public secondary schools in Ilorin West Local Government Area, Kwara state, Nigeria?*

Table 4

Level of Principals' Administrative Effectiveness in School Plant Maintenance

S/N	Items	N	Mean	SD	Decision
	In my school, the principal:				
1.	ensures that the school environment is always kept clean	240	2.59	.71	Average
2.	metes out punishment for a student who vandalises any of the school plant	240	3.61	1.18	High
3.	ensures that classrooms are not defaced with different inscriptions by students	240	1.34	.57	Low
4.	instantly repair any of the damaged school plant, which the school management has financial capability over	240	2.20	.94	Average
5.	periodically sensitises students on the need for proper use of school plant	240	1.15	.63	Low
6.	constitutes a committee on school plant maintenance	240	1.37	.82	Average
7.	sentises members of the host community on the maintenance school plant	240	1.92	.74	Average
8.	Communicates the Ministry of Education at the right time to pass information on school plant destruction	240	3.04	1.17	High
	Grand Mean		**2.15**		

As shown on Table 4, 1tems 1, 4, 6 and 7 had mean scores of 2.59, 2.20, 1.37 and 1.92 respectively and as such adjudged average; items 2 and 8 had mean scores of 3.61 and 3.04 respectively thereby considered high; while items 3 and 5 had mean sores of 1.34 and 1.15 respectively thereby regarded as low. Therefore, with the grand mean score of 2.15, level of administrative effectiveness in school plant maintenance was rated average. The findings of the study revealed that the level of principals' administrative effectiveness in school plant maintenance in public secondary schools in Ilorin West Local Government, Kwara State, Nigeria was average. This depicts that the level of principals' administrative effectiveness in school plant maintenance has not been outstanding. This finding supports the position of Garba (2020) that one of the problems facing public secondary schools in North-eastern Nigeria is the improper maintenance of the school plant. This finding is also in tandem with the finding of Abas (2020) that the level school plant maintenance in public secondary schools in Akinyele Local Government, Oyo State, Nigeria was moderate.

Conclusion

The study concluded that the level of principals' administrative effectiveness in public secondary schools in Ilorin West Local Government, Kwara State was average. Specifically, the level of administrative effectiveness in supervision of instruction and plant maintenance was average while that of school discipline was low.

Recommendations

The study recommended that:

i. Public secondary school principals should intensify efforts in carrying out supervision of instruction, ensuring school discipline and maintaining school plant in order to enhance their administrative effectiveness.

ii. Principals should be more committed to supervision of instruction by periodically visiting teachers in classrooms, observe the necessary aspects of their job performance and give them feedback on their areas of strengths and weaknesses, in order to improve the level of their administrative effectiveness.

iii. Principals should scale up the level at which they maintain school discipline by making sure that the school rules and regulations are well implemented, breakers of school rules and regulations either teachers or students are given the deserved punishment, so as to boost their administrative effectiveness.

iv. Principals should be more dedicated to the maintenance of school plant by timely repairing or renovating any damaged school plant whose financial capability can cater for and report the ones that are financially beyond them to the appropriate quarters, in order to improve their administrative effectiveness.

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An Assessment of Senior Secondary School In-Service Science Teachers' Views of the Nature of Science

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ABSTRACT

This study examined the views of nature of science (NOS) of secondary school in-service science teachers in Egor Local Government Area of Edo State, South-South, Nigeria, relative to experience and professional training. Three research questions and two hypotheses guided the study. The study adopted the descriptive survey design. The population for the study comprised 211 secondary school in-service science teachers in Egor Local Government Area of Edo State, South-South, Nigeria. A sample of 100 secondary school in-service science teachers was randomly selected from twenty-one public and private schools. Data were collected through the administration of validated questionnaire adapted from Palmquist and Finley (2007) views of nature of science. Findings from this study revealed that based on the scientific literacy approach of the five levels of Palmquist and Finley (2007) views of the nature of science, secondary school in-service science teachers have both traditional and contemporary views of the nature of science (NOS).Most teachers held traditional view, while a reasonable number have contemporary view. There was no significant difference in the views of nature of science between experienced and in experienced science teachers. There was no significant difference in the views of nature of science between professionally and non-professionally trained science teachers. It was concluded that the teaching of science is limited owing to inadequate science teachers' professional training in the nature of science and its application to science teaching. Based on the finding, it was recommended that the goals of science teaching are to be framed within the elaborate understanding of the nature of science so as to achieve the gains of science education.

Keywords: Nature of Science (NOS), Experienced Science Teacher, Professionally Trained Science Teacher.

Introduction:

Science has come to stay in school curricula in almost every country around the world. In Nigeria, science is a core subject at the basic levels of education. The development of science education in many countries is varied and diverse (Omoifo & Urevbu, 2005., Abimbola, 2015., Upahi, Ramnarain & Ishola, 2020). However, one common goal of science education in the different contexts is to achieve a scientific literate citizenry (McDonald & Abd-El-Khalick, 2017).

In Nigeria, one of the six Nigerian goals of science education is to produce scientists with knowledge and skills of the 21st century for national development (FME, 2018:15). Science education is also to provide a range of competences for sustainable economic self-reliance. Achieving these goals requires qualified and highly scientific literate teachers. McDonalds & Abd-El-Khalick (2017) conceive such teachers as those who understand, scientific facts, concepts, principles, theories and science process skills and are away of the complex relationship between science, technology and society. Such teachers actually must develop an understanding of the **Nature of Science** (NOS). Science therefore needs to recognize the nature of the scientific endeavor and how it relates to science teaching if they are to help their students completely understand the content and underlying philosophy of science (Omoifo & Urevbu, 2005). In view of this, the National Science Teachers Association (NSTA, 2010) proposed that all those who are involved in science teaching should have a common view of the nature of science. In Nigeria, this view is interpreted to have informed a stronger advocacy for teachers to develop an understanding of the scientific enterprise as articulated in the nation's policy document and revised science curriculum (Upahi & Ishola, 2020). Consequently, Jegede (1998) in Abimbola (2015) asserted that the importance of teacher knowledge base for effective science teaching and teacher preparation programmes that will produce sound and effective scientifically literate teachers in Africa in general and Nigeria particular have long been stressed.

There is a lack of consensus as regarding the definition of nature of science (Irzik & Nola, 2014; McDonald & Abd-El-Khalick, 2017). However, Lederman and Lederman (2014) defined it in terms of characteristics of scientific knowledge that derived from the manner in which the knowledge is developed. As a result, scientific knowledge is considered to be empirical, tentative and partially subjective as if depends on a particular scientist's background, aims and experiences. Nature of science represents the unique characteristics of science by describing and explaining what the science is, how it works and how it is different from other disciplines, what scientists have done throughout history, and how science and scientists interact with in the society. Therefore, nature of science typically refers to the epistemology of science, science as a way of knowing, or the values and beliefs inherent to the development of scientific knowledge (Lederman & Lederman, 2014). There are various views of the **nature of science**. One of such views is that proposed by Palmquist and Finley (2007): Traditional (or naïve) and 'contemporary' (or informed) views. A total of twenty three (23) of science realms have been investigated. However, each is known to fall into five (5) broad categories: scientific knowledge, scientific method, scientific theory, scientific law and the role of the scientist (Palmquist and Finley, 2007).

The traditional view of nature of science holds that science bases on truth to be told, tentativeness of scientific knowledge, empirical nature and reliance on prior knowledge. Contemporary view of nature of science has made it known that science is conducted in a social context, providing opportunities for personal bias and public adoption or rejection of

ideas. Thus, science is a human activity, has social machinery and operates as an institution. It then follows that to communicate and teach science as a human and social institution, teachers must have contemporary (or informed) view of nature of science (Sambo, Mahmud & Eggari, 2015).

Scientific knowledge is the value obtained by scientists from scientific investigation and is represented by facts, concepts, theories and laws which similarly represent the product of science (Naseer & Afzal, 2022). Scientific method is the process skills of inquiry that include observing, classifying, experimenting, measuring, inferring, communicating, questioning, hypothesizing, predicting, using numbers, making operational definitions and interpreting data. (Demirel & Cakiroglu, 2022). Scientific theory is a reliable, rigorous and comprehensive form of scientific knowledge which guide the enterprise of finding facts and is neutral concerning alternatives among values. McDonald and And-El-Khalick (2017) defined scientific theory as a complete and exhaustive account of reality. It explains unobservable phenomena. Scientific law is a descriptive generalization of how some aspects of the natural world behaves understated circumstances (Schofield & Takriti, 2023). Hence, scientific law can only describe observable phenomena, but cannot explain the mechanism by which the law comes to be, explanation is the domain of scientific theory. Scientific law describes things that occur in the natural world without any human intervention. Natural law is another name for scientific law. Scientists' role is the way science operates. It requires creativity, imagination, open-mindedness and objectivity (Upahi, Ramnarain & Ishola, 2020).

Current teaching and learning practices follow learner-centered approach that is underpinned by the constructivist's view (NERDC, 2009). This principle advocates the provision of opportunities for students to construct new understandings for themselves at both individuals and social levels (Oyinloye & Ige, 2018). However, the teacher has significant role to play in this endeavor (Ajaja, 2012). The role of the teacher is that of a facilitator (Abimbola, 2015). Therefore, science teachers must possess an adequate understanding of the nature of science to effectively contribute to the students' understanding of this concept (Lederman & Lederman, 2014).

With the use of different methods and instruments, the literature suggests that most science teachers possess an inadequate understanding of the NOS. Their conceptions of the NOS are mixed, unsolified and confused (Ajaja, 2012., Dorsah, 2020., Dorji & Jatsho, 2022). Also, there is no significant different between science teachers' professional training or teaching experience in school and their conceptions of the nature of science (Sambo, Mahmud & Eggari, 2015., Adedoyin & Bello, 2017, Adegboye, Bello & Abimbola, 2017, Dorji & Jatsho, 2022). The studies related to conceotions of the NOS held by science teachers can be categorized in five major groups: Scientific knowledge, scientific method, scientific theory, scientific law and role of scientists.

In various studies, majority of science teachers lack clear understanding of the NOS in terms of scientific knowledge, scientific method and scientists' work (Dorji & Jatsho, 2022, Schofield & Takriti, 2023). In terms of scientific knowledge, most teachers had simple conceptions regarding a hierarchical relationship between hypotheses, theories and laws (Dorji & Jatsho, 2022). The teachers believed that when a hypothesis is proven correct, it becomes a theory. After a theory has been proved true many times by enough evidence, it becomes a law. Accordingly, scientific theories were a lesser type of knowledge than laws. Also, many science teachers confused a scientific theory with scientific fact. They believed that theories were facts before being proven by experiment

(McDonald & Abd-El-Khalick, 2017). The conception that these constructs are different types of ideas was not grasped (McDonald & Abd-El-Khalick, 2017, Upahi, Ramnarain & Ishola, 2020).

The scientific method is commonly perceived by science teachers as a universal step-wise method to be followed in order to reach certain results or unambiguous scientific truth. Rather, most science teachers believe that a good scientist follow the steps depending on the nature of the experiment (McDonald & Abd-El-Khalick, 2017). The conceptions of science teachers on scientists' work are subjectively and objectively, theory-laden and theory-free, resulting in lack of clear understanding (McDonald & Abd-El-Khalick, 2017, Dorji and Jatsho, 2022).

Teachers' conceptions nature of science is influenced by the kinds of textbooks they use for instruction (Ajaja, 2012). Upahi, Ramnarain and Ishola (2020) found that secondary school science teachers respond to textbooks in a way that contribute to transmission mode of science teaching. Adedoyin and Bello (2017) stated that various studies revealed that in any classroom, the science taught and the way it is taught depends primarily on what the teacher believes, knows and does. This implies that science teaching and practices in most schools in the developing countries do not follow the recommended standard use of inquiry-based learning, discovery and science process skills.

Science teachers' conceptions of the nature of science influence their choices of instructional approaches, whether traditional or contemporary (Ajaja, 2012). The traditional approach starts the definition of a topical idea by the teacher and finishes with a problem while the contemporary approach starts from a problem and the learner to the pretermined body of knowledge, which is the constructivist's approach to science teaching. Bello and Abimbola (2017) further explained that in constructivism, learners should create their own knowledge through the interaction of what they already know and the ideas, events and activities with which they come in contact with. In recent time, nature of science emphasizes that knowledge should be constructed and created by the learner rather than knowledge being prepared and distributed to the learner by the teacher who claims to be a reservoir of knowledge.

The study which was motivated by research efforts on teachers' conceptions of nature of science globally and the intention of contributing words re-engineering science education for sustainable self-reliance in Nigeria has the main purpose of examining senior secondary school in-service science teachers' views of the nature of science in Egor Local Government Area of Edo State, South-South, Nigeria. The specific areas of emphasis in this study are: Finding out the significant difference in the views of nature of science between experienced and inexperienced science teachers as well as professionally trained and non-professionally trained science teachers.

Statement of the Problem

Science teaching involves guiding and directing students' science activities in order to produce learning. This is the contemporary approach to science teaching. But, observation has shown that most science teachers embrace the traditional methods of instruction to teach concepts in science. This approach starts with the definition of a topical idea by the teacher and finishes with a problem. This means, science teachers still believe that science bases on truth, to be told. Such instruction did not bring into account the misconceptions of the learners. Hence, students encounter difficulties in understanding certain concepts of science and are also unable to extend the knowledge of ideas to fix problems outside the classroom.

There are indications in science education literature that learning science by secondary school science students in Nigeria seems to be a problem as manifested in their continuing poor performances at the Senior School Certificate

Examinations conducted by WAEC and NECO (Omoifo, 2012., Nworgu & Ortum, 2013., Egbo, 2014., Abimbola, 2015., WAEC Chief Examiners' report, 2019). There is also a serious concern about factors that underline secondary school students' achievement in science. Factor such as in-service science teachers' views of the nature of science are major barriers to learning of scientific facts, concepts, theories and laws by the students (Sambo & Eggari, 2015., Adedoyin & Bello, 2017., Upahi & Ishola, 2020). Science teachers' mastery of the distinct nature of science is required in providing explanations of scientific facts, concepts, theories and laws to students, thereby enhancing meaningful learning by the students. It is therefore necessary to find out if science teachers hold appropriate views of the nature of science as part of efforts to enhance their pedagogical content knowledge.

Research Questions

The following research questions were raised to guide the study:

1. What are science teachers' views of the nature of science?
2. Do views of the nature of science differ between experienced and inexperienced science teachers?
3. Do views of the nature of science differ between professionally trained and non-professionally trained science teachers?

Hypotheses

Based on the research questions, question 1 were answered while research questions 2and 3 were hypothesized and tested at 0.05 alpha level of significance as follows:

1. There is no significant difference in the views of nature of science between experienced and in-experienced science teachers.
2. There is no significant difference in the views of nature of science between professionally and non-professionally trained science teachers.

Methodology

The study adopted a descriptive survey employing ex-post-facto design. The independent variables of the study are teaching experience and professional training; the dependent variables are in the five key realms of the nature of science: scientific knowledge, scientific theory, scientific method, scientific laws and the role of a scientist. The population of the study comprised 211 secondary school in-service science teachers in Egor Local Government Area of Edo State, Nigeria. The study was carried out in both public and private secondary schools in Egor local government area of Edo state, Nigeria. Eighteen (18) secondary schools were randomly selected. The sample consists of 100 science teachers, 60 (60%) experienced and 40 (40%) in-experienced science teachers. Sixty- two (62%) are professional teachers having taken courses in principles of teaching and class management during pre-and in-service teacher preparation programmes in the faculty and institute of education, while 38 (38%) are non-professionals. Data for the study were collected through a Likert scale instrument titled "Views of Nature of Science Questionnaire" (VONOSQ). The instrument (VONOSQ) adapted from Palmquist and Finley (2007), consists of two major sections: section A seek for competency statements on the five board categories of the nature of science, as characterized by the traditional and contemporary views. Section B is made up of science teachers demographic information like teaching experience and professional training. The VONOSQ instrument was validated and the reliability was determined using Cronbach alpha reliability procedure that yielded a reliability coefficient of 0.70. Data for the study were analyzed using percentages to compare groups

and chi-square (x^2) test of significance. Attempt was made to answer the question: what views of the nature of science do the science teachers who participated in the study held'? The percentages of teachers with traditional/ naïve view, contemporary/ informed view and mixed view were determined by classification of teachers' views for each aspect of the NOS as on table 1 below. All the decisions to accept or reject null hypotheses were made at the 0.05 level of significance. Tables are used to present statistical results.

Results

Research question 1: What are the science teachers' views of the nature of science?

The group with the highest percentage was taken as having the view of the nature of science.

Table 1: Classification of Teachers for each Aspect of the Nature of Science (NOS)

S/N	Area of Nature of Science (NOS)	Views: Traditional N	Traditional %	Contemporary N	Contemporary %	Mixed N	Mixed %	Decision (Highest Percentage)
1.	**Scientific theory**							
	1. Theories are based directly on observations or theory-dependent.	37	37.0	9	9.0	54	54.0	Mixed
	2. New theories are improvements over old theories because observations improve and increase over time or one invention of scientists.	23	23.0	6	6.0	71	71.0	Mixed
	3. An entire theory is rejected if subject to a single contradictory fact or does not necessarily compel the abandonment of a theory.	31	31.0	48	48.0	21	21.0	Contemporary
	4. A theory is a hypothesis that has been proven to be correct or is a tool used to describe, explain and predict scientific phenomena.	20	20.0	27	27.0	53	53.0	Mixed
	5. Old theories are no use to scientists or fit within contained scientific scope.	29	29.0	40	40.0	31	31.0	Contemporary
2.	**Scientific Knowledge**							
	1. Scientific knowledge corresponds directly to reality or increases in parts from observations.	37	37.0	20	20.0	43	43.0	Mixed
	Scientific knowledge is temporal or progresses by an accumulation of observations.	-	-	29	72.5	11	27.5	Contemporary

S/N	Area of Nature of Science (NOS)	Views Traditional N	%	Contemporary N	%	Mixed N	%	Decision (Highest Percentage)
	2. Scientific knowledge is created and validated by common acceptance within the scientific community or is proven or disproved owing to the direct influence of observations.	20	20.0	18	18.0	62	62.0	Mixed
	3. Scientists create knowledge based on prior knowledge, observations and logic or scientific knowledge is unchanging	39	97.5	-	-	1	2.5	Traditional
	4. The tentativeness of knowledge is related to how much people work on it or the progression or scientific knowledge is not continuous.	30	75	-	-	10	25	Traditional
3.	**Scientific Law**							
	1. Scientific law are found directly in nature or are created by scientists.	34	34.0	25	25.0	41	41.0	Mixed
	2. Scientists interprets the laws found in nature or laws are validated within the scientific community	36	36.0	2	2.0	62	62.0	Mixed
	3. Scientific laws can be proven to be absolutely true or are a scientist's best attempt part of nature.	13.	13.0	12	12.0	75	75.0	Mixed
4	**Scientific Method**							
	1. Science relies on precise control of experiments (and match with prediction) for proof or scientists are not compelled to the traditional scientific method.	29	29.0	1	1.0	70	70.0	Mixed

S/N	Area of Nature of Science (NOS)	Views: Traditional N	Traditional %	Contemporary N	Contemporary %	Mixed N	Mixed %	Decision (Highest Percentage)
2.	The use of traditional scientific method is necessary to discover and validate theories or there is no single scientific method.	11	11.0	36	36.0	53	70.0	Mixed
3.	There is a single method of doing science or methods said by scientists depend on circumstances.	7	7.0	59	59.0	34	34.0	Contemporary
4.	The scientific method is a step-by-step process or knowledge can be gained by other means than the scientific method.	9	19.0	1	1.0	80	80.0	Mixed
5.	The method must be planned out in advance of the inquiry or scientists can adjust their method of inquiry in the middle of an investigation and still obtain valid results.	20	20.0	12	12.0	68	68.0	Mixed
5.	**Roles of Scientists**							
	1. A Scientist evaluates scientific claims exclusively through empirical evidences or the primar7y act of scientist is often a leap of imagination or creativity	22	22.0	7	7.0	71	71.0	Mixed
	2. All actions of a scientist are assumed to be open-minded and objective or a scientist interprets results based on prior knowledge, observations, logic and social factors.	16	16.0	6	6.0	78	78.0	Mixed
	3. A scientist is someone who uses the traditional scientific method or creates theories based on prior knowledge, observation and logic.	2	2.0	70	70.0	28	28.0	Mixed
	4. A scientist strives to discover the absolute truth or works within the scientific community and contemplates the work of other scientists.	6	6.0	10	10.0	84	84.0	Mixed
	5. Scientists must avoid being influenced by anything outside of pure science or making decisions before inquiry based on prior knowledge, observations, logic and social factors.	39	39.0	18	18.0	43	43.0	Mixed

Table 1 shows that most teachers have mixed views of the nature of science. This decision was taken using group with the highest percentage. Most teachers, particularly those who participated in the study, however, held traditional views of the nature of science realms except for scientific theory 3 and 5, scientific knowledge 2, scientific method 3 and Roles of Scientists 3 where majority of the teachers exhibited more of the modern or informed view. Results also show that no teacher who participated in the study had any traditional view of the nature of science knowledge 2 while 79 teachers representing 79.0% had contemporary view. However, 21 teachers representing 21.0% had mixed views of scientific knowledge 2. On the contrary, 71 teachers representing 71.0% held traditional view for scientific knowledge 5 while non-had any contemporary view, 29 teachers representing 29.0% mixed views.

Hypothesis 1 There is no significant difference in the views of the nature of science between experienced and inexperienced science teachers.

Table 2: Chi-square(x^2) test of significance between Percentages of Inexperienced and Experienced Science Teachers views of the nature of Science (N=100)

S/N	Nature of Science (NOS)	Views: Traditional (%) Inexperienced (0-5) years	Traditional (%) Experienced (6 years and above)	Contemporary (%) Inexperienced (6 years and above)	Contemporary (%) Experienced (6yrs and above)	Mixed (%) Inexperienced (0-5) years	Mixed (%) Experienced (6years and above)	X^2 (df=2)	Deci-sion
1	**Scientific theory**								
1	Theories are based directly on observations or theory dependent.	11.0	26.0	6.0	26.0	28.0	-	0.193	NS
2	New theories are improvements over old theories because observations improve and increase over time or one invention of scientists.	6.0	17.0	4.0	2.0	30.0	41.0	0.151	NS
3	An entire theory is rejected if subject to a single contradictory fact or does not necessarily compel the abandonment of a theory.	6.0	5.0	20.0	34.0	14.0	21.0	0.558	NS
4	A theory is a hypothesis that has been proven to be correct or is a tool used to describe, explain and predict scientific phenomena.	2.0	1.0	2.0	6.0	36.0	53.0	0.439	NS
5	Old theories are of no use to scientists or fit within contained scientific scope	2.9	1.0	26.0	40.0	12.0	19.0	0.631	NS
2.	**Scientific Knowledge**								
1	Scientific knowledge corresponds directly to reality or increases in parts from observations.	3.0	5.0	2.0	12.0	35.0	43.0	0.098	NS
2	Scientific knowledge is temporal or progresses by an accumulation of observations.	-	-	29.0	50.0	11.0	10.0	0.193	NS
3	Scientific knowledge is created and validated by common acceptance within the scientific community or is proven or	5.0	9.0	4.0	13.0	31.0	38.0	0.256	NS

	disproved owing to the direct influence of observations.								
4	Scientists create knowledge based on prior knowledge, observations and logic or scientific knowledge is unchanging	39.0	43.0	-	5.0	1.0	12.0	0.004	Sig.
	5. The tentativeness of knowledge is related to how much people work on it or the progression of scientific knowledge is not continuous.	30.0	41.0	-	-	10.0	19.0	0.472	NS

		Views						**X^2 (df=2)**	**Deci-sion**
		Traditional (%)		**Contemporary (%)**		**Mixed (%)**			
S/N	**Nature of Science (NOS)**	**Inexperienced (0-5) years**	**Experienced (6 years and above)**	**Inexperienced (6 years and above)**	**Experienced (6yrs and above)**	**Inexperienced (0-5) years**	**Experienced (6years and above)**		
3.	**Scientific Law**								
	1. Scientific laws are found directly in nature or are creative by scientists.	14.0	20.0	8.0	17.0	18.0	23.0	0.623	NS
	2. Scientists interpret the laws found in nature or laws are validated within the scientific community.	17.0	19.0	-	2.0	23.0	39.0	0.311	NS
	3. Scientific laws can be proven to be absolutely true or are scientists are a scientist's best attempt to explain part of nature.	6.0	8.0	3.0	9.0	32.0	43.0	0.507	NS
4.	**Scientific Method**								
	1. Science relies on precise control of experiments (and match with prediction) for proof or scientists are not compelled to use the traditional scientific method.	16.0	13.0	-	1.0	24.0	46.0	0.111	NS
	2. The use of traditional scientific method is necessary to discover and validate theories or there is no single scientific method.	10.0	1.0	9.0	27.0	21.0	32.0	0.000	Sig.
	3. There is a single method of doing science or methods used by scientists depend on circumstances	3.0	4.0	23.0	36.0	14.0	20.0	0.111	NS
	4. The scientific method is a step-by-step process or knowledge can be gained by other means than the scientific method.	10	9.0	-	1.0	30.0	50.0	0.343	NS
	5. The method must be planned out in advance of the inquiry or scientists can adjust their method of inquiry middle of an investigation and still obtain valid results.	7.0	13.0	3.0	9.0	30.0	38.0	0.404	NS
5.	**Roles of Scientists**								

1.	A scientist evaluates scientific claims exclusively through empirical evidences or the primary act of scientist is often a leap of imagination or creativity.	8.0	14.0	1.0	6.0	31.0	40.0	0.294	NS

		Views							
		Traditional (%)		Contemporary (%)		Mixed (%)		X^2 (df=2)	Deci-sion
S/N	Nature of Science (NOS)	Inexperienced (0-5) years	Experienced (6 years and above)	Inexperienced (6 years and above)	Experienced (6yrs and above)	Inexperienced (0-5) years	Experienced (6years and above)		
2.	All actions of a scientist are assumed to be open-minded and objective or a scientist interprets results based on prior knowledge, observations, logic and social factors.	3.0	13.0	1.0	5.0	36.0	42.0	0.061	NS
3.	A scientist is someone who uses the traditional scientific method or creates theories based on prior knowledge, observation and logic.	-	2.0	31.0	39.0	9.0	19.0	0.274	NS
4.	A scientist strives to discover the absolute truth or works within the scientific community and contemplates the work of other scientists.	4.0	2.0	3.0	7.0	33.0	51.0	0.331	NS
5.	Scientists must avoid being influenced by anything outside of pure science or making decisions before inquiry based on prior knowledge, observations, logic and social factors.	12.0	127.0	100	8.0	18.0	25.0	0.196	NS

Considering teachers with different experiences, results on table 2 under views on scientific theory show chi-square (x^2) values of 0.193, 0.151, 0.558,0.439 and 0.631 for scientific theories 1,2,3,4 and 5 respectively, df = 2, significant at 0.05. This means no significant difference exists ¡n the views of NOS between novice or inexperienced (0-5) years and experienced (6 years and above) science teachers. Therefore, null hypothesis is retained.

Views of novice and experienced teachers on scientific knowledge 4 produce a x^2- value of 0.004, df =2, significant at 0.05. This means there is a significant difference. Therefore null hypothesis is rejected but retained on the views of scientific knowledge 1, 2,3 and 5 with x^2 - values of 0.098, 0.193, 0.256 and 0.472 respectively, df = 2, significant at 0.05.

There is no significant difference in the views of teachers with different experiences as regards scientific laws. Results on table 4.3 under scientific law proves this, with x^2 –values of 0.623, 0.311 and 0.507 for scientific law 1, 2 and 3 respectively, df =2, significant at 0.05, meaning that the null hypothesis is retained.

From the results, difference ¡n views between novice and experienced teachers is significant at scientific method 2 with a X^2 – value of 0.000, df = 2, significant at 0.05. Therefore, null hypothesis is rejected, but retained at scientific method 1, 3, 4 and 5. where there is no significance at 0.05 level of significance

Results show that difference in views between inexperienced and experienced teachers is not significant at the roles of scientists' realm of the NOS. Chi-square (x^2) values of 0.294, 0.061, 0.274, 0.331 and 0. 196 for views on roles of scientists 1, 2, 3, 4 and 5, df = 2, not significant at 0.05 show that the null hypothesis ¡s retained.

Hypothesis 2: There is no significant difference in the views of the nature of science between professionally non-professionally trained science teachers.

S/N	Nature of Science (NOS)	Views Traditional (%) Professional	Views Traditional (%) Non Professional	Views Contemporary (%) Professional	Views Contemporary (%)	Mixed (%) Professional	Mixed (%) Non Professional		Decision
1.	**Scientific Theory**								
1	Theories are based directly on observations and theory-dependent	14.0	23.0	9.0	-	390	15.0	0.000*	Sig.
2	New theories are improvements because observations improve and increase over time or one inventions of scientists.	6.0	17.0	4.0	2.0	52.0	19.0	0.000*	Sig.
3	An entire theory is rejected if subject to a single contradictory fact or does not necessarily compel the abandonment of a theory.	7.0	4.0	29.0	25.0	9.0	19.0	0.147	NS
4	A theory is a hypothesis that has been proven to be correct or is a tool used to describe, explain and predict scientific phenomena.	3.0	-	6.0	2.0	53.0	36.0	0.267	NS
5	Old theories are of no use to scientists or fit within contained scientific scope	3.0	-	38.0	28.0	21.0	10.0	0.244	NS
2.	**Scientific knowledge**								
1.	Scientific knowledge corresponds directly to reality or increase in parts from observations.	7.0	1.0	7.0	7.0	48.0	30.0	0.215	NS
2.	Scientific knowledge is temporal or progresses by an accumulation of observations.	-	-	52.0	27.0	10.0	11.0	0.217	NS

S/N	Nature of Science (NOS)	Views Traditional (%) Professional	Traditional (%) Non Professional	Contemporary (%) Professional	Contemporary (%)	Mixed (%) Professional	Mixed (%) Non Professional		Decision
3.	Scientific knowledge is created and validated by common acceptance within the scientific community or is proven or disproved owing to the direct influence of observations.	6.0	8.0	12.0	5.0	44.0	25.0	0.246	NS
4.	Scientists create knowledge based on prior knowledge, observations and logic or scientific knowledge is unchanging.	50.0	32.0	-	5.0	12.0	1.0	0.001 *	Sig
5.	The tentativeness of knowledge is related to how much people work on it or the progression or scientific knowledge is not continuous.	34.0	32.0	-	-	23.0	6.0	0.023	Sig

There is a significant difference in the views of professional and non-professional science teachers on scientific theories 1 and 2 with the results of x^2 _ values of 0.000 and 0.000 respectively, df=2, significant at 0.05. to the contrary, there is no striking difference in the views of professional and non-professional science teachers on scientific theories 3,4 and 5 with the results of x^2 _ values of 0. 147, 0.267 and 0.244 respectively, df= 2, significant at 0.05. This means the null hypothesis is retained.

There is no significant difference in the views of professional and non-professional science teachers' scientific knowledge 1, 2 and 3 following the results of x^2 _values of 0.215 and 0.246 respectively, df=2, significant at 0.05. this means the null hypothesis is retained. Hence, there is a significant difference in the views of professional and non-professional science teachers on scientific knowledge 4 and 5 with the results of x^2 _ values of 0.001 and 0.023 respectively, df=2, significant at 0.05. This means the null hypothesis is rejected.

From table 3, the x^2 _ values of 0.066and 0.226 for scientific laws 1 and 2 respectively at df=2 are not significant at 0.05. This shows that there is a difference in the views of professional and non-professional science teachers on scientific laws 1 and 2, but the difference is not significant. Hence, the hypothesis of no significant difference is therefore retained. The null hypothesis is rejected at scientific law 3 with a x^2_ values of 0.042, df=2 and significant at 0.05, indicating a significant difference.

Views of professional and non-professional science teachers on scientific method 3 produced a x^2_ values of 0.003, df=2, significant at 0.05. This means there is a significant difference. Therefore, null hypothesis is rejected, but retained on the views of scientific method 1,2,4 and 5 with x^2 - values of 0.381, 0.101, 0.164 and 0.091 respectively, df= 2 but not significant at 0.05.

Also from the results, views of professional and non-professional science teachers' views on the roles of scientists' realm of the NOS have a x^2 _ values of 0.001at df= 2, significant at 0.05 for roles of scientists 1. This means. There is a striking difference in the views as regards roles of scientists 1, but this difference is not significant at roles of scientists 2,3,4 and 5 with x^2 values of 0.412, 0.087,0.438 and 0.780 respectively, df= 2 but not significant at 0.05. at this point, the null hypothesis is retained.

Discussion

This study investigated the Nigerian secondary school science teachers' views of the nature of science (NOS). This study is most significant in the sense that it has thrown more light on what our science teachers know and their views of nature of science. Table 1 shows that most science teachers have mixed views on the NOS. Therefore it is in record that science teachers generally have little or no formal exposure to contemporary ideas from history, philosophy and sociology of science, which are the basis to science education. The findings were related to those of Ajaja (2012), Dorsah (2020), Dorji and Jatsho (2022) who found out that secondary school science teachers' conceptions of the nature of science are mixed, unsolified and confused. Most have traditional view while a lot have contemporary view. However, the results of the findings fails to agree with Demirel, Sungur and Cakiroglu (2022) and Chuene and Singh(2023) in their separate studies all the science teachers who participated in the study had contemporary view of the NOS meaning that they are aware of the social context of science in Oyo State, Nigeria showed that all the teachers who participated in the study had traditional view of the NOS. The study also showed that most science teachers lack clear understanding of the NOS in terms of scientific knowledge, scientific method and scientists' work. These findings agree with the findings of Omoifo and Urevbu (2005),

Dorji and Jatsho (2022), Schofield and Takriti (2023).

Hypothesis 1 addressed the issue of no. significant difference in the views of NOS between experienced and inexperienced science teachers. The result is that there is no significant difference. This finding is in line with the finding of most researchers amongst whom are Omoifo and Moemeke (2003), Adegboye, Bello and Abimbola (2017) but contrary to the finding of Sambo, Mahmud and Eggari (2015) who claimed that experienced science teachers have contemporary views of the NOS.

The level of insignificance was confirmed in certain aspects of NOS. Hence, the null hypothesis 2 which states that there is no significant difference in the views of the NOS between professionally and non-Professionally trained science teachers was retained. These aspects are mainly in scientific methods and role of scientists. This findings agrees with those of Palmquist and Finley (2007), Sambo, Mahmud and Eggari, (2015), Adedoyin and Bello (2017), Dorji and Jatsho (2022), but contrary to the finding of Sambo, Mahmud and Eggari (2015) who asserted that professionally trained science teachers have contemporary view of the nature of science.

Conclusion

Based on the findings, most in-service science teachers generally have mixed views of the nature of science. Teaching experience and professionalism do not influence the views of science teachers on the nature of science.

Recommendations

Based on the findings of the study and conclusion drawn, the following recommendations were made: .

- Method courses in teachers' preparation programme should portray a contemporary view of the NOS and this may be achieved through the use of strategies such as inquiry-based learning.
- Conferences, seminars, workshops, in-service training should be periodically organized for science teachers and made compulsory where teachers can be given formal exposure to contemporary ideas from the history, philosophy and sociology of science.
- Secondary school science curriculum should be restructured to emphasize the contemporary approach to the teaching of science.

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