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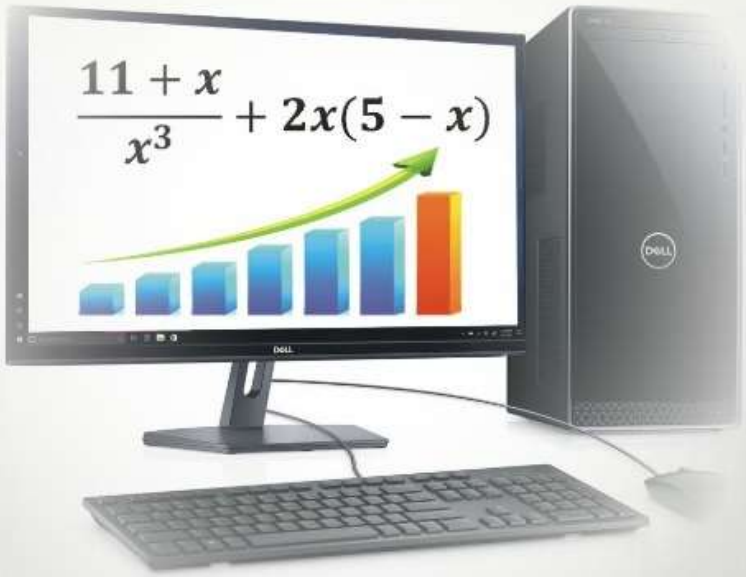

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EFFECTS OF MATHEMATICS SCRABBLE GAMES ON SENIOR SECONDARY SCHOOL STUDENTS' INTEREST IN PROBABILITY IN ENUGU STATE

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Abstract
The study investigated the effects of mathematics scrabble game on senior secondary school students' interest in probability. Four (4) research questions and six (6) hypotheses guided the study. Pretest-posttest non-randomized quasi-experimental research design was adopted for the study. The population is made up of 4598 senior secondary class two (SS 2) students from the 31 secondary schools in Enugu Education Zone. A sample of 368 SS 2 students was used for the study. Probability Interest Scale (PIS) was used for data collection. The instruments were validated by three experts. A trial test was carried out to verify the reliability of the instrument. The Probability Interest Scale (PIS) was calculated using Cronbach's Alpha (α) which was obtained as 0.85. The study lasted for six weeks. Data generated from the study was analyzed using mean and standard deviation to answer the research questions while the Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The result of the study revealed among others, that mathematics scrabble game increased students' interest in probability. However, there was no significant effect or interaction between gender and teaching methods. It was therefore recommended that mathematics scrabble game which is an innovative strategy and students-centered approach should be adopted as an alternative to the expository method in teaching probability concepts in mathematics.
Keywords: *Mathematics, Scrabble, Games, Mathematical games, Probability, Probability theory, Interest, Gender.*

Introduction

Mathematics is the science of structure, order, and relation that has evolved from counting, measuring, and describing the shapes of objects. It deals with logical reasoning and quantitative calculation (Nekang, 2018). Decker (2018) viewed mathematics as the science that deals with logical shapes, quantity and arrangement. According to Iyoke (2015), mathematics is a science visualized in symbols, logical statements, shapes, numerical quantities and arrangement. Obodo (2017) described mathematics as a precision tool used by all scientists in their search to a clear understanding of the physical world. He further stated that mathematics is such that its contribution goes beyond sciences to other fields of human endeavours.

Mathematics is taught as a core subject to all pupils/students at the primary and secondary school levels in Nigeria in order to give a sound basis for scientific and reflective thinking and prepare them for the next level of education (Federal Government of Nigeria (FGN), 2014). Mathematics is an important subject because it is the basis for scientific, industrial and technological advancement of any country. It is associated with more academic and career opportunities (Iji, Omenka & Akpan, 2017).

Mathematics Encyclopaedia (2015) stated that mathematics has several branches, which one of the branches is probability. Probability is the branch of mathematics concerning with numerical descriptions of how likely an event is to occur or how likely it is that a proposition is true. The probability of an event

is a number between 0 and 1, where, roughly speaking, 0 indicates impossibility of the event and 1 indicates certainty (Britannica website, 2014). The higher the probability of an event, the more likely it is that the event will occur (William, 2013). Probability theory is also used to describe the underlying mechanics and regularities of complex systems (Britannica website, 2014). Probability theory has been applied in many disciplines such as business, life sciences, humanities, education, agriculture, and the social sciences. (Rasimah & Aida, 2020). Probability theory is also used to describe the underlying mechanics and regularities of complex systems (Britannica website, 2014).

In spite of the importance and usefulness of probability as a branch of mathematics and emphasis placed on the teaching and learning, a major problem still exists. While research into students' perceptions of probability and statistics generally suggest a positive attitude towards studying the subject, there are studies that confirm that students' tend to see probability and statistics as difficult (Leavy, Hannigan, & Fitzmaurice, 2013; Hannigan, Gill, & Leavy, 2013). It becomes necessary to look for inventions such as mathematics games which will help to develop the interest of students' in probability at the senior secondary school level of education.

Interest is a subjective feeling of intentness or curiosity over something. It is an important variable in learning because when one becomes interested in an activity, one is likely to be more deeply involved in that activity. No wonder, Obodo in Adigun (2017) stated that interest is a very strong factor in the teaching and learning of Mathematics. Adeniyi and Salman (2015) stressed that interest controls the motivation to learn. Studies carried out by Batanero, Chernoff, Engel, Lee, & Sánchez, (2016) and Koparan, (2019) recommended that one of the ways to overcome the students' lack of interest in mathematics is through the use of challenging yet interesting teaching scenarios, such as the use of games.

Games are social activities with set of rules in which the hallmark is to win (Ezeamaenyi, 2001). Instructional games are structured and interactive activities governed with a set of rules for the purpose of engaging two or more students in a game designed to achieve a set of instructional objectives (Akanmu and Adeniyi, 2020). A mathematical game is a type of play that follows a set of rules, aims at definite goal or outcome, and involves competition against other players or against barriers imposed by the nature of the game itself (Abonyi, Maduagwuna & Ugama, 2014). Mathematical games can take the form of puzzles, fallacies or any type of mathematics which provides amusement or curiosity, enjoyment and recreation. They also stimulate mathematical thinking, generate excitement and spirit of competition (Omeodu & Fredrick 2019). Nekang (2018) disclosed that mathematical games help students to explore elementary number concepts such as the counting sequence and series, number and numeration, basic number operation, one-to-one correspondence, and computation strategies. Examples of mathematical games include; card game for learning number concept, geoboard games for learning geometric concepts, coordinate game for learning coordinates and cartesian plain, scrabble game, ludo game and coin game for learning of probability.

Abonyi, Maduagwuna and Ugama (2014) investigated the effect of mathematical game on students' achievement in quadratic expression and found out that those taught with mathematical games perform better than those taught with expository approach. They researcher further stressed that games do not only help in releasing tension and boredom in class but also provide an environment where the children can develop their individual and collective skills and acquire more knowledge. However, in order to achieve the most from probability game, it is important that suitable instructional games are chosen. Whenever a game is to be conducted, the number of students, proficiency level, cultural context, timing, learning topic and classroom settings are factors that should be taken into account (Sari, 2016). Instructional games can be broadly characterized into two: manual games and electronic games. Manual games are basically games which can be played with ordinary objects around, such as boards, papers and cards etc. Electronic games however, are games that involve human interaction with a user interface to generate usual feedback on a video device. Games, whether electronic or manual are characterized by rules, goals, objectives, outcomes and feedback,

conflict, competition, challenges, opposition, interaction and representation of story (Prensky in Nekang, 2018). The researcher decides to make use of scrabble game which could be manual or computer in nature. However, manual scrabble game will be used for this study. This is because manual scrabble game does not depend on electricity, it does not fail and it is cheaper to use.

Scrabble is a board game in which players try to make words from letters printed on small plastic blocks and connect them to words that have already been placed on the board. It is played by two to four players with the players using their vocabulary to create words. They can make a word from 7 letters given to each players to put on available scrabble board in the games. One of the players must get the highest score to win the game. In Scrabble, players pick letter tiles at random from a bag of 100 tiles. Some letters are more common in English, so there are more of them in the game. Events are mutually exclusive if they cannot happen at the same time. The chance of one or the other happening can be found by adding each probability. The use of scrabble games in probability classroom makes mathematics lessons more interesting and enjoyable for the students, this is the reason the study investigated the effects of the use of mathematics scrabble games on senior secondary school students' interest in probability. However, as good and interesting as the use of scrabble game technique may be, not much studies have been carried out on the effectiveness of mathematics scrabble game in teaching probability. It is in this regard that this study was carried out with ultimate intention to find out the effect of mathematics scrabble games on senior secondary school students' achievement and interest in probability, which will in turn guarantee wealth creation of the individual citizens and national development.

In addition to the above, influence of gender on students' achievement in mathematics has remained a controversial and topical issue amongst educationists and psychologists. Alordiah, Akpadaka and Oviogboda (2015) investigated the influence of gender on students' academic achievement in mathematics, the result also showed that male students performed better than female students. Oribhabor (2019) also found out that boys perform better than girls in mathematics. In the light of the above, the study will also determine the effect of mathematics scrabble games on students' achievement in probability based on gender in senior secondary schools.

The purpose of this study is to find out the effect of mathematics scrabble games on senior secondary school students' interest in probability. Specifically, the study sought to;

1. determine the extent to which mathematics scrabble games affect students' interest in probability in senior secondary schools.
2. determine the extent to which mathematics scrabble games affect students' interest in probability based on gender in senior secondary schools.

The following research questions were posed to guide the study.

1. What are the mean interest scores and standard deviations of students, taught probability using mathematics scrabble games and those taught using expository method?
2. What are the mean interest scores and standard deviations of male and female students, taught probability using mathematics scrabble games?

The following null hypotheses were formulated to guide the study. The hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the mean interest scores of students taught probability using mathematics scrabble games and those taught probability using expository method.
2. There is no significant difference between the mean interest scores of male and female students taught probability using mathematics scrabble games.
3. There is no significant interaction of gender and method on student's mean interest scores in probability.

Methods

The research design adopted for this study was the non-equivalent quasi-experimental design, thus, a pretest-posttest non-randomized control group design. Intact classes were used for experimental and control

groups to avoid randomization of the research subjects. The study area covered Enugu Education Zone which comprised of, Enugu East, Enugu North and Isi Uzo Local Government Areas. The population of the study consisted of all senior secondary two (SSII) students in public secondary schools in Enugu Education Zone, numbering 4,598 students as at the time of this study. From this population, three schools were randomly sampled. In each of the three secondary schools two SSII, two intact classes from each school was sampled also. One intact class in each school was randomly assigned to experimental group and one intact class from each school was assigned to control group using simple balloting. The total sample of 368 students in the six SSII intact classes described above constituted the subjects of the study. 202 students out of the sample belonged to the experimental group while 166 students were in the control group. Also the sample was made up of 92 males and 110 females of the experimental group. Probability Interest Scale (PIS) was developed by the researcher and used for data collection in the study. The Probability Interest Scale (PIS) consists of 20 items and was developed with 4 point scale. The PIS items were used to ascertain the students' interest in probability both in pretest and post-test. The instrument for data collection was validated by three experts. The instruments were subjected to trial testing to ensure the reliability of the instrument. The researcher administered the instrument to a group of thirty (30) senior secondary school class two (II) students from Community Secondary School, Umueze Awkunanaw in Agbani Education Zone different from the Education Zone used for the study. The researcher calculated the reliability of the Probability Interest Scale (PIS) using Cronbach's Alpha (α) which was obtained as 0.85. Mean and standard deviation were used to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

Results

Research Question One: What are the mean interest scores and standard deviations of students, taught probability using mathematics scrabble games and those taught using expository method?

Table 1: Mean interest scores and standard deviations of students taught probability using mathematics scrabble games (experimental group) and expository method (control group).

Group	No. of Students	pretest Mean	pretest SD	posttest Mean	posttest SD	Gain score
Experimental	202	44.64	9.51	64.28	8.43	19.64
Control	166	42.27	13.78	48.40	12.67	6.16

Table 1 shows that the students who were taught probability using mathematics scrabble games had interest scores 44.64 and 64.28 respectively with a corresponding standard deviation of 9.51 and 8.43 respectively in their pretest and posttest. The students taught probability using expository method had the interest scores of 42.27 and 48.40 respectively with a corresponding standard deviation of 13.78 and 12.67 respectively in their pretest and posttest. This indicated that the mean interest scores of the students in the experimental group are higher than that of the control group in the posttest. There is little clustered in the standard deviation of students in the experimental group which indicates that students shows more interest when taught probability using mathematics scrabble games.

Research Question Two: What are the mean interest scores and standard deviations of male and female students taught probability using mathematics scrabble games?

Table 2: Mean interest scores and standard deviations of male and female students taught probability using mathematics scrabble games (experimental group).

Gender	No. of Students	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gain score
Males	92	42.56	10.72	64.59	7.42	22.03
Females	110	40.53	11.76	62.86	9.92	22.33

From the result presented in table 2 above, the posttest interest scores of students taught probability using mathematics scrabble games were found to be 64.59 for male and 62.86 for female respectively while the corresponding standard deviation for the male and female students are 7.42 and 9.92 respectively. The result indicated that male students had more interest in the experimental group than their female counterparts and there is little cluster in the standard deviation of male than their female counterparts in the posttest.

Hypotheses

Hypothesis One: There is no significant difference between the mean interest scores of students taught probability using mathematics scrabble games and those taught probability using expository method.

Table 3: Analysis of Covariance Results of students taught probability using mathematics scrabble games on interest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	1867.587[a]	1	1867.587	114.415	.000	
Intercept	18376.098	1	18376.098	278.743	.000	
Group	1750.257	1	1750.257	19.233	.002	S
Error	3035.001	366	6.221			
Total	30572.000	368				
Corrected Total	31179.535	367				

The data in table 3 shows that the F-value on mean interest scores of the students in the experimental and control groups in post interest scale is 19.233 which has associated probability of 0.002 level of significance, which is less than 0.05 level of significance set for the study. Therefore, the null hypothesis is rejected. This means that there was a significant difference between the mean interest scores of students in the experimental and control groups in post interest scale.

Hypothesis Two: There is no significant difference between the mean interest scores of male and female students taught probability using mathematics scrabble games.

Table 4: Analysis of Covariance Results of male and female students taught probability using mathematics scrabble games on interest.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	6055.211[a]	1	6055.211	2.877	.011	
Intercept	8153.474	1	8153.474	176.927	.000	
Gender	16.854	1	16.854	2.877	.047	NS
Error	5085.397	366	8.014			
Total	16910.000	368				
Corrected Total	**1096.001**	**367**				

The data in table 8 shows that the F-value on mean interest scores of male and female students in experimental group in posttest interest scale is 2.877 which has associated probability of 0.467 level of significant, which is greater than 0.05 level of significance set for the study. Therefore, the null hypothesis is not rejected, this means that there is no significant difference between the mean interest scores of male and female students in experimental group in post interest scale.

Hypothesis Three: There is no significant interaction of gender and method on student's mean interest in

Table 5: Analysis of Covariance in the interaction of gender and mathematics scrabble games on students' mean interest in probability.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	2028.043[a]	3	676.014	41.548	.000	
Intercept	18096.130	1	18096.130	77.240	.000	
Group	7012.571	1	7012.571	21.107	.000	
Gender	121.084	1	121.084	5.734	.032	
group * gender	390.563	1	390.563	3.091	.080	NS
Error	38171.120	364	3.007			
Total	26308.000	368				
Corrected Total	**5745.086**	**367**				

The data in table 5, group * gender as main effect, gave an f-value of 3.091 which has associated probability 0.080 level of significance, which is greater than 0.05 level of significance set for the study. Therefore, the null hypothesis is not rejected, indicating that there is no significant interaction of gender and mathematics scrabble games on student's interest in probability.

Discussions

Table one (1) shows that the experimental group had more positive interest towards probability than those taught using expository method after treatment. This is line with the finding Omeodu and Fredrick (2019), and Ochulor (2020), who found out that mathematical games are very useful tools in arousing students' interest in mathematics for a better achievement. Also, table two (2) shows that male students recorded higher interest in the experimental group than their female counterparts which is in line with the study Oribhabor (2019) who studied influence of gender on academic achievement in Mathematics among senior secondary school students and submitted that there is a significant difference in the mathematics achievement of the male and female students in favour of the males.

Table three (3) shows that there is a significant difference between the mean interest scores of students in experimental. This means that the use of mathematics scrabble games in teaching probability increased students' interest better than the use of expository method. The findings agree with the findings of Amaal and Majeda (2014) and Tembe, Anyagh, and Abakpa (2020) who pointed out from their findings that if students are taught using students-centered techniques or methods such as scrabble games techniques, students' interest and achievement will be enhanced. However, table four (4) showed that there is no significant difference between the mean interest scores of male and female students in experimental group in post interest scale. This implies that mathematics scrabble games had equal effect on both male and female student's interest in probability. Consequently, the interaction effect between teaching strategy and students gender was very significant. The findings agreed with the findings of Tembe, Anyagh, and Abakpa (2020) and Torty and Offorma (2013) that there was no significant interaction effect of method and gender on students' interest in mathematics.

Conclusions

Considering the findings of this study, the following conclusions were drawn.

1. The students taught probability with mathematics scrabble games had more positive interest than those taught with expository method.
2. This implies that the teaching method bridges the gender – gap between male and female students hence students-centered teaching method should be encouraged.
3. Constructive games should be encouraged in classroom in order to help students inhabit different perspectives and understand probability as part of larger, holistic systems of thought.

Recommendations

The following recommendations are hereby made in line with the findings and implications of the study:

1. Mathematics teachers should adopt the game method in teaching probability since game method enhances the students' level of critical and reflexive thinking in solving mathematical problems.
2. Workshops, seminars, conferences and in-service training should be regularly organized for mathematics teachers to update their knowledge on the use of games in teaching mathematics.
3. Mathematics teachers should be motivated and encouraged by both the school management to regularly make use of varied approaches and adopt the mathematics games technique their classes for optimum students' achievement and interest in probability.

References

Abonyi, O. S., Maduagwuna, N. M. & Ugama, J. O. (2014). Effect of mathematical game on students' achievement in quadratic expressions. *International Journal of Scientific & Engineering Research*, 5 (6), 678 – 684.

Adeniyi, C.O. & Salman, M.F. (2015). Effects of Personalized System of Instruction on Senior Secondary School Students' Achievement in Mathematics. ABACUS. *Journal of Mathematical Association of Nigeria*, 40(1), 122-133.

Akanmu, M.O. and Adeniyi, C.O., (2020). Effects of Mathematical Games on Senior Secondary Students' Academic Performance in Mathematics in Ejigbo, Osun State, Nigeria. *Malaysian Online Journal of Education*, 5(1), 1-9.

Alordiah, C.O.; Akpadaka, G. & Oviogboda, C. O. (2015). The influence of gender, school location and socio-economic status on students' academic achievement in mathematics. *Journal of Education and Practice*, 16 (17): 130-136.

Amaal, A. & Majeda, A. (2014). Effect of Using Word Games on Primary Stage Students' Achievement in English Language Vocabulary in Jordan. *American International Journal of Contemporary Research*, 4 (9), 144 – 150.

Batanero C., Chernoff, E., Engel, J., Lee, H., & Sánchez, E., (2016). Research on Teaching and Learning Probability. Springer Nature Publisher. https://www.springernature.com/gp/products/books

Decker, J. (2018). Is mathematics a science? Retrieved from https://www.researchgate.net/post/Is_Mathematics_A_Science

Ezeamaenyi, M.O.N. (2001). Facing challenges of the third millennium through varieties in Mathematics, Science and Computer Education, Enugu: Royal Ventures.

Federal Government of Nigeria, (2014). *National Policy on Education*. http://erie.Uoregon.edu//publicatios//class-size/practices.htm/

Hannigan, A., Gill, O., & Leavy, A. M. (2013). An investigation of prospective secondary mathematics teachers' conceptual knowledge of and attitudes towards statistics. *Journal of Mathematics Teacher Education*, 16(6), 427-449. https://doi.org/10.1007/s10857-013-9246-3

Iji, C.O., Omenka, J.E. & Akpan, E.M. (2017). Effect of Multimedia Aided Instruction on Upper Basic Education One Students' Interest and Achievement in Geometry in Uyo Metropolis. Unpublished M.Ed Thesis of Federal University of Agriculture, Makurdi.

Iyoke, J.O. (2015). Effects of two mathematical games on Secondary School Students' Achievement, Interest and Retention in Algebra. An unpublished MSc. Thesis. Department of Mathematics and Computer Education, Enugu State University of Science and Technology, (ESUT) Enugu.

Koparan, T. (2019). Teaching game and simulation based probability. *International Journal of Assessment Tools in Education*, 6(2), 235–258.

Leavy, A. M., Hannigan, A., & Fitzmaurice, O. (2013). If you're doubting yourself then, what's the fun in that? An exploration of why prospective secondary mathematics teachers perceived statistics as difficult. *Journal of Statistics Education*, 21(3): https://doi.org/10.1080/10691898.2013.11889684.

Nekang, F. N. (2018). The use of mathematical games and secondary school students' achievement in mathematics in the fake division, the southwest region of Cameroon. *Journal of Education and Entrepreneurship*. 5 (1), 20-31.

Obodo, G.C (2017). The Place of Mathematics in Contemporary National Development. *Journal of General Studies*. 5(1), 13-19

Ochulor, H.C. (2020). Effects of four algebraic games on Junior Secondary School Students' Achievement, Interest and Retention in Algebra in Enugu State. An unpublished MSc. Dissertation. Department of Mathematics and Computer Education, Enugu State University of Science and Technology, (ESUT) Enugu.

Omeodu M. D. & Fredrick, F. C. (2019). Effect of Game Teaching Method on Students Mathematics Achievement in Aboh-Mbaise Local Government Area, Imo State. *International Journal of Innovative Social & Science Education Research* 7(3):18-23.

Oribhabor, C.B. (2019). The Influence of Gender on Mathematics Achievement of Secondary School Students in Bayelsa State. *African Journal of Studies in Education*, 14(2): 196-206.

Rasimah A. & Aida, W.Z.A., (2020). Enhancing the Teaching of Probability and probability Distributions in Upper Secondary using Computer Graphics. Retrieved from https://www.researchgate.net/publication/339439111

Sari, I.N. (2016). The Influence of Motivation and Learning, Teaching Methods and Means of Education Student Achievement. *Sinergi Jurnal Ilmiah Ilmu Manajemen*, 6(2)

Tembe N., Anyagh P. I., & Abakpa, B. O. (2020). Students Mathematics Interest as Correlate of Achievement in Mathematics: Evidence from a Sub-Saharan Student Sample. Department of Mathematics Education, Federal University of Agriculture Makurdi, Nigeria [1] Orcid ids: 0000-0002-7962-3248[1]

TIMSS *2015* Mathematics *Encyclopedia*: Education Policy and Curriculum in *Mathematics* and Science.

Torty, O.U., & Offorma, G.C., (2013). Effect of collaborative learning method on secondary students' interest in English Language tenses. *Int. J. Educ. Res.*, 12(2): 128-135.

INFLUENCE OF AUDIO-VISUAL INSTRUCTIONAL MATERIALS IN TEACHING AND LEARNING OF ENGLISH LANGUAGE IN SECONDARY SCHOOLS IN ENUGU EAST LOCAL GOVERNMENT AREA OF ENUGU STATE

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Abstract
This study investigated the influence of Audio-Visual Instructional material in teaching and learning of English language in secondary schools in Enugu East LGA. The study adopted the descriptive research design. Three research questions and one hypothesis guided the study. The population of the study was 14,978 which comprises of both students and teachers in Enugu East Local Government Area was used for the study. Simple random sampling technique (balloting without replacement) was used to sample 292 students and 8 teachers out of the population which was used as the sample size for the study. The instrument used for data collection was a structured questionnaire tagged "Audio-Visual Instructional Material for Teaching and Learning of English language". The instrument was designed on a 4-point Likert rating scale of Strongly Agree, Agree, Disagree and Strongly Disagree with values of 4, 3, 2 and 1 respectively. The instrument was validated by three experts, one in educational technology, one in English language and one in measurement and evaluation. The reliability of the instrument was determined using Cronbach Alpha which yields a coefficient value of 0.80. Research questions were answered using mean and standard deviations. The study found that audio-visual materials influence students' performance by improving retention, promotes conceptualization of difficult words amongst others thus helping to bring effectiveness in learning. Based on the findings of the study, it was recommended among others that government should make available and teachers should utilize audio-visual instructional materials in teaching the students. Furthermore, teachers should be retrained through seminars, workshops and conferences on the proper use of modern instructional materials like projector and others.

Keywords: *Influence, Audio-Visual Instructional materials, teaching and learning, English language, secondary schools, Enugu East LGA.*

Introduction

Teaching and learning is the concern of trained teachers. Though learning is a complex process, it can however, be defined as a change in disposition, a relatively permanent change in behaviour overtime and this is brought about by experience. Learning can occur as a result of newly acquired skill, knowledge, perception, facts, principles, new information at hand and so on (Adeyangu, 2013). Learning can be reinforced with instructional materials of different varieties because they stimulate, motivate and arrest learners' attention during instructional process. Instructional material is therefore vital in teaching English language.

English language is a subject of study which helps in realizing the nation's educational objectives and technological aspirations. Ebuoh (2018) considered English language as a subject that encroaches into all aspects of human endeavours and further described it as the life wire in the study of various disciplines. Furthermore, English language is the understanding of the science of language which includes the study of nature and importance of language as a vehicle of communication. It also involves the study and understanding of language and the problems militating against the effective learning of language. English language is a vehicle or tool of communication. It is man's most basic tool without which it would be difficult for man and woman to live together, to think, to act and share ideas together (Ebuoh, 2018). It makes it possible for man to engage in social conversation, to transfer ideas, thoughts and feelings through mass communication media, to

develop social and linguistic units or communities. English language is the language of Britain, North America, Australia and some other countries. In other words, it is the official language of Britain, United States of America (USA), most of the common wealth countries and Nigeria in particular.

There is a good relationship pointed to a good relationship between effective teachings and using of instructional materials, Bolick (2013). He argued that while some educators have been fascinated by the potential of instructional materials to enhance teaching and learning, teachers' lagged behind in using instructional materials during teaching and learning. It was expressed that instructional materials will ever incite teaching reform in teaching languages. Dike, (2013) defined audio-visual materials as; those materials which do not depend solely upon reading to convey meaning. They may present information through the sense of hearing as in audio resources, sight, as in visual resources or through a combination of senses. Indeed, the variety of such resources is a striking feature. Anila *et al,* (2012) stated that the term audio-visual materials is commonly used to refer to those instructional materials that may be used to convey meaning without complete dependence upon verbal symbols or language. Anila *et al* (2012) further stated that audio-visual materials include materials and equipment alike that materials are considered to be system, or body of content of potential value when put to work, while equipment or instructions, often referred to as hardware, components, are the means of presenting such content. Instructional materials are integral components of teaching-learning situations; it is not just to supplement learning but to complement its process. It is then showed that, if there must be an effective teaching learning activity, impact of audio visual instructional materials will be necessary.

The adequate provision of instructional materials for teaching is important but it is useless filling up rooms with materials which may end up getting spoilt without being put into use for a day. It therefore means that the effective impact of instructional materials is necessary for the materials. The extent of use of instructional materials in teaching and learning stimulates on the operational definition of perception as it is reflected and focused on variable and contextual factors as having effects on how perception takes place. The individual perceives as a result of variables surrounding the interpretation. This is why a teacher supposed to organize his or her method of teaching around the aim and objective he/she intends the student to achieve.

High cost of some audio- visual instructional materials and poor performances of secondary school students are some of the fundamental issue which educational policy makers need to resolve. It was stated that adequate provision of facilities and equipment and their proper impact have always been positively correlated with good performances and poor performance have been blamed on in adequacies and ineffective impact. The teaching in secondary schools should be dynamic, practical oriented and activity based. This would only be possible when the necessary instructional materials are adequately provided in the secondary schools. The benefit of the use of instructional materials are only realized when the available materials/facilitates are utilized by teachers in teaching-learning process.

Most teachers have formed the habit of adopting the verbalistic and theoretical method as a way of teaching subjects in secondary schools especially English language; this could be as result of unavailability of instructional materials in the schools. The teacher level of resourcefulness, creativity and imagination is crucial for the achievement of quality education. These are expressed in how well he is able to perceive, create and use the relevant information carriers that can enhance and promote effective teaching and learning activities. Our education system does not emphasize the internal production or improvisation of instructional materials particularly audio-visual materials as a tool for enhancing teaching and learning process.

The modern world use digital tools, to improve teaching and learning process, the use of audio-visual materials are likely to make teaching and learning interactive, interesting, and enhances retention and understanding for a longer period, the lack of the use of audio-visual materials or availability of audio-visual materials could be the cause of low performance or failure of students in secondary schools in English language in previous years. This question then is what is influence of Audio-Visual

Instructional material in teaching and learning of English language in secondary schools?

The general purpose of this study is to determine the influence of audio-visual instructional materials in effective teaching and learning of English language in secondary schools in Enugu East L.G.A. The objectives of the study is to determine:

1. The influence of audio-visual instructional materials on the ease of learning of English language in secondary schools in Enugu-East L.G.A
2. The influence of audio-visual instructional materials in teachers instructional delivery of English language in secondary schools in Enugu-East L.G.A
3. The extent to which Audio-visual instructional materials are available for teaching and learning English language in secondary schools in Enugu-East L.G.A

The findings of the study after publication in journals and other media will be of great benefit to students offering English language in schools because student offering English language need genuine audio-visual instructional material to help them enhance their learning capacity, advancing their performance and for them to assimilate quick. This study will also inspire English language teachers to adopt the use of audio-visual materials in the teaching and learning of English language. The study will be significant to school management to see the reason or need to provide the relevant audio-visual instructional material that is needed to enhance teaching and learning process and finally, it will be of great use to scholars who will in future seek to carryout research on recreational activities. This is because the report of the research will offer them a rich source of literature and a spring board for take-off in their research activities.

The study was restricted to determine the influence of audio-visual instructional materials on effective teaching and learning of English language in secondary school students in Enugu-East Local Government Area of Enugu State. The study covered the teachers and students in selected schools in Enugu East Local Government Area.

The following research questions were formulated to guide this study:

1) What is the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools in Enugu-East L.G.A?
2) What is the influence of audio-visual instructional materials in teachers instructional delivery of English language in secondary schools in Enugu-East LGA?
3) To what extent are the Audio-visual instructional material available for teaching and learning English language in secondary schools in Enugu-East L.G.A?

The following hypothesis guided the study:

1. There is no significant difference between the mean response scores of teachers and students on the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools in Enugu-East L.G.A

Methods

The design for this study is survey design. According to Mugenda & Mugenda (2019) the survey design is the best method available to social scientists who are interested in collecting original data for the purpose of describing the population which is too large to observe directly. The researcher combined both qualitative and quantitative approaches to research. The study focused on quantitative approach, which was used on teachers and students respectively using interview and questionnaires. The quantitative approaches were used when there was need for in-depth explanation and hard data respectively, so as to meet the required objective. So both approaches supplement each other.

This study was carried out in Enugu East local government area. Enugu East is a Local Government Area in Enugu State, Nigeria. Enugu East is made up of three zones/districts: Nike-Uno, Ugwogo and Mbuli Njodo. It had an area of 383km² and a population of 279,089 at the 2006 census. The postal

code of the area is 400. Most of the residents are mainly traders. This research was conducted in some sampled schools in Enugu East. Purposely to investigate the influence of audio-visual instructional materials on effective teaching and learning. The researcher chose the area because of her familiarity with the area.

The population of this study comprised both English Language teachers and students in the sampled secondary schools in Enugu East local government area of Enugu state, which are Community High School Emene, Abakpa National Grammar School, Nike Trans-ekulu girl's Secondary school, all in Enugu-East local government area of Enugu state. The population of the study was 14,978 which comprises of both students and teachers in Enugu East Local Government Area. The researcher randomly sampled 300 respondents for the study which comprises of eight (8) teachers and two hundred and ninety two (292) students.

The researcher developed a structured instrument named "Influence of Audio-visual Instructional Materials (IAIM)". The instrument has two sections, A and B. Section A contains the respondents bio-data. While section B is divided into four parts with 21 items structured to assist the researcher in providing clues to the research questions that guided the study. The response format for the instrument is a 4 point scale. Each of the items has a four point scale of Strongly Agree (SA) – 4 points, Agree (A) – 3 points, Disagree (D) – 2 points, Strongly Disagree (SD) – 1 point

The instrument went through face and content validity. The instrument was validated by three experts, the instrument was validated by three experts, one from measurement and evaluation, one from Educational Technology and the other from English language department, all from the Faculty of Education, Enugu State University of Science and Technology. The instrument was assessed in terms of clarity, relevance and suitability of the items raised within the instrument.

To ascertain the internal consistency of the instrument, the researcher conducted a trial test using 20 students from two public schools in Nkanu West L.G.A. They were allowed to complete the instrument at their own convenience. The responses to the various items of the questionnaire used in computing its reliability coefficient using Cronbach Alpha reliability estimate. Reliability indices of .60, .79 and .69 were obtained for Parts 1, 2, and 3 respectively, while the overall reliability index stood at .80, indicating that the instrument is highly reliable and suitable for the study.

The researcher administered the instrument directly to the respondents using two research assistants. The research assistants were briefed by the researcher on the conduct of the exercise in a one-day consultative meeting, during which they were acquainted with the purpose of the study and how the questionnaire should be administered and collected. Appointments were booked with the respondents for collection at later dates for those who were not able to fill their own copies of the instrument.

The responses were analysed using Microsoft Excel 2013. The research questions were answered using mean and standard deviation.

Results

Research Question 1

What is the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools in Enugu-East L.G.A?

Table I: Mean and standard deviation scores of the respondents on the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools.

S/N	The influence of audio-visual include:	SA (F) 4	A (F) 3	D (F) 2	SD (F) 1	Total	Mean	SD*	Decision
1.	It makes the students to remember the concept for longer period of time.	150	100	20	30	300	3.2	0.96	Agreed
2.	They give clear conceptsthus help to bring effectiveness in learning	123	147	3	27	300	3.2	0.73	Agreed
3.	Provide opportunities foreffective communication.	120	150	10	20	300	3.2	0.65	Agreed
4.	Provide variety to teaching.	70	150	50	30	300	2.8	0.79	Agreed
5.	Elicit interest in the learner	99	101	40	60	300	2.8	1.22	Agreed
6.	Make students to be focused digital learning.	121	79	30	70	300	2.7	1.41	Agreed
7.	Provide inspiration amongthe students.	99	101	40	60	300	2.8	1.22	Agreed
	Grand Mean/SD						2.96		

Key: SA = Strongly Agree. A = Agree D = Disagree SD = Strongly Disagree, SD* = Standard deviation

The respondents agreed in all the items with mean values above the cut off point of 2.5 that audio-visual materials influence teaching and learning by making them to remember the concept for longer period of time, convey the same meaning as words but gives clear concepts thus, helping to bring effectiveness in learning. Majority of the respondents further agreed that audio-visual materials also provide opportunities for effective communication between teacher and students, provide variety to teaching and provide interest and inspiration among students. The standard deviations shows a measure of the deviation of the individual responses from the mean response. The sixth item had the highest standard deviation and thus the individual respondents differed in their response to the item more than the others and the third item had the least deviation.

Research Question 2

What is the influence of audio-visual instructional materials in teachers instructional delivery of English language in secondary schools in Enugu-East L.G.A?

Table 2: Mean and standard deviation scores of respondents on influence of audio-visual instructional materials in teachers instructional delivery of English language in secondary schools.

S/N	The influence of audio-visual instructional materials on teachers include:	SA 4	A 3	D 2	SD 1	Total	Mean	SD	DECISION
8.	Provides teachers with variety of instructional pedagogy.	157	93	16	34	300	3.24	0.99	Agreed
9.	Make teaching to be very easy for the teachers.	171	104	19	6	300	3.48	0.79	Agreed
10.	Audio visual materials saves energy for teachers.	170	106	21	3	300	3.48	0.67	Agreed
11.	Audio visual materials help to sustain the instructional contents.	123	147	13	17	300	3.25	0.72	Agreed
12.	Make teachers to have effective control of students during teaching.	150	130	10	10	300	3.40	0.63	Agreed
13.	Provide variety of measurable examples in teaching of English language concepts	110	160	20	10	300	3.23	0.65	Agreed
	Grand Mean/SD						3.35		Agreed

Key: SA = Strongly Agree. A = Agree D = Disagree SD = Strongly Disagree, SD* = Standard deviation

The table 2 above was to ascertain the influence of audio-visual instructional materials on teachers, it was discovered in items with mean values above the cutoff point of 2.5 that audio visual materials have influence on teachers performance in the sense that it provides variety in teaching, makes teaching to be very easy for teachers, saves time and energy for teachers, help to avoid excessive, empty, and meaningless verbalization in teaching English language, sustain instructional content and provides variety in teaching of English language concepts. The eight item had the highest standard deviation and thus the individual respondents differed in their response to the item more than the others and the twelfth item had the least deviation.

Research Question 3

To what extent are the Audio-Visual Instructional materials available for teaching and learning English Language in secondary schools in Enugu East L.G.A?

Table 3: Mean and standard deviation scores of respondents on the extent of audio visual instructional materials available for teaching of English Language.

S/N	To what extent are the	VGE 4	GE 3	LE 2	VLE 1	Total	Mean	SD*	DECISION
14.	Overhead Projector	10	14	142	134	300	1.67	0.67	LE
15.	Actuating projector machine	7	14	131	148	300	1.60	0.71	LE
16.	Desk top computers	54	59	100	101	300	1.80	0.76	LE
17.	Tape recorder	9	21	141	129	300	1.70	0.65	LE
18.	Audio cassette player	49	54	110	97	300	2.35	0.64	LE
19.	Slide Projector	11	10	115	164	300	1.56	0.54	LE
20.	Flash cards	13	12	141	134	300	1.68	0.59	LE
21.	Models	15	52	132	101	300	1.94	0.51	LE
22.	Microphone	52	49	96	103	300	2.16	0.47	LE
23.	DVDs	13	12	141	134	300	1.68	0.59	LE
	Grand Total						1.82		LE

Key: VGE = Very Good Extent, GE = Good Extent, LE = Low Extent, VLE = Very Low Extent, SD* = Standard deviation

The results in table 3 above shows that all the items had mean values below the cut-off point 2.0. This shows that the respondents disagreed that all the items mentioned (overhead projector. Therefore, all the instructional materials listed are available to the teachers to a low extent.

There is no significant difference between the mean response scores of teachers and students on the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools in Enugu-East L.G.A

Hypothesis 1

Table 4: T-test analysis of no significant difference between the mean response scores of teachers and students on the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools in Enugu-East L.G.A

S/N		Teachers N=8		Students N=292		P value	Decision
		X	SD	X	SD		
1.	Influence of audio-visual instructional materials on ease of learning	2.91	0.67	3.01	0.84	0.690	NS

Key: S = Significance; S = Not Significance

Table 4 shows the result of the t-test analysis conducted to tests the hypothesis. The p value obtained is 0.690 which is greater than 0.05 at $p<0.05$ level of significance. Therefore, there is no significant difference on the mean response scores of teachers and students on the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools. Therefore the null hypothesis of no significant difference on the mean response scores of teachers and students on the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools was not rejected.

Discussions

The summary of the findings was done based on the responses of the respondents as regard to the research questions which guided the study. In table 1 the respondents agreed that audiovisual materials influence students' performance by making them to remember the concept for longer period of time, convey the same meaning as words but gives clear concepts thus, helping to bring effectiveness in learning, audiovisual also provide opportunities for effective communication between teacher and students, provide variety of teaching and provide interest and inspiration among students. This is in line with findings of Gopal (2010) that audio-visual materials help the teacher to overcome physical difficulties of presenting subject matter since with audio-visual materials, the barrier of communication and distance is broken. Gopal (2010) further emphasized that audio-visual resources can play a major role of making learning permanent. In conclusion, audio-visual methods seem to facilitate the acquisition, retention and the recall of lessons learned because they evoke the maximum response of the whole organism to the situations in which learning is done.

The results of table 2 shows that that audiovisual materials have influence on teachers performance in the sense that it provides variety in teaching, makes teaching to be very easy for teachers, saves time and energy for teachers, help to avoid excessive, empty, and meaningless verbalization in teaching English language and provides variety in teaching of English language concepts. In table 3 it was discovered that audio-visual instructional materials are to a low extent available to the teacher. Perhaps, it is still believed that English language can still be understood theoretically without the use of audio-visual material. Thus, it's no surprise that the respondents disagreed that teachers use audio-visual materials often.

The table 4 shows that there is no significant difference on the mean response scores of teachers and students on the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools. Therefore, teachers and students response did not significantly differ as regards to the influence of audio-visual instructional materials on the ease of learning of English language in secondary schools.

Conclusions

In conclusion, the results of findings show that audio-visual instructional materials to a greater extent reduces the difficulty encountered by students and teachers during the learning of English language. Furthermore, they positively influence teacher's instructional delivery of the subject allowing them to create greater academic impact within a short period of time. Unfortunately, a good number of audio-visual instructional materials are greatly unavailable for teaching and learning English language in the secondary schools.

Recommendations

From the findings of the study, the following recommendations were made:

1. Audio-visual aids should be procured, and distributed in all the secondary schools where they are either lacking or inadequate.
2. Audio-visual instructional materials are useless where it can't be manipulated. Thus, English language teachers should be effectively trained and encouraged to update their knowledge through workshops and presentation.
3. Teachers should be taught to improvise where possible when the electronic materials are not available.

4. Teachers should be encouraged and frequently supervised to ensure adequate and proper utilization of available instructional materials.

References

Adeyangu, F. (2013).Library Experts Speaks on Audio-Visual Material. *A paper presented at the United Nations Educational, Scientific and Cultured Organization (UNESCO).* World Day for Audio-Visual Heritage. Lafia.

Anila, A., Ellington, R., Eric, R, Francine, J. & Glenda, P. M. (2012). Supporting STEM education in secondary science contexts. *Interdisciplinary Journal of Problem-Based Learning* 6 (2) 4

Bolick, N. L. (2013). *The efficacy of the mind map study technique*.

Dike, B.A (2013). The effect of instructional materials on learning of history in selected Primary Schools in Ogbomosho Local Government Area: *Unpublished B.ED Thesis.*

Ebuoh, M. M. (2018). Effects of flat pictures and models on students' academic achievement and retention in English language in senior secondary schools in Enugu Education zone. *Unpublished PhD thesis.* Enugu State University of Science and Technology, Enugu.

Gopal, P. (2010). Digital language laboratory and the teaching of English in India. *Educational Quest – An International Journal of Education and Applied Social sciences* 1(1), 39-45

Mugenda, A. & Mugenda, G. (2019). Research methods: Qualitative and mixed methods approach. *Centre for innovative leadership and governance.*

Onyia, M. N (2013). Instructional materials and design: Issued and Challenges. *Academic Journal of Interdisciplinary studies, 2(6)* 153-158.

DEREGULATION OF EDUCATION MANAGEMENT IN NIGERIA: IMPLICATION FOR EQUALITY OF ACCESS TO POST PRIMARY SCHOOL EDUCATION IN IMO STATE

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Abstract
In the bid to grapple with her socio-economic problems, Nigeria has been experiencing series of reform programmes in which among them are commercialization and globalization of the economy as well as deregulation. The extension of the deregulation programmes of education sector informed the present study; "Deregulation of Education in Nigeria: implications for Equality of Access to Education in Imo State, the purpose of which was to ascertain whether education deregulation could guarantee citizen's equal right to education, ensure standard between public and private educational institution. Four research questions and two null hypotheses were formulated for the study. A twenty-nine item questionnaire was developed and administered to 684 respondents comprising 354 education experts and 330 parents drawn from both of public and private secondary schools in Imo State. The Sampling was done using the multi –stage sampling techniques. The mean scores and standard deviations were used to analyze the data collected while the z-test standard statistics was used to test the two null hypotheses. In the findings, the study discovered that deregulation negates citizen's right to education, once government disengages in funding education. It was discovered that the deregulation does not guarantee equal access to education for all. It also negates equality of standard between private and public schools. Based on the findings, it was recommended that government should provide access to education for public good.

Keywords: deregulation, education, management, equality of access, post-primary, private and public.

Introduction

Deregulation is a neo-liberal economic concept that seeks to open-up institutions or companies by insisting on removal of statutory regulations. As the title connotes, de-regulation means the removal or withdrawal of rules and regulations or some statutory controls from an establishment or organization so that it can compete with other or similar organizations, the warp and woof of this ideology is that barriers to entry or exit into any sector or organization, as hitherto provided by the government, should be discarded and liberalized. With deregulation, an organization or agency is divested of its privileged right of monopoly in the production, provision and distribution of any goods or services. By this measure, noted Enemuo (2015), the veil of protectionism hitherto accorded and enjoyed is thrown aboard and an era of liberalization of access is thereby ushered in. In line with this, Akpotu (2015) opines that deregulation involves the virtual elimination of price, entry and exit controls, and the elimination of monopoly in any individual sub-market. When control of regulation is eliminated or removed, private investor is allowed to come on board, invest and operate in an open market competition. Thus, deregulation denotes a paradigm shift from a public-sector led economy (characterized by restrictive control) to an open and liberalized private sector led economy characterized by emphasis on the logic of market driven competition.

When it comes to education, deregulation means that education will no longer be only a government provided public benefit, but will also include the participation of interested individuals and corporations (Danhassan & Abdulmumirie, 2015).

Deregulation, as applied to the education sector, involves the removal of all types of impediments to entry into the education sector by private persons who are competent and qualified to do so, according to Kalusi and Ozano (2015:15). It is a level playing field for individuals and organizations interested in providing educational services to society's members.

By deregulation, when all control measures are removed, individuals, organizations are encouraged to provide educational services, have access to the same client's ad patronage allowing free market forces to determine fees. With emergence of many secondary schools as a result, parents now have opportunity to make choices, fees might be lowered and quality services provided.

On the other hand, if the investors expect high returns, they may impose prohibitive school fees which weak parents might not be able to afford thereby denying their children rights to some quality education. This can result to inequality in access to education of the children.

Nigeria is known to have a great number of out of school children. With the emergence of privatization and deregulation the number of school children in the streets tends to increase.

Once there are lapses in educational policy and administration, it breeds indiscipline, increase in failure rates, derivation of duties Among staff e.t.c. however, it become vital to identify the extent deregulation of education affect equal access to quality education with a view to tackle them for effective realization of educational objectives.

Broadly stated, the purpose of this study is to determine the implication of deregulation of education in Imo State. Specifically the study seeks to find out the extent to which:

1. A citizen's right is guaranteed in a deregulated school system.
2. Deregulation guarantees equal access of educational opportunity to secondary school students in Imo State.
3. Deregulation of education in Nigeria will enhance the standard of education in both public and private secondary school in Imo State.
4. Deregulation of Secondary education will aid in promoting national unity.

The study would serve as a variable tool in affirming or disproving Neo-liberal economic theory guiding this research; namely Laissez-faire theory by its application to education sector. It would also have immense benefits especially to PTAs of public schools who would be acquainted with the adverse effects of deregulation in sustaining public schools. More so, it would assist them to evaluate their contributions to the schools

It would further give insight to policy makers on whether deregulation assisted in improving or decreasing access to quality education. This would therefore make them consider alternative polices and perhaps needs to restructure the curriculum to provide qualitative education in the school system.

For the government, it would bring to them into focus the understanding that education is a social responsibility that is for public good and as such not to be abandoned to the whims and coprices of deregulation in the ever changing market force competition. It would however assist principals, teachers, Education commission as well as students to organize, and coordinate their school properly. It would finally assist in improving the research work of other researchers. The study tries to cover the degree of citizens rights to quality education and possibility of deregulation promoting access to national unity. It tries also to cover secondary schools in Imo state.

The study is limited to determining the degree of a citizen's right of access to quality education, equality of educational opportunity and the possibility of deregulation promoting the attainment of national unity. The work is limited to secondary schools in Imo State. Secondary school in Imo state are 291 in number, unevenly spread across the three (3) education zones cutting across the three political/ senatorial zones in the state; namely: Owerri, Okigwe and Orlu Zones.

The following research questions guided the study

1. To what extent would deregulation guarantee the citizens' right to education?

2. To what extent would access to equal educational opportunity be guaranteed in a deregulated school system in Imo State?
3. To what extent would educational deregulation, given our peculiar circumstances, guarantee equality in educational standards in both public and private schools
4. To what extent does deregulation of education aid towards promoting national unity?

The following null hypotheses were formulated to guild the study. The null hypotheses were tested at 0.05 level of significance.

1. There will be no significant difference between the mean ratings of education experts, and parents on whether deregulation will ensure citizens' right to education
2. There will be no significant difference between the mean ratings of education experts, and parents on whether deregulation will guarantee equal access to education.

Methods

The design of the study is the descriptive survey research design. The rationale for choosing a descriptive survey research design is in line with Nworgu (2019) who stated that descriptive survey research aims at collecting data on, and describing in a systematic manner, the characteristics features of facts in a given population.

The study tried to cover the secondary schools in Imo State that are spread with the three educational zones and Local Government Area of Imo State.

The population used for the study comprises all the 9136 educational experts (made up of 40 education offices and 9096 teachers) and 125,645 (approximate) parents of secondary school students in the 585 *(459 public and 126 government approved private) secondary schools in Imo State. Secondary Schools teachers, educational officers and parents were chosen because they respectively stand in the best position to assess the advantage and or disadvantage of deregulation policy.

The sample of the study consists of 684 respondents. They were selected using the multi-stage sampling technique. Using the purposive sampling technique, the researcher selected the three education zones in the state. The three zones are Okigwe, Orlu and Owerri. Owing to the manageable number of education officers in the three zones (24 in number) there was no sampling for them. All participated.

At the next level, given that there are 307 (215 public and 92 private) secondary schools in the three zones-thus spread: Okigwe 97 (63 public and 34 private); Orlu 93 (52 public and 41 private) and Owerri 117 (100 public and 17 private), using the proportional Stratified Random Sampling Techniques, 10% of the schools (public and private) in each of the zones was considered representatives as it accords well with Nwana's (2021) recommendation that where the number is a few thousands, (78,879 thousand in the present study) a 10% sampling will do. Following this, 11 (8 public and 3 private), 9 (5 public and 4 private) and 13 (11 public and 2 private) secondary schools were selected from Okigwe, Orlu and Owerri educational Zones respectively.

In all, 33 (24 public and 9 private) secondary schools participated in the study. From each school of the zones came twenty respondents made up ten (10) teachers and ten (10) parents and these was added to the 24 educational officers in the three zones. In sum, 684 subjects participated in the study. All these are as shown in a sample of Respondents' distribution table3. (See appendix ii).

The instrument used for data collection is the questionnaire. The questionnaire is known as: Education Deregulation Appraisal Questionnaire (EDAQ). The researchers developed EDAQ to gather data from the respondents based on the topic with much insight drawn from the literature reviewed.

The EDAQ instrument was a 29 item questionnaire divided into two sections: A and B. while section A is on demography, section B, which has fixed evaluation statement so constructed to aid understanding and response, was divided into four (4) cluster, with A seeking to elicit information on the effect of deregulation on a citizens' right to education. Cluster B focuses on access to educational opportunity. Cluster C dwells on education deregulation and standards between public and private secondary schools while cluster D was focused on Education

Deregulation vis-à-vis the promotion of national unity.

The EDAQ instrument, modeled on four-point rating scale, has response modes of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD) rated 4,3,2 and 1 Respectively.

The instrument was face-validated by three experts, one Philosophy of Education, and another in Measurement and Evaluation and the third in Arts Education (Educational Technology). They were requested to study the items and assess the instrument in terms of language, relevance, comprehensibility and comprehensiveness. Their corrections and comments were used to modify the questionnaire. The modification gave rise to the final draft which was produced and eventually administered on the respondents.

In order to establish the reliability of the instrument, a test retest exercise was carried out using 20 respondents drawn from three education zones of Isiala Mbano, Ehime and Ihite Oboma. These are all outside the educational zones being used for the study. After two weeks the same instrument was administered to the same respondents again. The interval of two weeks was necessary to check recall effect and bias. Furthermore, the test-retest sample of 20 respondents was decides in favor of as following Croker cited in Onwuka (2019), the correlation co-efficient yields better results with group below 30.

Using the Cronbach alfa, the data were analyzed to establish the internal consistency and reliability of the instrument. It yielded the following results: cluster A (on education deregulation and citizen's right to education) yielded. 6568, cluster B (on education deregulation and access to equal educational opportunity (5217, cluster C (on equality of standard between public and private secondary school). .6678, cluster D on deregulation and promotion of national unity) 7218. These gave a sum total of 0.76 reliability co-Efficient interpreted to mean that the instrument is Reliable.

The instrument was administered to the respondents using trained research assistants who were employed by the teachers for the purpose. In each of the selected schools used, teachers were used to reach at the students, through whom the literate parents were reached.

The frequencies and the mean scores (both descriptive statistics tools) were used to analyze the data collected, all towards providing answers to the research questions guiding the study. A mean of 2.5 was used to establish a cut-off point. In other words, items with mean scores of 2.50 and above were categorized as meeting the acceptance mean and accordingly accepted, and those below the 2.50 mean were rated as not meeting the acceptance mean accordingly rejected. The z-test statistics was used to test the null hypotheses at 0.05 alpha levels.

Results

The extent deregulate guarantee citizens' right to education?

Data in respect of result were analyzed descriptively using the mean statistics and the findings are reported on Table 1 following, where X_1 = the mean of education experts; X_2 = the mean of parents; and X the mean of X_1 and X_2

Table 1: mean rating of education experts and parents on deregulation and citizen's right to education

S/N	ITEM	Education Experts			Parents						Rank
		X_1	SD	*DEC*	X_2	SD	DEC	X	SD	DEC	
1	The extent Education is a fundamental right	3.56	0.6.8	SA	3.64	0.66	SA	3.60	0.67	Accept	5
2	The extent Deregulation negates citizens right to Education	3.56	0.68	SA	3.64	0.66	SA	3.60	0.67	Accept	5
3	The extent Deregulation leaves citizens' education to the vagaries of force competition	3.66	0.5	SA	3.78	0.48	SA	3.72	0.49	Accept	4
4	The extent Right to education will be limited by prohibitive fees in a deregulated education system	3.76	0.42	SA	3.74	0.48	SA	3.75	0.45	Accept	3
5	The extent Right to education is not guaranteed for the less privileged in a deregulated education system	3.84	0.44	SA	3.78	0.50	SA	3.81	0.47	Accept	1
6	The extent The financial capability of parents will determine right of access if education is deregulated	3.82	0.36	SA	3.76	0.44	SD	3.79	0.40	Accept	2
	Cluster mean	3.70	0.51	SA	3.74	0.50	SA	3.72	0.51	Accept	

The extent access to equal educational opportunity be guaranteed in deregulated system?

The data for the results above were analyzed descriptively using the mean statistics and the findings are reported on Table 2 following, where X_1 = the mean of education experts; X_2= the mean of parents and X = the mean of X_1 and X_2.

Table 2: mean rating of education experts, and parents on deregulation and access to equal Education opportunity.

S/N	ITEM	Education Experts			Parents						Rank
		X_1	SD	*DEC*	X_2	SD	DEC	X	SD	DEC	
7	The extent Deregulation of education creates wide range of admission choice	3.24	0.82	SA	3.16	0.62	SA	3.2	0.72	Accept	5
8	The extent Deregulation negates the UNO declaration of equal access to education on the basis of merit	3.64	0.64	SA	3.68	0.54	SA	3.66	0.59	Accept	4
9	The extent Access to good education/school will depend on one's ability to pay	3.84	0.46	SA	3.82	0.38	SA	3.83	0.42	Accept	3
10	The extent Deregulation does not guarantee equal and adequate education to children of different economic background	3.88	0.42	SA	3.86	0.38	SA	3.85	0.40	Accept	2
11	The extent Deregulation makes education elitist only the rich can afford quality education usually provided in costly private schools	3.84	0.48	SA	3.82	0.42	SA	3.83	0.45	Accept	3
12	With Deregulation, The extent the poor students stand disadvantaged	3.86	0.34	SA	3.86	0.36	SA	3.86	0.35	Accept	1
	Cluster mean	3.73	0.53	SA	3.70	0.45	SA	3.71	0.49	Accept	

The extent Deregulation guarantee equality of standard between public and private secondary schools?

Data in respect of result three were analyzed descriptively using the mean statistics and the findings are reported on table 3 below, where X_1 = the mean of X_1 = the mean of education experts; X_2 = the mean of parents; and X= the mean of X_1 and X_2.

Table 3: mean rating of education experts and parents on deregulation vis-s-vis equality standard between public, and private school.

S/N	ITEM	Education Experts			Parents						Rank
		X_1	SD	*DEC*	X_2	SD	DEC	X	SD	DEC	
13	The extent Deregulation will stimulate competition between public and private schools	2.86	0.88	A	2.7	0.93	A	2.81	0.90	Accept	7
14	The extent deregulation does not favor equality of standard between public and private schools	2.92	0.86	A	3.01	0.86	SA	2.96	0.86	Accept	
15	The extent competition between public, and private school will result to better standard	2.56	1.02	A	2.52	1.04	A	2.54	1.03	Accept	9
16	The extent best graduate students in secondary school to be preferable to public schools	3.11	0.64	SA	3.06	0.86	SA	3.09	0.75	Accept	5
17	The extent deregulation will make private school to be preferable to public school	2.56	0.88	A	2.54	0.92	A	2.55	0.90	Accept	8
18	The extent deregulation will make cause migration of good teachers to high-paying schools	3.76	0.64	SA	3.24	0.78	SA	3.20	0.71	Accept	4
19	The extent deregulation do not guarantee the substance of public education	3.46	0.66	SA	3.44	0.66	SA	3.45	0.66	Accept	2
20	The extent deregulation will lower standard because prospectors will be profit-making	2.78	0.98	A	2.82	0.88	A	3.80	0.93	Accept	1
21	The extent Deregulation will create schools for haves and schools-for-haves-nots	3.44	0.64	SA	3.41	0.46	SA	3.42	0.55	Accept	3
	The extent deregulation aid the promotion of national unity										

Data in respect of result four were analyzed descriptively using the mean statistics and the finding are reported on Table 4 below, where X_1 = the mean of education experts; X_2 = the mean of parents; and X = the mean of X_2 and X_2.

Table 4: mean rating of education experts and parents on deregulation vis-à-vis the promotion of national unity.

S/N	ITEM	Education Experts			Parents						Rank
		X_1	SD	*DEC*	X_2	SD	DEC	X	SD	DEC	
22	Education is an instrument for national unity and integration	2.68	0.94	A	2.66	0.86	A	2.65	0.90	Accept	8
23	Deregulation does not favor the national principle of freedom equality and justice	3.16	0.66	SA	3.14	0.62	SA	3.15	0.64	Accept	5
24	Deregulation widens the social gap between the rich and poor	3.76	0.52	SA	3.78	0.42	SA	3.77	0.47	Accept	2
25	Deregulation will discourage students from studying outside their tribe and or place of birth	3.76	0.68	SA	3.78	0.42	SA	3.51	0.55	Accept	4

There will be no significant difference between the mean ratings of education experts and parents on whether deregulation will ensure citizens' right to education.

Table 5: Result of z-test Analysis of Education Experts and Parents on Education Deregulation and Citizens right to Education

Categories	N	X	SD	DF	Level of sig.	z-cal	z-table	Dec
Education Experts	354	3.70	0.51	682	0.05	-1.03	1.96	110_1
Parents	330	3.74	0.50					Accepted

Table 5 above presents the z-test analysis of the mean ratings of education experts and parents on the phenomenon of education deregulation and citizen's right to it. An examination of the table indicated shows the critical value required for significance at 682 degree of freedom at 0.05 confidence level is 1.96. Given this, the calculation z-value (z-cal) of 1.03 is not significant, an indication the views of the respondents are appreciably the same. The null hypothesis is, therefore, accepted.

There will be no significant difference between the mean ratings of education experts and parents on whether deregulation will equal access to education.

Table 6: Result of z-test Analysis of views of Education Experts and parents on Education Deregulation and Access to equal Education opportunity

subjects	N	X	SD	DF	Level of sig.	z-cal	z-table	Dec
Education Experts	354	3.72	0.52	682	0.05	0.54	1.96	110_1
Parents	330	3.70	0.45					Accepted

Table 6 above presents the z-test analysis of the mean ratings of education experts and parents on education deregulation and access to equal educational opportunity. The critical value required for significance of these means at 682 degree of freedom (df) at 0.05 percentage probability level is 1.96. With the calculated z-value (z-cal) being 0.54, the indication is that it is not significant. Therefore, the respective null hypotheses are accepted, meaning in effect that the views of the two classes of respondents (education experts and parents) do not differ appreciably.

Discussions

Analysis of data in respect of the findings show that all the related items met the accepted criterion mean of 2.50 and above on the four-point ratings scale. Consequent upon this, it is perspective of both the parents and education experts, the deregulation, inter alia, constitutes a potent threat to a citizen's right to education as a fundamental right; leaves quality education more as a preserve of children whose parents are financially capable, all consequent on the prohibitive fee the institution of learning charge. This contradicts the intents of Article 26 of the universal deregulation on human rights (to which Nigeria is a signatory) with a provision that everyone has the right to education. Education shall be free at least in the elementary and fundamental stages. Elementary education shall be compulsory …. Higher education shall be equally accessible to all on the basis of merit.''

Findings in the table two showed that all the items met the acceptance criterion mean of 2.50 and above in the four –point rating scale. Thus, both the parents and education experts agreed that education deregulation has all it takes to, provide parents and their wards with a wide range of school choices; but does not guarantee equal access to education to children of different economic background; makes access to quality education elitist; at the disadvantage of poor students, and in all constitutes an antithesis to the UNO declaration of equal access to education on the basis of merit. Accordingly to Mbipom and Achibong (2015), this is exemplified in the emergence of private schools at all levels of the nation's education system. Malogo (2015) opined the deregulation makes education to be hijacked by men of wealth and influence" and for Onigbo (2015), with deregulation education becomes a preserve for children of the blessed elite families. S much as these findings are interested and understandable, they are no less disturbing; dieturbing for the fact that it is against the spirit and interests of the constitution 9the ground norm of our legal system which in S.42 (2) provides that "no citizen of Nigeria shall be subjected to any disability or deprivation merely by reason of the circumstances of his birth "(FRN-1999).

Findings in the table three reveals that with no exceptions all the items met the acceptance criterion mean of 2.50 and above on the four-point rating scale. Consequent on his, both the education experts and parents seem agreed the deregulation of education, among other things, stimulates competition between public and private schools but will not guarantee equality of standard in such schools' creates a situation where private educational institutions will be the most sought after and consequent in the bring about a social milieu of schools of the "haves" and the "have not". The finding is line with Okafor (2022) and Mbipom and Achibong (2015) views and findings that deregulation stimulate competition between public and private schools, all the same, the findings give course for concern and worry because as noted by Sanyaolu (2015), deregulation neither favours nor guarantee equality of standard among schools. And

what is more, because deregulation precipitates a situation where the private schools will turn out to be most sought after (Adeiyi (2015), Enemou (2015) and Fasana (2006)) because of apparent availability of equality education (which all the same is not accessible to children of different economic backgrounds (Malago (2015)), it will end up balkanizing our educational institutions into schools of the "haves" and "the have not" (Shuiab, 2005).

Findings in table four shows that education experts and parents agreed the education in instrument to forging nations unity (as in formed is setting up unity schools)

However limiting access to quality education of children of different does not favour principles of freedom, justice and access to education.

Apart from limiting access to education, Shuaib (2015) and kalusi and Ozano (2015) have noted the deregulation will widen the gap between the rich and the poor in matters of access to quality education. And what is more, noted Sanyaolu (2016), the policy of deregulation has cause the "unity" schools to starts losing in their unity functions.

In data analysis showed the calculated z-value of -1.03 being lower than the critical value of 1.96, therefore, there is no significance difference between the responses from the two classes of respondents, namely; the education experts and parents on the issue of deregulation of education and citizens' right to it. This is also in line with the findings of Oguntuase (2015), Shuaib (2015) and wakocha (2015) that citizens' right education will suffer enormous restriction consequent on the regime of prohibitive fees that will ensure.

Analysis of data finding showed also that the calculated z-value of 0.54 being lower than the critical value of 1.96. Therefore the views of education experts and parents on this issue of equality of access to education in deregulated social milieu do not significantly differ leading to the acceptance of the null hypothesis. Consequently, access to quality education is obvious only to those who can "pay" leaving those unable to "pay" with no other option than the decaying public schools (shuaib, 2005). Rightly did Malogo (2006) lament that under the deregulation milieu, education would be hijacked by men of wealth and influence.

Recommendations

Sequel to the findings of the study and the educational implication arising there from, the researcher recommends as follows

1. Government should be cautions in adopting educational deregulation bearing in mind that while the policy is an economic theory, education is not a commodity but a public good. In fact, rather than deregulation education, the dividends accruing to government from the deregulation of other more business sectors should be used to fund education,.
2. Government should continue to fund public schools so as to make them viable and able to engage the private schools in competition not just for clientele but also for standards otherwise our public schools which are fast dwindling in standard and viability will sooner than later come to constitute and matter just for the concern of historians.
3. Adequate provision should also be made by the government for children of low income families to have access to quality education through awards of scholarships and bursary provisions. In the end, the graduates from public and private schools could be seen competing for job openings on equitable grounds.
4. Although deregulation policy is welcome because of its positive character of breaking monopolies and removing protectionism, it should be noted that the enabling environment is not yet ripe in Nigeria considering our very low literacy level (57%). Consequent on this, it believes on government and consumers of product of education-private and corporate organizations to join hands and ensure sustainable quality education. More so, government is expected therefore to monitor closely school fees charged by private schools to avoid excessive profit at the expenses of quality teaching and learning.

References

Adeniyi, O. (2016). Reforming the education sector. *This Day Newspaper* December 1,P.17

Akpotu, N.E. (2015). Deregulatng the Nigeria university system for equity and access. In Akpa, G.O, Udoh, S.U & Fagbemiya, E.O. (eds) *Deregulating the provision and management of education in Nigeria.* Jos: Ginec concept. Pp.59-64

Asogwa, T.E. (2008), Deregulation of Education in Nigeria: Implication for equal access to Education in Enugu State. *M.ED Thesis U.N.N*

Danhansan, M. A. & Abdulmunine (2015). Deregulation of Education and Citizenship Right to Education: Acritical analysis. In A.O. Enoh, *Deregulation of Education in Nigeria: Philosophy perspective* pp 23-28

Enemuo, P.C. (2015). An Appraisal of Derugulation of Education in Nigeria and Attainment of National Objectives. *In Nigerian Journal of Educational philosophy* 12(1), 50-57.

Fasana, R. (2016). Let the unity schools go (2). Vanguad Newspaper, November 28,p.40

Federal Republic of Nigeria (1999). *Constitution of the Federal Republic of Nigeria*, Lagos: Government press, lagos.

Kalusi, J.I. & Ozano, P.B.O. (2015). Deregulation of education and citizenship right to education in Nigeria. *In Nigeria Juornals of Educational Philosophy*. 12(1) 14-19.

Kalusi, J.I. & Ozano, P.B.O (2015). Deregulation of education and citizenship right to education in Nigeria: *Nigerian Journals of Educational Philosophy* (NJEP) 12(1)pp 14-19

Malogo, B. (2006). Unity school and a minister's spunk. The Guardian *Newspaper*, November 16, p.77.

Mbipom, G. & Archibong, I.J. (2015). Student's perception of education deregulation policy in south-Eastern Nigeria federal Universities. In Akpa, G.O, U doh, S.U. & Fegbamiye, E.O. (eds)

Deregulating the provision and management of education in Nigeria. Jos: M.P Ginac concept Ltd. pp 82-86.

Nwana, O.C. (1981). *Introduction to educational research*. Ibadan: Heinemenn Educational bks (Nig) ltd.

Ocho, L.O. (2012) the role of educational administration an dplanners in Achieving Educational Administration and planning. Journal of educational administration and planning 2 (1), 7.

Okafor, F.C. (1985), PHILOSOPHY OF Education. Third World Perspective, Washington: Brandsmics publishing.com

Oguntuase, J.T. (2015). An evaluation of private participation in the provision of education in the federal capital territory Abuja. In Akpa, G.O, Udoh, S.U & Fagbamiye, E.o.(ed) *Deregulating the provision and management of education in Nigeria.* Jos: Ginac Concept ltd. pp. 164-168.

Onuigbo A.U. (2015). The myths and realities of globalization and deregulation of education sector in Nigeria. In enoh, A.O. (ed) *Deregulation of education in Nigeria: philosophical perspective*. Jos: Saniez press. Pp 136-143.

Sanyaolu, K. (2016, October 8). From unity to privilege schools. In *the guardian Newspaper*, p. 53.

Shuaib, Y.A. (2006). Theory of privatizing education. *New Nigerian Newspaper*, p. 10.

Wokocha, A.M, (2015). Education and deregulation in Nigeria. *Nigeria journal of Educational Philosophy* (njep), 12(1). Pp. 1-7.

UTILIZATION OF INNOVATIVE EDUCATIONAL SOFTWARE BY MATHEMATICS AND COMPUTER SCIENCE LECTURERS IN TERTIARY INSTITUTIONS IN ENUGU STATE

BY

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Abstract
The main purpose of the study was to ascertain the extent of utilization of innovative educational software by mathematics and computer science lecturers of tertiary institutions in Enugu state. Two research Questions were formulated to guide the study, while two null hypotheses were tested at p < 0.05. Descriptive survey research design was adopted for the study. The population for the study comprised 73 lecturers in ICT- related Departments in Enugu State public tertiary institutions. A researcher's made structured questionnaire titled extent of utilization of Educational software Questionnaire (AUESQ) was used as the instrument for data collection. The instrument was face validated by three experts from the Department of Science and Computer Education; one expert in measurement and evaluation and the other two in computer Education all in Faculty of Education, Godfrey Okoye University. Reliability coefficient of 0.76 was obtained using Cronbach Alpha. The research questions were answered using mean and standard deviation. The hypotheses were tested with t-test and analysis at 0.05 level of significance. The findings revealed that the extent of utilization of Innovative educational software by mathematics and computer science lecturers in tertiary institutions in Enugu state was low. It was recommended among others that the management of tertiary institutions should organize regular workshop and conferences to equip mathematics and computer science lecturers with the relevant of ICT skills needed to compete with their contemporaries in developed countries of the world.

Keywords: *innovative educational software, lecturers, mathematics, computer, education, tertiary institutions*

Introduction

Technology has revolutionized the world in which schools operate. Since the 20th century, Technology has, become an integral part of the educational system. Currently, around the globe, technologies have permeated the process of teaching, learning, research and almost every element of educational process. This trend has continued to evolve and get better, and at every point in time, more technologies are developed and deployed to suit contemporary societal needs and situations. Computer has become of the prominent technologies which has infused significantly in education and has over the years increased in sophistication and usefulness. The use of computer in the education system has received more attention for improving the standard of learning, as

well as teaching. Various resources such as computer, internet, broadcasting, technologies are being used to improve the education system (Majoka, Fazal & Khan, 2013). In earlier days teachers were not much aware of the need bringing computers to an essential part of their day to day activities. Moreover, it was impossible to do study in foreign country without going over there. Computers make it possible by using various technologies such as online education, distance education, computer aided courses and so on in the field of education. No doubt, computers have become essential for everyone in every field. Teachers now use technologies like smart classes, LCD projectors, EDUCOM, Laptop, memory sticks in their classroom to make effective learning process (Dabas, 2018).

Computers were born basically outs need of man's need for calculations. According to Hemmendinger (2019), computer once meant a person who did work of human endeavor. Eziokwu (2019) defined computer as a machine that can be instructed to carry out sequences of arithmetic or logical operations automatically via computer programming. It is defined as a technological innovation that controls the stored programs that can perform some of the intellectual roles of man even beyond human capability. It is a power- driven machine equipped with keyboards, electronic circuits, storage compartments, and recording devices for the high speed performance of mathematical and other numerous operations (Tayo, Ajibade and Oyedokun, 2019). The computer comprises of several components which are needed to carry out different but integrated functions. The basic components of a computer system are hardware, software and metalworking components (Eziokwu, 2019). Computer software is a collection of data or computer instructions that tell the computer how to work. This is in contrast to physical hardware, from which the system is built and actually performs the work. In computer science and software engineering, computer software is all information processed by computer systems, programmes and data. Computer software includes computer programmes, libraries and related non executable data, such as online documentation or digital media. Computer hardware and software require each other and neither can be realistically used on its own (Wikipedia, 2019). There are different types of computer software. According to Eziokwu (2019), the two main types of computer software are the system software and the application software. The system software provides the platform for users to install and run application software, and it's made up of multiple programs needed to run a computer system smoothly. Application programs are designed to perform specific tasks. The specific tasks determine the type of Application software that is needed. There are several types of Application software which are Educational software, Entertainment Software, Basic Software, Medical software, Biological Software, Analytical Software, among others.

Educational software refers to any and all software designed for use in the education industry. The software includes everything from student information systems and classroom management software to reference management software and language learning software (Generation 2, 2020). According to Wikipedia (2019), educational software is a term used for any computer software which is made for an educational purpose. It encompasses different ranges from language learning software to classroom management software and to reference software, etc. The purpose of educational software is to make education more effective and efficient. Some of the educational software include: Learning Management System (LMS), Student Information System (CMS) and Assessment software (AS). Learning Management System (LMS) serves as a central hub where teacher and lecturers can upload and organize course material for student access. Schools and universities use learning management system to reduce the use of paper, as well as make documents available out of the classroom. Examples of LMS include Canvas, Google Classroom, Blackboard learn, and so on (Generation 2, 2O20).

Student Information System (SIS) store and track all students' information including grades, attendance records, and more. SIS products are used by teachers, students and parents to communicate all relevant information pertaining to a student's schooling. Examples of this software include power school SIS, Gradelink, Elucian Banner, and so on. Classroom Management system is used by teachers to add

another dimension to lessons. These tools typically add an interactive element to lesson. These tools typically add an interactive element to lesson plans that better engage students. Examples include McGraw Hills Connect, power school unified, Lanuschool, Edsby, and others. Assessment software provides students with a portal to take computerized tests and quizzes. Popular Assessment products used by Education professionals include survey Anyplace, Canvas, Kahoot, McGraw Hill Connect, and so on. Despite the importance of the educational software, Nannim, Yushau & Gital (2018) reported that the lecturers' level of awareness of ICT Facilities for teaching purpose was low. The same result is found in the research done by Kpolovie & Awusaku (2016) who revealed that ICT adoption attitude of lecturers was lowly negative. Eziokwu (2019) reported further that it is the Computer Studies teachers that should have be leading in the area of using computers application like LMS, CMS, AS in their area of teaching, as such application helps to improve teaching and learning of Computer Studies and reduces any form of malpractices done in education.

These negative reports from scholars on lecturers/teachers gave a negative indication that the extent of Utilization of Innovative Educational Software among Mathematics and Computer Lecturers in Tertiary Institutions will be low. However, there is need for the researchers to determine the extent of Utilization of Innovative Educational Software among Mathematics and Computer Lecturers in Tertiary Institutions in Enugu State in order to be assertive on the state of Utilization of Innovative Educational Software among Mathematics and Computer Lecturers since that the researchers have discovered from literature that there is no study that determined the extent to which lecturers utilize them in Nigeria, especially in Enugu State.

Technology has permeated the process of teaching, learning, research and almost every element of educational process. This trend has continued to evolve and get better, and at every point in time, more technologies are developed and deployed to suit contemporary societal needs and situations. Computer has become of the prominent technologies which has infused significantly in education and has over the years increased in sophistication and usefulness. The use of computer in the education system has received more attention for improving the standard of learning, as well as teaching. Teachers now use technologies like smart classes, LCD projectors, EDUCOM, Laptop, memory sticks in their classroom to make effective learning process but teachers in Secondary Schools do not use computer applications like Learning Management System (LMS), Student Information System (CMS) and Assessment software (AS). This is because such teachers are not exposed during their days in tertiary institutions especially the Computer teachers (Eziokwu, 2019). This report tailed with the reports of other scholars revealed that there is low level of the lecturers' awareness on ICT Facilities for teaching purpose. These reports give a negative indication that the extent of Utilization of Innovative Educational Software among Mathematics and Computer Lecturers in Tertiary Institutions will be low. This prompted the researchers to determine from the teachers of Tertiary Institutions if the same result will be obtained since that the researcher discovered from literature that no study known has examined the extent to which lecturers utilize them in Enugu State. Hence, the researchers decided to determine the extent of Utilization of Innovative Educational Software among Mathematics and Computer Lecturers in Tertiary Institutions in Enugu State.

The main purpose of the study was to ascertain the extent of Utilization of Innovative Educational Software among Mathematics and Computer Science Lecturers in Tertiary Institutions in Enugu State. Specifically, the study seeks to ascertain the:

1. Extent of utilization of innovative educational software by Mathematics and lecturers of tertiary institutions in Enugu State.
2. Extent of utilization of innovative educational software by computer science lecturers in tertiary institutions in Enugu State.

The following research questions were formulated to guide the study.

1. What is the extent of utilization of innovative educational software by Mathematics lecturers of tertiary institutions in Enugu state?

2. What is the extent of utilization of innovative educational software by computer science lecturers in tertiary institutions in Enugu state?

HO1: There is no significant difference in the mean scores of Mathematics and Computer Science lecturers of tertiary institutions on their extent of utilization of innovative educational software.

Methods

Descriptive survey research design was adopted for the study. The research design chosen for the study involves the collection of data from a representative sample of the population of lecturers based on which generalizations can be made.

The study covered tertiary institutions in Enugu State. Enugu State is located in the South-East of Nigeria. The state is bounded on the East by Ebonyi State, on the west by Anambra State, North by Kogi state and South by Abia State.

The population for the study was 165 Mathematics and Computer Science lecturers in Mathematics and Computer Science departments in public tertiary institutions. The population comprises of 67 Mathematics Lecturers and 98 Computer Science Lecturers in public tertiary institutions. Also, the population comprises 85 Mathematics and Computer Science Lecturers in universities, 34 in polytechnics and 46 in Colleges of Education.

The sample size for the study was 165 lecturers in Mathematics and Computer Science departments in public tertiary institutions, which comprises of 67 Mathematics lecturers and 98 Computer Science lecturers in public tertiary Institutions. No sampling techniques was used because the population of the study was very small which is manageable.

A researcher-made structured questionnaire titled ‘’Utilization of Educational Software Questionnaire (AUESQ)’’ was used as the instrument for data collection. It comprised 22 items from sections, in line with the research questions which guided the study.

The instrument was face validated by experts from the Department of Science and Computer Education; one expert in Measurement and Evaluation and the other two in Computer Education, all in the Faculty of Education, Godfrey Okoye University, Enugu

Reliability coefficient of 0.87 was obtained for the items, using Cronbach Alpha, which indicated that the instrument is reliable and suitable for use.

The researcher, with the help of two trained research assistants, visited each of the tertiary institutions to administer the questionnaire to the respondents. The distributed copies of questionnaire were collected after completion on a date agreed by each of the respondents and research assistant. Out of the 164 copies administered, only 154 were successfully retrieved. This gave a 93.3% return rate.

The research questions were answered using mean and standard deviation. The null hypotheses were tested with students at 0.05 level of significance. t-test was considered appropriate for testing the hypotheses as only two levels of an independent variable (that’s Mathematics and Computer Science Lecturers) for the Null Hypothesis (Uzoagulu ,2011).

Results

Research Question 1: What is the extent of utilization of innovative educational software among Mathematics and Computer Science lecturers of tertiary institutions in Enugu state?

Table1: Mean Scores and Standard Deviations on the Extent of Utilization of innovative educational software among Mathematics and Computer Science lecturers of tertiary institutions in Enugu

SN	ITEMS	UNIVERSITY		POLYTECHNIC		OVERALL		DEC
		$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	
1.	Canvas	2.15	0.86	1.91	0.62	2.03	0.74	LE
2.	Google Classroom	2.09	0.81	1.93	0.77	2.01	0.79	LE
3.	Blackboard Learn	1.85	0.86	1.97	0.38	1.91	0.62	LE
4.	SAP Litmos	1.76	0.72	2.42	0.66	2.09	0.69	LE
5.	Talent LMS	2.26	0.73	1.82	0.73	2.04	0.73	LE
6.	Moodle	1.93	0.88	1.83	0.30	1.88	0.59	LE
7.	Power School	1.77	0.86	2.29	0.66	2.03	0.76	LE
8.	Gradelink	2.01	0.68	1.97	0.70	1.99	0.69	LE
9.	Elucian Banner	2.21	0.59	1.77	0.99	1.99	0.79	LE
10.	InfiniteCampus	2.27	0.59	1.73	0.89	2.00	0.74	LE
11.	Skyward Student Management Suit	1.83	0.9	2.47	0.58	2.15	0.74	LE
12.	Munis	1.99	0.84	2.15	0.64	2.07	0.74	LE
13.	Dyknow	1.96	0.84	2.12	0.58	2.04	0.71	LE
14.	ClassDojo	1.76	0.82	2.24	0.48	2.00	0.65	LE
15.	McGraw Hill Connect	1.94	0.63	2.32	0.63	2.13	0.63	LE
16.	LanSchool	2.04	0.74	2.16	0.66	2.10	0.70	LE
17.	Power School Unified Classroom	2.03	0.67	1.95	0.79	1.99	0.73	LE
18.	Edsby	1.79	0.61	2.19	0.85	1.99	0.73	LE
19.	Kahoot	2.34	0.63	1.58	0.79	1.96	0.71	LE
20.	Survey Anyplace	2.34	0.63	1.36	0.77	1.85	0.70	LE
	Total	2.02	0.74	2.01	0.67	2.02	0.71	LE

Table 2 shows the Mean Scores and Standard Deviations on the Extent of Utilization of innovative educational software among Mathematics and Computer Science lecturers of tertiary institutions in Enugu. The results showed that item 1 to 20 have mean scores that are less than the cutoff point of 2.50, thus, responses were considered to be low extent. This implies that mathematics and computer science lecturers have low level of utilization of innovative educational software. Furthermore, the overall mean

score and standard deviation were 2.02 and 0.71 respectively, which indicates that the extent of utilization of innovative educational software among Mathematics and Computer Science lecturers is low.

Research Question 2: What is the extent of utilization of innovative educational software among Mathematics and Computer Science lecturers of universities, polytechnics and colleges of education in Enugu state?

Table2: Mean Scores and Standard Deviations on the Extent of Utilization of Innovative Educational Software among lecturers of universities, polytechnics and colleges of education in Enugu State

SN	ITEMS	UNIVERSITY		POLYTECHNIC		COLL. OF EDUCATION		OVERALL		DEC
		$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	
1.	Canvas	1.96	0.85	2.18	0.66	1.96	0.64	2.03	0.74	LE
2.	Google Classroom	2.04	0.65	2.00	0.82	2.00	0.69	2.01	0.79	LE
3.	BlackboardLearn	2.00	0.68	1.82	0.50	1.89	0.68	1.91	0.62	LE
4.	SAP Litmos	2.26	0.71	2.00	0.69	1.94	0.64	2.09	0.69	LE
5.	Talent LMS	2.07	0.78	2.14	0.71	1.89	0.68	2.04	0.73	LE
6.	Moodle	1.89	0.58	1.91	0.61	1.83	0.62	1.88	0.59	LE
7.	PowerSchool	2.04	0.81	2.09	0.81	1.94	0.64	2.03	0.76	LE
8.	Gradelink	2.04	0.65	2.05	0.72	1.83	0.71	1.99	0.69	LE
9.	Elucian Banner	2.07	0.73	2.00	0.87	1.83	0.79	1.99	0.79	LE
10.	Infinite Campus	1.96	0.71	2.18	0.73	1.83	0.79	2.00	0.74	LE
11.	Skyward Student Management Suit	2.15	0.72	2.23	0.75	2.06	0.80	2.15	0.74	LE
12.	Munis	2.07	0.78	2.14	0.77	2.00	0.69	2.07	0.74	LE
13.	Dyknow	2.07	0.68	2.05	0.79	2.00	0.69	2.04	0.71	LE
14.	ClassDojo	2.04	0.71	2.00	0.69	1.94	0.54	2.00	0.65	LE
15.	McGraw Hill Connect	2.15	0.60	2.23	0.61	2.00	0.69	2.13	0.63	LE
16.	LanSchool	2.26	0.66	1.91	0.68	2.11	0.76	2.10	0.70	LE
17.	PowerSchool Unified Classroom	2.07	0.68	1.73	0.83	2.17	0.62	1.99	0.73	LE
18.	Edsby	1.93	0.68	2.18	0.80	1.83	0.71	1.99	0.73	LE
19.	Kahoot	1.93	0.83	2.09	0.61	1.83	0.62	1.96	0.71	LE
20.	SurveyAnyplace	1.74	0.53	1.82	0.73	2.06	0.87	1.85	0.70	LE
	Total	2.03	0.70	2.05	0.72	1.95	0.70	2.02	0.71	LE

Table 2 shows the Mean Scores and Standard Deviations on the Extent of Utilization of innovative educational software among lecturers of universities, polytechnics and colleges of education in Enugu State. The results showed that item 1 to 20 have mean scores that are less than 2.50. Thus, the responses were considered to be low extent. This implied that lecturers have low level of utilization of innovative educational software in universities, polytechnics and colleges of education in Enugu State.

Testing of Research Hypotheses

HO1: There is no significant difference in the mean scores of Mathematics and Computer Science lecturers of tertiary institutions on their extent of utilization of innovative educational software.

Table 4: Student's t-test on the mean scores of Mathematics and Computer Science lecturers of tertiary institutions on their extent of utilization of innovative educational software

	Mean Difference	Std. Error Difference	t	Df	Sig. (2-tailed)	Decision
Equal variances assumed	.010	.115	.087	152.000	.931	NS
Equal variances not assumed	.010	.117	.086	124.679	.932	

Hartley test for equal variance: F = 1.220, Sig. = 0.1913

Table 4 shows the Student's t-test on the mean scores of Mathematics and Computer Science lecturers of tertiary institutions on their extent of utilization of innovative educational software. The table shows that the F-value of Hartley test for equal variance is 1.220 and the significant value is 0.1913 which means that t-test should be tested at Equal Variances Assumed where the t-test is 0.87 and the significant value is .931. Since that the significant value of .931 is greater than 0.05, the null hypothesis 1 is not rejected, thus it is not significant. Therefore, there was no significant difference in the mean scores of Mathematics and Computer Science lecturers of tertiary institutions on their extent of utilization of innovative educational software. It means that the higher mean score of Mathematics Lecturers on the Computer Science Lecturers is not significant.

Discussions

The summary of the finding is that the extent of utilization of innovative educational software by the Mathematics and Computer Science lecturers in universities, polytechnics and colleges of education is low and there was no significant difference in the mean scores of lecturers in universities, polytechnics and colleges of education. The findings is in line with the observation of Kpolovie and Awusaku (2016), that lecturers in Nigeria have adopted and utilized contemporary ICT facilities to a low extent.

Conclusions

The study revealed that the extent of utilization of innovative educational software by mathematics and computer science lecturers in universities, polytechnics and colleges of education in Enugu state is low. This implies that the universities, polytechnics and colleges of education are backward in terms of global trends in the adoption and use of ICT for teaching and research. This calls for concerted efforts on the parts of educational stakeholders towards addressing the anomaly in a bid to placing the Nigerian tertiary institutions in the league of competitive institutions in the world.

Recommendations

Based on the findings of the study the researcher recommends that:

1. The management of universities, polytechnics and colleges of education should organize regular workshops and conferences to equip mathematics and computer science lecturers with the relevant of the ICT skills needed to compete with their contemporaries in developed climes
2. The federal and state ministries of Education should sponsor and fund initiatives directed

towards building capacities in the area of ICT. This may include sponsoring mathematics and computer science lecturers for local and international courses in the field of educational technology.

References

Dabas, N. (2018). Role of Computer and Information Technology in Education System. *International Journal of Engineering and Techniques*, 4(1); 570-574.

Eziokwu, P.N. (2019). Extent of Awareness by the Computer Studies Teachers in Enugu Education Zone. *Journal of Educational Professionals* 1(2); 457 – 467.

Generation 2 (2020). Best education software. *http://www.g2.com/categories/education*

Kpolovie, P.J & Awusaku, O.K (2016). ICT Adoption Attitude of Lecturers. *European Journal of Computer* science *and Information* Technology, 4(5); 39-57.

Majoka, M.I, Fazal, S. & Khan, M.S. (2013). Implementation of Information and Communication Technology (ICTs) in Education Course: A case from teacher education institution in Pakistan. *Bulletin of Education and Research*, 35 (2); 12 – 19.

Nannim, A.F.,Yushau, B. & Gital, A.Y. (2018). Lecturers' level of awareness of ICT *Facilities* for teaching purpose. *AJSTME*, 14(2); 16-24.

Tayo, A.D., Ajibade, K.L. and Oyedokun, F. (2019). *The Modern Approach in Teaching and Learning of Computer Science.* Oyo: Adebisi Press.

Uzuagulu, A.E. (2011). *Practical guide* to writing *research project report in tertiary institutions*. Enugu: Cheston Publishers.

Wikipedia (2019). *Educational software*. *http://en.wikipedia.org/Educationalsoftware*

INNOVATIVE PEDAGOGICAL APPROACHES TO TEACHING AND LEARNING OF CHEMISTRY IN POST COVID 19

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Abstract
The study investigated innovative pedagogical approaches to teaching and learning chemistry in the post-COVID-19 pandemic. The advent of COVID-19 diseases imposed many challenges on different sectors of the Nigerian economy, and the educational sector was mostly affected. Two research questions guided the study and were answered using the mean and standard deviation. Two hypotheses were tested using t-test statistics at the 0.05 level of significance. The design of the study is descriptive. With a population of 240 students, it consists of 150 respondents: eighty-six males and sixty-four females. The instrument for data collection structured by the researchers is known as innovative pedagogy in the teaching of chemistry in the pandemic era (IPTCPE). Cronbach's alpha formula was used to determine the reliability of the instrument, which has an index of 0.95 for IPTCPE. The results showed that all the identified strategies helped to improve the learning experience in chemistry students. However, all the challenges identified affect students learning processes in the pandemic era. The result of the hypotheses showed that there was no significant difference in the mean rating of male and female students on teaching strategies that help improve the learning experience in chemistry. Lastly, there was no significant difference in the mean rating of males and females students among all the challenges. In accordance with the findings of the study, recommendations were proffered among the other governments and institutions.

Keywords: *Innovative Pedagogical Teaching, Chemistry in Post COVID 19*

Introduction

Innovative methods are marked by a new style of creating educational and cognitive activities for students. Innovations in the context of education are transformations and revolutions, the forms and methods of teaching, the teacher-student relationship, the use of information technologies for teaching, and the induction of new equipment in the educational process (Maxmudianova, 2021).Innovative technology helps to realize the main goal of teaching science and provides a way to change from studying a subject as a structural and systematic education to studying as a means of communication and thinking. It relocate educational and cognitive activities to a productive and creative level. Characteristics of innovation pedagogical are the compulsory existence of elements of creativity expecting development, working ahead concentration on the personality, its development and collaboration, type of relationship, cooperation, mutual assistance, and co-creation.Pedagogy is the study of the methods and activities of teaching (Eric Bruillard, 2020). There are some pedagogical approaches that have been in use in school, such as discussion, laboratory, problem-solving dialogue, seminars, conference methods, demonstrations, constructive methods, lectures with PowerPoint presentations, and projects, but only a small number of lectures, teachers, and institutions are making regular use of these methods. A new pedagogical method is needed to increase the active participation of students, their precepts, and their development. The change from textual learning

contents to visual learning content is more effective in learning through innovative pedagogical methods (ViJayalakshmi, 2019).

The outbreak of the COVID-19 pandemic affected human life and many sectors of the economy, both in developing and developed countries (Wargadinata, Maimunah, Eva, and Rofq, (2020). According to Tesar (2020), the corona virus disease 2019 (covid-19) was found in Wuhan, the capital of central China, in Hubei province. The virus ravages the whole world, according to the World Health Organization (WHO) 2020, which states that Corona virus disease (COVID-19) is an infectious disease and is caused by the newly discovered Corona virus. WHO explains further that people infected with the COVID-19 virus have knowledge of mild to moderate respiratory illnesses and regain control of themselves without special treatment, are vulnerable to old people, and have health challenges such as chronic respiratory disease, cardiovascular disease, diabetes, and cancer? (Abougeye, Emmanuel, Joseph Anthony Yawson, and Kofi NyantakyiAppiah (2020).

In the words of Pham and Tien-Thi-Hanh (2020), the COVID-19 protocol and regulation were implemented by countries authorities to avoid the spread of the diseases. Such protocols include reducing social gathering, promoting social distancing, and implementing national lockdown. Liguori and Winker (2020) opine that the COVID-19 outbreak constitutes challenges to education institutions; tertiary, secondary, and primary were shut down by force and looked for alternative teaching and learning strategies (approaches). According to Demuyakor (2020), under the outbreak of the COVID-19 pandemic, tertiary institutions were forced to experiment with electronic learning (e-learning) since traditional class-based learning could not be possible. The sequel to that is that COVID-19 has disrupted the education system. Some affected stakeholders are academic staff, students, government authorities, and parents. If the transition from classroom-based learning to online learning is fruitful suppose online learning implementation poses new challenges, like innovation opportunities during this trial period in the higher education sector, which cannot be ignored. So many questions arise regarding the quality of online teaching and learning for students.

The existence of COVID-19 has deprived many students of quality education because of total lockdown, which made infrastructure challenges inherited in education easy. This article discusses the following challenges: higher education institutions during the COVID-19 era, lockdown, challenges from online teaching and learning, and online versus offline learning.

According to Huang, Liu, Tlili, Yang, and Wang (2020), higher institutions shut down campuses and terminate all physical classroom teaching and every campus event like workshops, graduation ceremonies, and conferences. Chang and Fang (2020) noted that for teaching and learning to continue, most universities should introduce an online learning platform instead of class-based teaching and learning. Most academic institutions encounter some difficulties, such as lack of resources and connectivity issues. Students and academics find it difficult to adjust. Bacher-Hicks, Andrew, Joshua Goodman, and Christine Mulhern (2020) indicated that academia and students preferred traditional classes over adjusting to online learning, which poses new challenges to academia and students during the COVID-19 outbreak. The major question that pops up to many people is whether online learning is better and more effective when compared with class-based learning. In an attempt to address the issue, they show that traditional face-to-face learning is appreciated over online learning because of the changes that are involved. In the words of Dawadi, Saraswati, Ramgiri, and Padamsimkhada]0(2020), for low-income earners, online learning enlarges the already existing inequalities because of differences in social-economic education background. Dawadi et al. emphasize that there is uneven access to e-learning and e-resources, which enlarges the inequalities between disadvantages and advantages for children. Wahid, Ridzal, Florence, Pribadi, and Berlian Ester Wakas (2020) noted that online learning is not convenient for science students in fields like chemistry, mathematics, biology, and physics due to the fact that conducting experiments is not possible in online learning. Similarly, Radha, Mahalakshmi, Sathis Kumar, and Saravanakumar, (2020), argue that traditional class-based learning is student choice, unlike online learning. The class base is authentic,

moderate for discussion, and there is real room for interaction with their teachers and friends. Inasmuch as there is one remarkable success for higher institutions that possess well-established online learning and teaching systems, It has been observed that changing from traditional class-based to online learning was not easy for most colleges and universities.The following are challenges associated with shifting to online learning: a lack of instruction material, i.e., teacher resources ensure that students are engaged in a virtual learning environment; academia and students find it difficult to adjust; back to basics needs; unconducive physical space and environment; lack of teaching and learning resolve (instruction material). With the advent of the COVID-19 outbreak, academia was not able to adjust. Nurges and Sievertsen (2020) highlighted that the COVID-19 outbreak in academia was not able to adjust to the new teaching platform. Moreover, some lack sufficient knowledge of information technology and comprehensive teaching; teaching was not easy; how to arrange and implement online teaching as planned led to decreased user satisfaction since no training was provided to academia on online teaching (Chen, Tinggun, LijuanPeng, Xiaohua Yin, JingtaoRong, Jianjun Yang, and Guodong Cong (2020).Student challenges include the inability to maintain focus in virtual teaching and learning and adjusting to the new assessment format. Moreover, Burgers, Simon, and Hans Henriksievertsen, (2020) discovered that social issues, lecturer issues, and access to online learning platforms constitute a problem for students intentions of learning online. O'keefe (2020) states that during online learning, technical issues can occur because most students do not have the technology knowledge and technical support to facilitate online learning.

In the words of Adnan and Anwar (2020), students have some barriers to obtaining access to digital devices like computers, smart phones, tablets, laptops, and even data from an internet connection for online learning. Moreover,Crawford, Joseph, Kerryn Butler-Henderson, Jurgen Rudolph, BashaMalkawi, Matt Glowatz, Rob Burton, Paulo Magni, and Sophia Lam, (2020) identified that students cannot access online learning because of a lack of suitable hardware or software. Students Representative Councils (SRCs) asked for the provision of digital learning devices to ensure that every student has equal access to online learning. Abougeye et al The challenges of students in tertiary institutions" social education research emphasize that although students have digital learning devices and internet data, they cannot access online tools because of a poor network at home. COVID-related challenges and new teaching regulations ushered in online teaching and learning. Lack of teaching and learning resources hinders the smooth running of online learning since there is no infrastructure or resources to facilitate online learning. There are technology challenges for laboratory and technical science that require hand-on-experience implementation of virtual learning and require careful planning and strategies to deal with some of the challenges faced by students and faculty. The school encourages an integrated educational experience and employs new teaching pedagogy (Ametepe and Khan, 2021).

Faculty had some challenges because of the sudden change from physical teaching to the use of technology for online teaching. Such challenges include engagement of students in virtual learning, teaching resource development, and pedagogical adjustment to online teaching. These challenges retrogress the situation: lack of support for online instruction and faculty mentoring. It is important to have effective pedagogy developed and a convenient learning environment that supports student learning. No studies have addressed faculty and student challenges. The strategies were total online, that is, the teaching and learning were completely virtual; lectures and laboratories were carried out in a synchronous manner. The instructors and students met synchronously, utilizing an online management learning system via a blackboard. On the first instance, a serious effort was made in the class to communicate the delivery method by mentioning the advantages and getting students on board. The paper presents implementation and strategies developed in the teaching and learning of chemistry online. Strategies adopted for assessment are grading students assignments, weekly updating of books, asking for feedback, and questioning. At the beginning, reading quizzes are offered format.Strategies resulting in student learning during the COVID-19 pandemic (Ametepe and Khan, 2021). Coman, Tiru, Mesesan –

Schmitz Stanciu, and Bularca, (2020). Note that the use of information and computers are electronic learning. This system develops and transmits educational knowledge through the use of many electronic devices, such as CDs, mobile phones, radio, television, and computers, which aid electronic learning. With the arrival of the World Wide Web, the use of offline resources, for example, CDs, ROMs, and pre-recoded class sessions, is now functional. A teacher can decide to record his teaching and package on CD and send it to students to watch at their various locations. Video camera is very important to use for recording such, but it is easy to use software by the teacher to record, edit, score, and give students the presentation. Students can download, watch, and copy such recordings on digital video display mobile devices or computers at various locations. Moreover, further discussions and clarifications on the watch session can be forwarded to the teacher through phone and email. Abah, Anyah, and Age, (2017) indicated that a flipped classroom entails classroom inverter energy. Here, students study at home instructional content through electronic, digital, means with their peer group and teachers. Chukwuemeka, Dominic, Kareem, and Mailafia, (2020) state that lecturers might create practical video contents of lectures and practical demonstrations that could be used throughout the session, thereby using editing software and camcorder. Portable devices are used to store the contents so students can safely transport media and learn it at home.

Purpose of study: The main purpose of the study is to investigate innovative pedagogical approaches in the teaching of chemistry in the post-COVID-19 pandemic era. Specifically.

(1) teaching strategies capable of improving learning experiences in chemistry
(2) challenges that affect the process of learning in the post-COVID-19 pandemic

Research Questions

The following research questions guide the study:

- What teaching strategies help to improve the teaching and learning of chemistry during the COVID-19 era?
- What are the challenges that affected the process of learning in the post-COVID-19 pandemic?

Hypotheses

The following two hypotheses guide the study:

H_{O1} There is no significant mean difference between male and female students' responses to teaching strategies that help improve learning experiences in chemistry.

H_{O2} There is no significant mean difference between male and female students' responses to challenges that affect student learning processes during the COVID-19 pandemic.

Methods

Descriptive survey design; this design involves collecting data from a sample of the population through their response to a questions. The design is appropriate because it identifies, determines, or describes situations or events as they are (Ali 2006).

The area of study is the Federal College of Dental Technology Therapy in Enugu State. The choice of area is based on the researcher's familiarity with the location, which will grant them the opportunity to supervise and monitor the whole area.

Population of the study: The population of the study is two hundred and forty (240) students of dental technology and dental therapy. The reason for the population is that they carry out experiments in the laboratory and are aware of the dos and don'ts of the laboratory, as well as for convenience.

The sample size is one hundred and fifty students (150). The sample proportion of the population will be calculated using Kumar's manual of sampling technique, which has a formula.

N N – population, n sample size $(e)^2$ - level of significant.

$$n = \frac{I}{I + N(e)^2}$$ I - Constant

Method of data collection: The data collection was analyzed using the mean and standard deviation. Hypotheses were tested using the t-test

The researchers used response such as strongly agreed, agreed, disagreed, and strongly disagreed.

Instrument was developed by the researchers from the data collected in this study. The instrument was the

Innovative Pedagogical Approach to Teaching and learning of Chemistry in the Pandemic Era (IPTCPE).
Validation: The instrument was validated by three experts, one from measurement and evaluation and two from science education, all from the University of Nigeria, Nsukka.

Reliability: Cronbach's alpha internal consistency method was used to determine the reliability of the instrument. An internal consistency reliability of 0.95 was established for the instrument.

Method of data analysis: Research questions were answered using the mean and standard deviation, with a mean of 2.50 as the benchmark for the decision rule. Any item with a mean score equal to or above the criterion mean of 2.50 is considered to be accepted. Any item that scores below this criterion is not accepted.

Research Question 1: What are the teaching strategies that help improve the Teaching and learning experience in chemistry?

Table 1: Teaching and learning strategies that help to improve learning experiences in chemistry

	ITEMS	MALE – 86			FEMALE – 64		
S/No	Teaching strategies that help To improve learning experience in chemistry	$\bar{x}$	SD	Dec.	$\bar{x}$	SD	Dec.
1	Recording of lectures before actual teaching.	2.74	1.10	Accepted	2.80	1.07	Accepted
2	Animation	2.22	1.08	Rejected	2.23	1.02	Rejected
3	Live recorded lectures	2.83	1.06	Accepted	2.91	1.05	Accepted
4	Quizzes reading	2.73	1.13	Accepted	2.83	1.07	Accepted
5	Evaluation of class work, homework.	2.80	1.11	Accepted	2.89	1.10	Accepted
	Grand Mean/ Standard Deviation	2.66	1.09	Accepted	2.73	1.06	Accepted

Data in table 1 showed that the respondent (150 students) male had mean rating score ranging form 2.22 to 2.83 with a grand mean of 2.66 and female with mean rating ranging from 2.23 to 283 and grand mean of 2.73 .It was only in item 2 (animation) that the respondents mean score of 2.2, which is below the criterion mean score of 2.50, therefore the respondents showed that it was not among the teaching strategies that help to improve learning experience in chemistry. In all the rest of the identified items, the respondent had mean ratings that is greater than the criterion mean, showing that students need all the identified teaching strategies that help to improve learning experience in chemistry.

Hypothesis 1
There is no significant difference in the mean score between male and female students response on teaching strategies that helps to improve learning experience in chemistry.

Table 2: Summary of t-test Analysis on the mean rating scores of male and female students on teaching strategies that help to improve learning experience in chemistry

Variables	N	$\bar{x}$	SD	Df	Tcal	Sig.	Dec
Male	86	2.69	1.07				
				148	.420	.518	NS
Female	64	2.75	1.04				

Key: N = Sample Size, $\bar{x}$ = Mean, S = Standard Deviation, df = Degree of freedom, Dec = Decision, NS = Not Significant

Data in table 2 showed that an independent –sample t -test was conducted to test the mean rating of male and female students on teaching strategies that helps to improve learning experience in chemistry .The mean and standard deviation as were shown in the table are male ($\bar{x}$ =2.69,SD =1.07) and female ($\bar{x}$ =2.75, SD =1.04) . From the result of t- test, it was found that calculated value (0.420) is less than the tabulated value(1.660) Therefore, we fail to reject the null hypothesis that there is no significant difference in the mean score of male and female students on teaching strategies that helps in improving learning experience in chemistry.

Research Question 2: what are the challenges that affects the process of teaching and learning in post covid 19 pandemic?

Table 3: Challenges that affects students learning process at post covid 19 pandemic

	ITEMS	MALE – 86			FEMALE – 64		
S/No	Challenges that affects the process ofx learning in post covid 19 pandemic	$\bar{x}$	SD	Dec.	$\bar{x}$	SD	Dec.
1	Adjustment to online make learning in chemistry concept difficult	2.69	1.14	Accepted	2.77	1.10	Accepted
2	Remote natures of instructional no immediate feedback	2.90	1.08	Accepted	2.95	1.07	Accepted
3	Lack of motivation to learn.	2.83	1.07	Accepted	2.83	1.04	Accepted
4	Poor learning environment student lack interaction and focus	2.78	1.10	Accepted	2.86	1.06	Accepted

5	Student experience technology challenge because they share technology with their sibling at home	2.16	1.07	Rejected	2.19	1.02	Rejected
6	Student missed classes because of connectivity and technical difficulties	2.76	1.09	Accepted	2.80	1.05	Accepted
7	Students lack peer to peer interaction this lead to no collaboration of ideas and support.	2.72	1.13	Accepted	2.81	1.08	Accepted
8	Feedback from distance teacher or student engagement do not help to get extra ideas from them	2.80	1.09	Accepted	2.88	1.09	Accepted
	Grand Mean/ Standard Deviation	2.70	1.09	Accepted	2.76	1.06	Accepted

Table 3: Challenges that affect students learning processes post-COVID-19 pandemic

Data in Table 3 showed that. The respondents (150 students) male had a mean rating score that ranged from 2.16 to 2.90 with grand mean of 2.70 and female had a mean rating score that ranged from 2.19 to 2.95 with grand mean of 2.76. It was in only item five (i.e., student experience technology challenge because they share technology with their sibling at home) that respondents had a mean score of male 2.16 and female 2. 19 which is below the criterion mean score of 2.50; therefore,the respondent showed that item 5 is not part of the challenges that affect students learning process in the COVID pandemic era. In all the remaining identified challenge items, the respondent had a mean rating that was greater than the criterion mean, showing that students do have challenges that affect students learning processes post-COVID-19 pandemic

Hypothsis (2)

There is no significant difference in the mean score between male and female students responses to challenges that affect the student learning process during the COVID-19 pandemic.

Table 4: Summary of t-test Analysis on the mean rating scores of male and female students on challenges that affects student learning process during covid 19 pandemic

Variables	N	$\bar{x}$	SD	Df	Tcal	Sig.	Dec
Male	86	2.66	1.07				
				148	.474	.492	NS
Female	64	2.73	1.03				

Key: N = Sample Size, $\bar{x}$ = Mean, S = Standard Deviation, df = Degree of freedom, Dec = Decision, NS = Not Significant

Data in Table 4 shows that an independent-sample t-test was conducted to test the mean ratings of male and female students on challenges that affect the student learning process during the COVID-19 pandemic. The mean and standard deviation as were shown are males ($\bar{x}$ = 2.66, SD = 1.07) and females ($\bar{x}$

= 2.73, SD = 1.07),from the result of the t-tes it was found that calculated value.474 less than tabulated value (1.660) (. The null hypothesis was therefore not rejected. This indicates that there was no significant difference in the mean rating of male and female students on all the identified challenges that affect their learning process.

Discussion

The findings of the study showed that students need all the identified teaching strategies that help improve their learning experience in chemistry. The strategies were totally online, that is, the teaching and learning were completely virtual; lectures and laboratories were carried out in a synchronous manner. The instructors and students met synchronously, utilizing an online management learning system via a blackboard. This is in accordance with what Ametepe and Khan (2021) observed in teaching physics during the COVID-19 pandemic. The study developed teaching strategies, which include recording, lecturing, demonstration, use of resources, giving extra lessons, and using interactive online learning.

The findings of the study show that students identified all the challenges that affect their learning process. Lack of teaching and learning resources hinders the smooth running of online learning since there is no infrastructure or resources to facilitate online learning. There are technology challenges for laboratory and technical science that require hand-on-experience implementation of virtual learning and require careful planning and strategies to deal with some of the challenges faced by students and faculty. In line with the findings of Adnan and Anwar (2020), students have some barriers to obtaining access to digital devices like computers, smart phones, tablets, laptops, and even data from an internet connection for online learning. Likewise, Crawford, Joseph, Kerryn Butler-Henderson, Jurgen Rudolph, Basha Malkawi, Matt Glowatz, Rob Burton, Paulo Magni and Sophia Lam. (2020) identified that students cannot access online learning because of a lack of suitable hardware or software.

Conclusion

Education is the bedrock of every nation, both developed and undeveloped country. In Nigeria, the COVID-19 pandemic impedes physical presence in the classroom, workshops, and laboratories, hence hindering effective teaching and learning of chemistry. The COVID-19 pandemic has made people realize the need to integrate technology into teaching and learning and otherwise sustain the learning of chemistry. The teaching and learning of chemistry need an innovative pedagogical approach in responding to post-COVID-19 challenges. These challenges affect students, academics, and faculty in laboratory courses. The strategies were fully online format; these include many pedagogical techniques such as carrying out online demonstrations, engaging in help/tutorial sessions, providing outbreak sessions, endeavoring to post recorded information, using animation for clarification of difficulty concepts, reading quizzes to allow constant reading of concepts, and weekly help sessions to afford a platform for further discussion with the instructor. Some of these approaches that could be adopted and deployed for the dissemination of knowledge to students during and after the COVID-19 pandemic could be achieved.

Recommendations

The following recommendations were made based on the findings.

- Innovative technology-pedagogical approaches should be accommodated in the teacher training curriculum. This equips and updates teachers with adequate knowledge to practice in the field, both in distance learning sessions and conventionally.
- Capacity building on innovative technology should be organized by the government for teachers to update their knowledge. They should endeavor to be 21st century teachers, digitally inclined to impart knowledge to students.
- School administrators endeavor to see that necessary facilities, quality, and quantity are available for teacher and student usage. use of a technology-driven instruction platform.
- Training and workshops on how to use technology-driven instructional platforms need to be conducted for chemistry teachers because when they have knowledge and how to use them they will accept it.

References

Abougeye, Emmanuel, Joseph Anthony Yawson, and Kofi NyantakyiAppiah, (2020), "COVID-19" and E-learning: The Challenges of Students in Tertiary Institutions, Social Education Research 1–8.

Adnan, Muhammed and Kaint Anwar, (2020), online learning amid the COVID-19 pandemic students perspectives ''online submission 2 (1) 45–51.

Ali, A. (2006). Conducting research in education and social science. Enugu: Tashiwa Network LTD.

Abah, J. Anyah, P., and Age, T. (2017), A flipped applied mathematics classroom: Nigerian university students' experience and perceptions, Abacus, the Mathematical Association of Nigeria, mathematics education series, 42(1), 78–87.

Ampete J.D and Khan N.(2021) Teaching physics during COVID -19 pandemic implementation and report of teaching strategies to support student learning .Georgia gwinnett college school of Science and Technology . Lawrence ville, GA, 30043 United State of America.

Bacher-Hicks, Andrew, Joshua Goodman, and Christine Mulhern (2020), Inequality in household adaptation for schooling shocks: COVID-induced online learning engages merit in real time No. 27555, National Bureau of Economic Research.

Burgers, Simon, and Hans Henriksievertsen, (2020), "Schools, Skills, and Learning: The Impact of COVID-19 on Education,".

Chen, Tinggun, LijuanPeng, Xiaohua Yin, JingtaoRong, Jianjun Yang, and Guodong Cong (2020)"Analysis of user satisfaction with online education platforms in chain during the COVID-19 pandemic'' In healthcare, 8(3), p. 200 Multidisciplinary Digital Publishing Institute,

Chang Chiu-Lan and Ming Fang (2020) .E-learning and Online Instructions of Higher Education during the 2019 Novel Coron1virus Disease (covid-19) Epidemic". In Journal of Physics: Conference Series, 1574(1), p. 012166. IOP Publishing

Chukwuemeka, E.J. Dominic,S.,Kareem,M.A.,andMailafia,M.A.(2020), Redesigning the educational delivery system The needs and options for continuous learning during the Corona virus (Covid-19) pandemic Nigeria. Contemporary Educational Technology, 12(1), 1–11. https://doi.org/10.30935/crdtech1936.

Coman, C., Tiru,L. G., Mesesan-Schmitz, L., Stanciu, C., and Bularca,M.C.(2020).Online teaching and learning in higher education during the Corona virus pandemic: students' perspectives Sustainability, 12(24), 10367. https://doi.org/10.3390/su122410367.

Crawford, Joseph, Kerryn Butler-Henderson, Jurgen Rudolph, BashaMalkawi, Matt Glowatz, Rob Burton, Paulo Magni, and Sophia Lam, (2020). "Covid-19: 20 countries' higher education intra-period digital pedagogy response," Journal of Applied Learning and Teaching 3(1) 1–20.

Demuyakor, the John Corona virus (Covid 19), and online learning in higher education institutions. A survey of the perceptions of Ghanaian international students in China, online journal of communication and media technologies, 10 (3).

Dawadi, Saraswati, Ramgiri, and Padamsimkhada, (2020). impact of COVID-19 on the education sector in Wepal: challenges and coping strategies".

Eric Bruillard (2020), Rethinking Pedagogy for the Post-COVID-19 World, University of Paris, Eda research unit.

Huang, R.H.D.J. Liu, A.Tlili, J.F. Yang, and Wang H.H. (2020) Handbook on Facilitating Flexible Learning During Educational Disruption: The Chinese Experience in Maintaining Undisrupted Learning in the COVID-19 Outbreak at the Beijing Smart Learning Institute of Beijing Normal University.

https://vik asconcept.com,the importance of innovation in the new normal.

LiguoriEri and Christoph Winkler'' (2020). From Offline to Online Challenges and Opportunities for Entrepreneurship Education Following the COVID-19 Pandemic''

Maxmudjanova, D.K. (2021) Innovative Teaching Methods International Journal on Orang Technology, e-ISSN: 2615-8140,3(7) (https://journals.researchparks.org/index.php/ijot).

O'keefe, L.J., Rafferry, A. Gunder, and K. Vignare, (2020). "Deliver High-Quality Instructions Online in Response to COVID-19: Faculty Playbook,"Online Learning Consortium

Pham, Heip-Hung, and Tien-Thi-Hanh Ho, (2020) .Toward a' new normal with e-learning in Vietnamese higher education during the post-COVID-19 pandemic,'' higher education research and development 1–5.

Radha, R.K. Mahalakshmi, V. Sathis Kumar, and A. Saravanakumar (2020). E-learning during the lockdown of the COVID-19 pandemic: a global perspective'' International Journal of Control and Automation, 13(4) 1088–1099

Tesar, Mare K. (2020) Towards a Post-Covid 19 new normality physical and social distancing, the move to online and higher education 556-559.

Vijayalakshmi M. (2019) Innovation in Teaching Method .Journal of Applied Science Computations.

World Health Organization (WHO) (2020) Coronavirus (Google Scholar).

Wahid, Ridzal, Florence, Pribadi, and Berlian Ester Wakas (2020). Digital Activism Covid -19 Effect in Campus Learning'Buduapest International Reacher and Critics in linguistics and Education Journal 3(3)1336-1342.

Wargadinata, W. Maimunah, Li, Eva, D., and Rofq.Z. (2020) .Student's responses on learning in the early COVID-19 pandamic Tadris:Journal of Education and TeacherTraining,5(1) 141-153.

INFLUENCE OF STUDY HABIT SKILLS ON ACADEMIC PERFORMANCE OF SECONDARY SCHOOL STUDENTS ON MATHEMATICS IN ENUGU EDUCATION ZONE

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Abstract

The purpose of this study was to ascertain the influence of study habit skills on the academic performance of secondary school students on mathematics in Enugu Education Zone of Enugu State. Two research questions were constructed and two hypotheses formulated to guide the study. The Ex-post facto research design was used for the study. The population for the study was 4145 SS II students of Enugu Education Zone. The sample used for the study was 364 senior secondary school 2 students gotten using Yaro Yamane formula. The instruments used for the study were Mathematics Annual Cumulative Result (MACR) and a structured questionnaire titled: Study Habits Assessment Questionnaire (SHAQ). SHAQ was validated by two experts in Mathematics Education and one expert in Measurement and Evaluation. SHAQ yielded reliability coefficient of 0.64 obtained by Cronbach Alpha. Means, standard deviations and correlation coefficients were used to answer the research questions while regression analysis was adopted in testing the hypotheses at $p \leq 0.05$ level of significance. The findings of the study among others showed that the extent at which students engage in mathematics note-taking skills was high but its influence on the academic performance of secondary school students in mathematics was low. Hence, there was significance relationship between students' note-taking skills and their academic performance in secondary school mathematics. Based on the findings of this study, it was recommended among others that the students should work on the study habit which is students' note-taking skills.

Keywords: *study, habit, skills, academic performance, mathematics, note taking, reading.*

Introduction

Mathematics makes our lives orderly and prevents chaos. Certain qualities that are nurtured by mathematics are power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability and even effective communication skills (Charu, 2018). Mathematics is a deductive study of numbers, geometry and different dynamic constructs or structures. It is that branch of science that utilizes numbers and signs (Ugboduma, 2016). Numbers and signs are organized utilizing orderly numerical principles. Hence, Olatoye (2019) comprehensively defined mathematics as the science of space, time, capacity, amount, shapes, numbers and then association with each other.

Mathematics is the cradle of all creations, without which the world cannot move an inch. Be it a cook or a farmer, a carpenter or a mechanic, a shopkeeper or a doctor, an engineer or a scientist, a musician or a magician, everyone needs mathematics in their day-to-day lives (Upasna, 2017). Even insects use mathematics in their everyday life for existence. There are countless examples of mathematical patterns in nature's fabric. Anyone can be a mathematician if one is given proper guidance and training in the formative period of one's life. A good curriculum of mathematics is helpful in effective teaching and learning of the subject (Upasna, 2017).

The importance of mathematics in human existence, is evident in its use in day-to-day human activities and science and technology development. According to Yadav (2019), in order to live a social life, mathematical knowledge is needed, because of the give and take process; business and industry depends upon the knowledge of mathematics. Yadav also opined that the change in the social structure with regards to the modern facilities like mode of transport, means of communication and progress in the field of science and technology is due to mathematics only. In this way, mathematics has played an important role in not only understanding the progress of society but also to develop the society.

Mathematics is the foundation for nation building, since the level of mathematics skills and competences go a long way to determine the level of science and technological components of any nation, which is a basic requirement for its development (Jayanthi, 2019). Mathematics today has an enormous impact on science and society, though the influence is silent and hidden, yet it is shaping our world in many ways. According to Jayanthi, Mathematics reveals hidden patterns that help us to understand the world around us. Now, much more than arithmetic and geometry, mathematics today is a diverse discipline that deals with data, measurements and observations from science, with inference, deduction and proof; and with mathematical models of natural phenomena, of human behavior, and of social systems.

Despite the fact that mathematics is important and plays major roles in national development in any country of the world as well as on its citizenry, its teaching and learning are not meeting the expectations with the demand of the national development in Nigeria. The poor performance of Nigerian students in mathematics examinations is worrisome to mathematicians and mathematics educators, parents, public, philanthropists, media, and all other stakeholders (Olufemi, Adediran and Oyediran, 2018). It is disheartening to note that students' performance in mathematics in both internal and external examinations have been poor despite the numerous importance of mathematics (Ugboduma, 2017). The West African Examination Council (WAEC) (2020) Chief Examiner's Report on mathematics revealed persistent decline in the performance of mathematics because of candidates' lack of skill in solving mathematical problems.

Several factors have been held responsible for this state of poor performance on mathematics. Olufemi, Adediran and Oyediran (2018) opined that students' academic performance is affected by several factors which include students' learning skills, parental background, peer influence, teachers' quality, learning infrastructure among others. In their view, Harb and El-Shaarawi (2006) suggested three factors that intervene, that is, parents (family causal factors), teachers (academic causal factors), and students (personal causal factors), though the influence on mathematics performance varies from one academic environment to another, from one set of students to the next, and indeed from one cultural setting to another. Ogbogu (2011) identified poor funding, lack of frequent curricular review, over population, poor infrastructure and inadequate teaching and research facilities as factors which affect students' performance in mathematics.

Despite several factors enumerated that accounted for poor performance of students in mathematics, several approaches such as teaching methods, teaching strategies, games have been infused in attempt to remedy the situation, yet the problem persisted. This situation calls for the need to look into the study habit skills of the students that make the students perform poorly in mathematics.

Several definitions of the term, "study habit" have been offered by experts. Ozsoy in Hayede (2017) defined study habits as the methods of study used by students during an academic course within an appropriate environment; in other words, it is the ability of students to manage time for the successful accomplishment of academic tasks. Kabiru (2018) also defined study habit as the adopted way and manner a student plans his private reading after classroom learning so as to attain mastery of the subject. Good study habits according to Kabiru (2018) are good assets to learners because habits assist students to attain mastery in areas of specialization and ensuing excellent performance, while the opposite becomes constraint to learning and achievement

leading to failure. Kabiru further asserted that the act of mastery study habit is called the study habit skills.

Study habit skills have been described to include a lot of attributes. According to Oluwatimilehin and Owoyele (2012), study habit skills include: note taking, reading, time allocation, concentration, teacher consultation and preparation for examination. Taking of notes is important so that the student can confine information in notebooks, which are retrievable at later times when such information needs to be retained in the long term memory for future recall. Reading can be done aloud at first, in order that the auditory connection can be made that will synchronize with the visual connection to create a permanent association in the brain of the student. Re-reading can now be done internally with areas of concentration mapped out. Allocating time to specific subjects is another good study habit that helps in concentration. Humans tend to lose concentration after one and a half to two hours of intense study without any varying of stimuli, thus taking a break and switching to another course provides the efficiency-inducing change necessary for success at assimilation (Agbo, 2017).

More so, Study habit skills play an important role in academic success, and effective study cannot be conducted without using these skills. Students who have better academic performances adopt a wider utilization of these skills than those who make poor progress (Hayede, 2017). Thus, in order to improve academic performance of students, it seems essential to improve their study habit skills without which desired outcomes cannot be achieved. However, development of good study habit skills depends upon the combined efforts of parents and teachers according to Nsini and Emeya (2015). Nsini and Emeya asserted that study habit skills tend to affect the students' academic performances.

Academic performance has been the yardstick for a long time in the ascription of viability to a school, its administrator and the teachers. Thus if a school achieves success academically, it suffices to say that it will attract new entrants, including students and teachers. Academic performance has been defined by Rivkin, Hanushek and Kain (2014) as the cumulative function of current and prior school, community and family experiences. Academic performance entails a continuum of success academically, including the ability for one to fend for oneself after school, using the acquired skills and abilities, not just the grades (Schofield, 2006; Stringfield, Reynolds &Schaffer, 2008; Agbo, 2017). Little wonder, parents strive to see to it that their wards are high achievers in school in order for them to assure a secure future for their wards after the school experience.

Mathematics is the foundation for nation building but yet students' performances in Mathematics are poor. Many literatures have cited that there are poor students' performances in Mathematics especially in Nigeria. The poor performance of Nigerian students in mathematics examinations is worrisome to mathematicians and mathematics educators, parents, public, philanthropists, media, and all other stakeholders, and this has prompted many of the mathematics educators to embark on studies to determine the root cause of it. Many mathematics educators attributed it to candidates' lack of skill in solving mathematical problems, other attributed it to several factors which include students' learning skills, parental background, peer influence, teachers' quality, learning infrastructure, mathematics methodologies, among others.

But one area that only one scholar (Bassey and Edoho, 2018) to the best knowledge of the researcher has ever researched on is students' study habit in Mathematics. Student's study habit plays an important role in an academic success of a student and effective study cannot be conducted without using these habits. Majority of the education scholars have opined that study habit affects the students' performance, minority of the scholars have the contradictory findings. These controversies created by a gap which study intended to fill as whether the study habit influences on the students' performance in mathematics in Enugu Education study?

This study examined the influence of study habit skills on academic performance of secondary school students on mathematics. Specifically, the study sought to examine the influence of:

1. Note-taking on academic performance of secondary school students in Mathematics;
2. Reading on academic performance of secondary school students in Mathematics;

Two research questions were raised to guide the study. They are as follows:

1. To what extent does note-taking influence the academic performance of secondary school students in Mathematics?
2. To what extent does reading influence the academic performance of secondary school students in Mathematics?

The following null hypotheses were tested at 0.05 levels of significance.

Ho_1: There is no significant relationship between students' note taking skills and their academic performance as measured by their Mathematics Annual Cumulative Results (MACR).

Ho_2: There is no significant relationship between students' reading skills and their academic performance as measured by their MACR.

Methods

The researcher adopted the ex-post facto research design. The area that was used for this study was Enugu Education Zone of Enugu State. The population for the study was 4145 SS2 students in all the thirty-one (31) public secondary schools in the zone. The sample for this study was 364 SS2 students in Enugu Education Zone during the 2019/2020 academic session. Yaro Yamane formula was used to determine the sample size of 364 representing 8.78% from a finite population of 4145. The proportionate stratified random sampling procedure was used to obtain the sample size from each of the Local Government Areas in this study area. The procedure involved selecting the subjects in such a way that identified sub-groups of the population were represented in the sample in the same proportion that they existed in the population. The instruments that were used for data collection were Mathematics Annual Cumulative Result (MACR) scores and a structured questionnaire titled: Study Habits Assessment Questionnaire (SHAQ). MACR is a secondary data source that was collected by the researcher/research assistants for each of the study's respondents, which was recorded on SHAQ for each of the respondent. It is the respondents' SS2 Mathematics Annual scores. MACR was not validated and its reliability was not determined because it is a secondary data source. The instrument (SHAQ) was face validated by three (3) research experts, two (2) from mathematics education and one (1) from measurement and evaluation, all from the department of Mathematics and Computer Education, Faculty of Education, Enugu State University of Science and Technology, ESUT, Enugu. The instrument, SHAQ was subjected to trial testing after face and content validation to obtain the reliability of the instrument. The researcher administered the instrument to 20 SS2 students in two different co-educational secondary schools in Agbani Education Zone in Enugu State who were not part of the study. The reliability of the instrument SHAQ was established using Cronbach Alpha statistical method. The choice of using Cronbach Alpha (α) was to determine the internal consistency of the SHAQ and the reliability coefficients (r) of 0.69 and 0.65 were obtained for the two clusters of the instrument. Consequently, the overall reliability coefficient of 0.64 was obtained for the instrument. This reliability coefficient is considered adequate for the internal consistency of the instrument. On-the-spot administration of 364 SHAQ and collection of the 364 copies of the instrument were aimed by the researcher and two trained research assistants, that is, two research assistants for each of the schools sampled. The two research assistants were briefed on how to administer and collect the SHAQ from the respondents. The purpose of the study and focus of every section of the SHAQ were properly explained to the assistants, so that, they would be able to answer the respondents' questions properly during the exercise, if and when necessary. The research questions were answered using mean and standard deviation. The hypotheses were tested at 0.05 level of significance using regression analysis.

Results

Research Question 1

To what extent does note-taking influence the academic performance of secondary school students in Mathematics?

Table 1: Correlation Coefficient of Note-Taking and the Students' Academic Performance in Mathematics

AVERAGE RATE OF NOTE-TAKING	2.79	0.19	GE
MATHEMATICS ANNUAL CUMULATIVE RESULT (MACR)	45.09	17.06	LOW
CORRELATION COEFFICIENT 'r'	0.223	LOW R/S	

Where *LE represents Low Extent; GE represents Great Extent*

Table 1 displayed the Correlation Coefficient of Note-Taking and the Students' Academic Performance in Mathematics. Generally, students agreed that the extent at which they engaged in note-taking was high with the mean value of 2.72 and standard deviation of 0.19. Also, the result showed that the students' annual cumulative score in Mathematics was 45.09 with the standard deviation of 0.19. The study showed that the extent at which Note-taking influenced the academic performance of secondary school students in Mathematics was low with a correlation coefficient of 0.158.

Research Question 2

To what extent does reading influence the academic performance of secondary school students in Mathematics?

Table 2: Correlation Coefficient of Reading and the Students' Academic Performance in Mathematics

MEAN RATE OF READING	2.33	0.13	LE
MATHEMATICS ANNUAL CUMULATIVE RESULT (MACR)	45.09	17.06	LOW
CORRELATION COEFFICIENT 'R'	0.198	V.LOW R/S	

Where *LE represents Low Extent; GE represents Great Extent*

Table 2 displayed the Correlation Coefficient of Reading and the Students' Academic Performance in Mathematics. The table revealed that the extent at which the students engaged in reading of mathematics was low with the mean value of 2.33 and standard deviation of 0.13. Also, the result showed that the students' annual cumulative score in Mathematics was 45.09 with the standard deviation of 17.06. The study showed that the extent at which reading influenced the academic performance of secondary school students in Mathematics was very low with a correlation coefficient of 0.198.

Testing of the Research Hypotheses

Two null hypotheses which were tested at 0.05 levels of significance guided the study. The hypotheses were tested using the regression analysis. The results were shown in tables below.

Hypothesis 1

Ho_1: There is no significant relationship between students' note taking skills and their academic performance as measured by their Mathematics Annual Cumulative Results (MACR).

Table 3: Regression Analysis of the Students' Note-Taking and their Academic Performance in Mathematics

Model		Sum of Squares	Df	Mean Square	F	Sig.	Dec.
1	Regression	5268.081	9	585.342	2.063	.032[b]	S
	Residual	100442.285	354	283.735			
	Total	105710.366	363				

Multiply R=.223[a], R square=.050, Adjusted R square= .026, Std. Error of the Estimate=16.84444, Av. B= -85.142333, Av. Beta= .05188

a. Dependent Variable: ACR

b. Predictors: (Constant), ITEM9, ITEM7, ITEM6, ITEM3, ITEM4, ITEM1, ITEM2, ITEM5, ITEM8

Table 3 showed the Regression Analysis of the Students' Note-Taking and their Academic Performance in Mathematics. From the result of Regression ANOVA in Table 3, it revealed that the multiple correlation coefficients R was 0.223. This indicated that there was very low positive relationship between the predictor variable (Students' Note-taking) and the criterion variable (the Students' Academic Performance). The table also indicated that R^2 yielded 0.050, which was 5% of the variation in the Student' Academic Performance in secondary school Mathematics was attributable to the joint effect of Students' Note-taking.

The Analysis of Variance (ANOVA) for the regression (predication) showed that F-ratio was 2.063 and was significant at 0.032. Since 0.032 was less than 0.05, the null hypothesis 1 was rejected as stated. Hence, the study concluded that there was significant relationship between students' note taking skills and their academic performance as measured by their Mathematics Annual Cumulative Results (MACR). This implied that both the low positive relationship between the predictor variable and the criterion variable, and 5% of the variation in the students' academic performance in secondary school Mathematics was attributable to the joint effect of Students' note-taking were significant, which means that the students' note-taking significantly influenced the students' academic performance in secondary school Mathematics.

Hypothesis 2

Ho_2: There is no significant relationship between students' reading skills and their academic performance as measured by their MACR.

Table 4: Regression Analysis of the Students' Reading Skills and their Academic Performance in Mathematics

Model		Sum of Squares	Df	Mean Square	F	Sig.	Dec.
1	Regression	4135.717	10	413.572	1.437	.162[b]	NS
	Residual	101574.648	353	287.747			
	Total	105710.366	363				

Multiply R=.198[a], R square=.039, Adjusted R square= .012, Std. Error of the Estimate=16.96310, Av. B= -7.99609, Av. Beta= .0069

a. Dependent Variable: ACR

b. Predictors: (Constant), ITEM19, ITEM16, ITEM15, ITEM14, ITEM17, ITEM18, ITEM11, ITEM13, ITEM12, ITEM10

Table 4 showed the Regression Analysis of the Students' Reading skills and their Academic Performance in Mathematics. From the result of Regression ANOVA in Table 4, it revealed that the multiple correlation coefficient R was 0.198. This indicated that there was low positive relationship between the predictor variable (Students' Reading Skills) and the criterion variable (the Students' Academic Performance). The table also indicated that R^2 yielded 0.039, which was 3.9% of the variation in the Student' Academic Performance in secondary school Mathematics was attributable to the joint effect of Students' Reading Skills.

The Analysis of Variance (ANOVA) for the regression (predication) showed that F-ratio was 1.437 and was not significant at 0.162. Since 0.162 was not less than 0.05, the null hypothesis 2 was accepted as stated. Hence, the study concluded that there was no significant relationship between students' reading skills and their academic performance as measured by their Mathematics Annual Cumulative Results (MACR). This implied that both the low positive relationship between the predictor variable and the criterion variable, and 3.9% of the variation in the students' academic performance in secondary school Mathematics which was attributable to the joint effect of Students' Reading Skills were not significant.

Discussions

Influence of Note-Taking on Students' Academic Performance in Secondary School Mathematics

The finding of the study revealed that there was significant relationship between students' note-taking and their academic performance in secondary school Mathematics. This implied that students' note-taking positively and significantly influenced the students' academic performance in secondary school Mathematics. This finding tailed with the findings of Sharma (2020), Sakirudeen (2017), Hayede, Seyede, Shadman, Minoo and Ehsan (2017) and Sagbana (2012). Sakirudeen (2017) revealed that the study habit skills of note-taking, use of library and time allocation moderately influenced the academic performance of secondary school students in mathematics. Sagbana (2012) disclosed that mathematics students are very fond of copying mathematics notes but those students who developed the habit of making their own notes in class during teaching performed better in examination than those who relied mainly on textbooks reading.

Sharma (2020) revealed that study habit skills (note taking) had significant relationship on the academic performance. Taking notes is important so that the student can confine information in notebooks, which are retrievable at later times when such information needs to be retained in the long term memory for future recall. Since this study has revealed that the rate at students' note-taking was high, there is need for mathematics teachers and parents to sustain the tempo since that scholars have reveal that students' note-taking affected the students' academic performance in mathematics. The parents and mathematics teachers should ensure that students take down notes in mathematics.

Influence of Reading on Students' Academic Performance in Secondary School Mathematics

The finding of the study revealed that there was no significant relationship between students' reading skills and their academic performance in secondary school Mathematics. This implied that students' reading skills did not significantly influence the students' academic performance in secondary school Mathematics. This finding tailed with the assertions of Arora (2016) who revealed that students' reading skills does not necessary influence the students' academic performance in Mathematics. Woolfolk (2013) in his study revealed that reading have no significant effect on the students' academic performance rather it is the method used by the mathematics teacher that affect the students' academic performance. This is because according to Agbo (2017), a student cannot read what he does not understand; a student can still read without understanding what s/he is reading; a student can read and understand but still fail to perform well in the subject; a student can still read but still not learnt what s/he has read. Woolfolk (2013) opined that a student can read but still perform below average in the subject.

Reading is just a component of study habit that deals with interpreting what is written but does not mean that the student has learnt and retain what is written (Agbo, 2017). Agbo (2017) revealed that there was difference between reading and learning of mathematics. Hence, this finding implied that parents and mathematics teachers should not always emphasize and insist that their students/wards read the mathematics concepts that were taught but rather they should learn the mathematical concept through note-taking when studying, allotting time, concentrating on what they study and should study in such a way as they are preparing for mathematical examination. A student who does note-taking in mathematics is better than the student who relies purely on reading mathematics. Also, parents and mathematics teachers should ensure that their students understand mathematics. Finally, this finding implied that reading is just a step in learning mathematics but it is not the main component of study habit as it does not affect the students' academic performance in mathematics.

Conclusions

The study investigated the influence of study habit skills on academic performance of students in secondary school mathematics. From the findings of the study, it was revealed that the students' note-taking skills significantly influenced the students' academic performance in secondary school Mathematics as measured by their Annual Cumulative Results (ACR) while the students' reading skills did not have any significant relationship with the students' academic performance in secondary school Mathematics.

Recommendations

Based on the above findings of the study, the following recommendations are made:

1. The students should work on the study habit which is students' note-taking skills.
2. Federal/State Ministries of Education should organize conferences and seminars for the mathematics teachers, parents, school counselors and school administrators on the need for the mathematics teachers to educate on their wards/students on the need to teach their students mathematics how to take notes during lesson and also how to read mathematics perfectly.

References

Agbo, M. (2017). Study habits as predictors of students' academic achievement in Basic Science in Awka South Local Government Area of Anambra State. *Unpublished Project Work, Nnamdi Azikiwe University, Awka.*

Arora, R. (2016). Academic achievement of adolescents in relation to study habits. *The International Journal of Indian Psychology*, 3(2), 456-471.

Bassey, U.J. & Edoho, E.A. (2018). Study habits and students' achievement in mathematics in Ikono Local Government Area, Akwa Ibom State. *International Journal of Business and Social Science*, 3(2), 69-83.

Charu, T. (2018). Application of mathematics in real life. *International Journal of Computer and Mathematics Sciences, IJCMS* 7 (1), 165-178.

Harb, N. & El-Shaarawi, A. (2016). Factors affecting students' performance. *Munich Personal Repec Archive paper No 13621.*

Hayede, R.L., Seyede, F.S.F., Shadman, R.M., Minoo, M.C. & Ehsan K.N.L. (2017). The relationship between study habits and the academic performance of medical sciences students. *Journal of Holistic Nursing and Midwife, 27(2), 456-471.*

Jayanthi, R. (2019). Mathematics in Society Development. *Iconic Research and Engineering Journals.* Vol 3(3), 542-557/ISSN: 2456-8880.

Kabiru, M.B. (2018). Managing study habits and its impact on secondary school students' academic performance in Nigeria. *European Journal of Educational and Development Psychology*, 6(2), 878-899.

Nsini, A.A. & Emeya, S. (2015). Effect of study habit on academic achievement of Agricultural Science students in senior secondary schools in Emohua Local Government Area of Rivers State, Nigeria. *International Journal of Education and Evaluation*, 1(8), 103-119.

Ogbogu, C.O. (2011). Modes of funding Nigerian Universities and the implications on performance. *Paper presented at the 2011 Barcelona European Education Conference NH Calderon, Rambla, Barcelona, Spain.*

Olatoye, R.A. (2019). Study habit, self-concept and science achievement of public and private secondary school students in Ogun State, Nigeria. *An International Multi-Disciplinary Journal, Ethiopia*, 2(4), 211-223.

Olufemi, O.T, Adediran, A.A. & Oyediran, W.O. (2018). Factors affecting students' academic performance in Colleges of Education in South West, Nigeria. *British Journal of Education*, 6(10), 276-289.

Oluwatimilehin, J.T.B. & Owoyele, J.W. (2012). Study habits and academic achievement in core subjects among secondary school students in Ondo State, Nigeria. *Bulgarian Journal of Science Education Policy, BJSEP*, 3(2), 102-114.

Rivkin, S.G., Hanushek, E.A., & Kain, J.F. (2014). Teachers, schools and academic achievement. *Journal of Education, Stanford* 2(3), 456-469.

Sagbana, A.F. (2002). The relationship among self-esteem, motivation, personality and academic performance of students in Port Harcourt City. *Journal of Sociology* 6(66), 567-579.

Sakirudeen, A.O. (2017). Study habits and academic performance of secondary school students in mathematics: a case study of selected secondary schools in Uyo Local Education Council. *Research in Pedagogy* 7(2) 283-297.

Schofield, R.A. (2006). Research trends in clinical psychology. *Journal of Clinical Psychology* 6(2), 785-802.

Sharma, K.S. (2020). Effect of study habits and self-concepts of wastage and stagnation among SC students of primary classes. *Research Journal*

of Philosophy and Social Science, 1&2, 234-253.

Stringfield, S., Reynolds, D. &Schaffer, G. (2008). Improving secondary students' academic achievement through a focus on reform reliability. *Journal of Educational Research,* 2(3), 178-193.

Ugboduma, S.O. (2016). Study habits as predictors of mathematics students' achievement in Delta State Tertiary Institutions. *An Unpublished Dissertation of Enugu State University of Science and Technology.*

Upasna, R. (2017). A study of impact of visual imagery strategy on cultural appreciation and achievement in mathematics of upper primary students. *K.J. Somaiya Comprehensive College of Education, Training and Research, Mumbai*.

Woolfolk, A.E. (2013). *Educational Psychology* (5th Edition). Boston: Allyn and Bacon.

Yadav, S. (2019). Role of mathematics in the development of society. *International Journal of Research and Analytical Reviews (IJRAR)* 6(4), 36-46.

INFORMATION TECHNOLOGY SKILLS REQUIRED BY COMPUTER EDUCATION GRADUATES FOR EMPLOYMENT IN ENUGU STATE

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Abstract
The study investigated the information technology skills required by computer education graduates for employment in Enugu State. To find a solution to the gap created by gender (male and female computer lecturers) in the discourse under investigation. Two research questions and two hypotheses were formulated and tested at 0.05 level of significance. The researcher adopted descriptive survey research design for the study, while the total population was small and manageable. A 25-item structured questionnaire named Information Technology Skills for Employment Scale (ISES)" was used for data collection. The reliability estimate, a reliability coefficient of 0.66, 0.75, were obtained for cluster 1-2 respectively, while the overall reliability was 0.69. Mean and Standard Deviation were used to answer the research questions while t-test statistics was used on the four null hypotheses that guided the study. Based on the results, the research concluded that word processing, spreadsheet, skills are highly required computer education graduate for employment in Enugu State. Gender of the computer education lecturers do not differ significantly in mean ratings on the word processing, spreadsheet, skills are required by computer education graduate for employment in Enugu State. Based on the findings the researcher recommend among others; periodic supervision, seminars and workshop as well as School management should include proficiency in these identified skills as criteria for the recruitment of computer lecturers in Enugu State.

Keywords: *Computer, Word processing skill, Spreadsheet skill, Teaching, Gender.*

Introduction

The present human society is the age of information explosion in which an average individual wants to explore the information system, thus the ability for timely acquisition, utilization, communication and retrieval of relevant and accurate information has become an important attribute for better teaching and learning process. (Adeboye, 2011). The National Policy on Education (2014) stated that in recognition of prominent role of ICT in advancing knowledge and skills necessary for effective functioning in the modern world, there is urgent need to integrate ICT into education in Nigeria. The integration of computer in education has helped to develop positive changes in educational institutions and communities. The positive changes brought in by appropriate infrastructure and ICT facilities encompassing electricity, telephone, educational software, internet facility and hardware such as computer, scanners and multimedia projectors (Satharasinghe, 2017). It is a worthy of note that ICT doesn't exist in isolation because the world has grown into a global village and its functionalities are mostly carried out in the institution.

The term "Computer" has been defined by different people in different ways. Ejiofor, Okeke and Enemuoh (2016) defined computer as an electronic device or system, which has the ability to accept data internally, store data or results and automatically performs manipulative and logical operations on the data based on instruction, with the result of processing, released as information

It is worthy to note that computer system or its programmes cannot be adequately utilized without adequate skills for operation. Some common computer skills according to Ugwuanyi (2018) include, analytics, social media, graphics design, Microsoft office, spreadsheets, email communication, marketing automation and data visualization operational skills. Anikene (2011) noted that the types of computer skills employers expect will vary depending on the career or industry, Anikene, further asserted that some of the most important computer

skills include; operating system, office suites, presentation software, spreadsheets, communication and collaboration tools, accounting software, social media and data visualization. Okorie and Nwangwu (2011) stated that in teaching of computer the following basic skills are needed, they include; word-processing skills, spreadsheet skills, database management skills and internet skills among others.
Word-processing skills involves the ability to prepare standard document like letters memos, notices, reports, wills, agreements among others. With the aid of a processor or a computer using any available word processing software like; Word perfect, Word star, Microsoft, Multimate, Print master, First choice and Sign master among others (Anikene, 2011). Opie (2013) asserted that word-processing skills refers to efficient use of computer programme that provides for input, editing, formatting and output of text among other additional factors.

Spreadsheet skills involves the use of computer application for organizing, analysis and storage of data in tabular form. Okorie and Nwangwu (2011) noted that spreadsheet allows for the manipulation of large amounts of data. Spreadsheet skills are used to calculate numbers, compare and analyze data and use the data for report preparation and preparation and presentation. Tokshile (2019) noted that an excellent mastery of spreadsheets application is among the top information technology skills in the 21st century skills list for computer education students. It makes for a convenient and highly methodological way of conducting some of the most pertinent aspect of teaching duties.

Teaching of computer in the secondary schools or tertiary institutions requires the teacher's knowledge of basic information technology skills which shall be useful to enhance learning and motivate the learners. Asan (2013) observed that most computer tutors are not computer users and thus, lack information technology skills for effective teaching of computer education students for employment. Taylor (2011) supported that teachers seems to be having limited knowledge in the use of database and spreadsheet skills therefore requires skills training while on the job. Jankins (2018) noted that there is poor acquisition of ICT skills and strategies among computer education students in Nigeria which have resulted to a theoretically based teaching of computer. On the contrary, fisher (2017) revealed that 86% of computer teachers were classified as experienced computer users or having some knowledge of basic computer software applications. Information technology skills such as word processing, Database, Excel, PowerPoint and internet operations have significant impact on computer education graduates for employment (Ogundele and Etejere, 2013). Therefore, it becomes imperative to investigate the information technology skills required of computer education graduates for employment in Enugu State, hence the gap in the research findings of the above researchers.
Gender may be seen as a challenge in the information technology skills required of computer education graduates for employment in Enugu State. Gender is a socially learned behaviours and expectation associated with males and females (Azikiwe, 2011) It is described as the biological sex of individuals in terms of being male or female. In Nigeria societies there are differences and inequalities between woman and men in responsibilities assigned, activities undertaken, access to and control over resources as well as possession of skills (Ugwanyi, 2018) Ogundele and Etejere (2013)revealed that females are faster in typing skills than the males, however males poses more internet skills than the females. Study by Alaje (2013) reported that female students possessed efficient computer skills and used social media more than their male counterparts. Adebayo (2011) contend that male students are found to be more active and possess computer skills than their female counterparts.

The main purpose of this study is to find out the information technology skills required of computer education graduates for employment in Enugu State. Specifically this study sought to investigate into;

1. word processing skills required of male and female computer education graduates for employment in Enugu State.
2. spreadsheet skills required of male and female computer education graduates for employment in Enugu State.

The following research questions guided the study:

1. What are the word processing skills required of male and female computer education graduates for employment in Enugu State?
2. What are the spreadsheet skills required of male and female computer education graduates for employment in Enugu State?

The following null hypotheses were formulated and tested at .05 level of significance.

1. There is no significant difference in the mean responses scores of male and female computer education graduates on the word processing skills required for employment in Enugu State.
2. There is no significant difference in the mean responses scores of male and female computer education graduates on the spreadsheet skills required for employment in Enugu State.

Methods

Descriptive survey research design was adopted for this study. Descriptive survey research design according to Odi (2019) is one in which a group of people or items is studied by collecting and analyzing data from a few people or items considered to be representative of the entire group. The area of the study is Enugu State Nigeria. Enugu State is one of the five States in South East States of Nigeria. The population for the study comprised all the 62 computer education lecturers currently employed in four public and private universities (UNN, ESUT, GoUni, Renaissance university and Coal City University) in Enugu State. No sampling was done because the population was manageable and that formed the choice of design.

A 25-item structured questionnaire named "Information Technology Skills for Employment Scale (IOSES)" developed by the researcher were used for data collection. The instrument had two sections; A and B. Section A contains the respondents bio data while section B was divided into two clusters with 25 items structured questionnaire that assisted the researcher in providing clues to the research questions that guided the study. cluster 1, was on the word processing skills with 11 items, cluster 2 was on spreadsheet skills with 14 items. The response format for the instrument was 4-point scale of Highly Required (HE), Averagely Required (AR), Required (R), Not Required (NR).

Three experts validated the instrument. One of the experts in computer education, second expert in measurement and evaluation, third expert in Mathematics Education all from Mathematics and Computer Education Department in Enugu State University of Science and Technology. The reliability of the instrument was determined by administering 20 copies of the questionnaire to a sample of 20 computer education lecturers from Nnamdi Azikiwe University Awka, Anambra State. The instrument was divided into two clusters. Each cluster yielded the following reliability coefficient; cluster A had 0.66, cluster B had 0.75, the grand or overall reliability coefficient was 0.69, indicating that the instrument is reliable and suitable for the study.

The questionnaire were administered and retrieved by the researcher with the help of six research assistants. The data collected with the questionnaire were analyzed using Mean ($\bar{x}$) with Standard Deviation (SD) to answer each of the four research questions. However, each of the four hypotheses were tested using t-test statistics at 0.05 level of significance.

Results

Research Question 1:

What are the word processing skills required of male and female computer education graduates for employment in Enugu State?

Table 1: The mean and standard deviation scores of responses of male and female students on word processing skills required of male and female computer education graduates for employment in Enugu State

SN	word processing skills required include;	FEMALE = 17			MALE = 45			Total = 62		
		X	STD	Dec.	X	STD	Dec.	X	STD	Dec.
1	Preparation of documents	2.59	0.94	HR	2.82	1.11	HR	2.76	1.07	HR
2	Improvement of typing skills	3.06	1.20	HR	2.80	1.06	HR	2.87	1.09	HR
3	Editing of word documents	2.65	1.22	HR	3.04	1.00	HR	2.94	1.07	HR
4	Formatting of word document	2.88	0.86	HR	2.87	1.06	HR	2.87	1.00	HR
5	Deleting of word documents	2.88	1.05	HR	2.89	1.07	HR	2.89	1.06	HR
6	Rearranging of word document	2.18	0.81	NR	2.84	1.02	HR	2.66	1.01	HR
7	Space out of typed word document	2.71	1.11	HR	2.62	1.13	HR	2.65	1.12	HR
8	Saving of word document	2.94	1.03	HR	3.24	0.93	HR	3.16	0.96	HR
9	printing of word document	2.82	1.29	HR	3.09	0.93	HR	3.02	1.03	HR
10	Recording of information	2.00	1.28	NR	2.47	1.14	NR	2.34	1.19	NR
11	Mastery of the keyboard system	2.53	1.01	HR	2.69	1.28	HR	2.65	1.20	HR
	GRAND MEAN	2.66	1.07	HR	2.85	1.07	HR	2.80	1.07	HR

Data in table 1 showed the mean responses score of male and female graduates on word processing skills required of male and female computer education students for employment in Enugu State. From the table, male students agreed to all items with mean greater than 2.50 cut off point set for the study except items 6 and 10 with mean scores of 2.18 and 2.00 respectively. Similarly, female students agreed to all items with mean greater than 2.50 cut off point set for the study except item 10 with mean score of 2.47. The grand total shows that the students agreed to all the items except item 10 with 2.34. This shows that the word processing skills required by computer graduates students for employment in Enugu State include; preparation of documents, improvement of typing skills, editing of word documents, formatting of word document, deleting of word documents, rearranging of word document, space out of typed word document, saving of word document, printing of word document and mastery of the keyboard system.

Research Question Two: What are the spreadsheet skills required of male and female computer education students for employment in Enugu State?

Table 2: The mean and standard deviation scores of responses of male and female students on the spreadsheet skills required of male and female computer education students for employment in Enugu State

SN	spreadsheet skills required include;	FEMALE = 17			MALE = 45			Total = 62		
		X	STD	Dec.	X	STD	Dec.	X	STD	Dec.
12	Comparing of data	2.71	1.16	HR	2.47	1.10	NR	2.53	1.11	HR
13	Storage of data	2.47	1.18	NR	2.73	1.10	HR	2.66	1.12	HR
14	Preparation of data reports	2.59	1.18	HR	2.93	1.14	HR	2.84	1.15	HR
15	Presentation of data reports	2.71	1.31	HR	2.53	1.06	HR	2.58	1.12	HR
16	Drawing if pie-chart	2.71	1.16	HR	2.51	1.08	HR	2.56	1.10	HR
17	Graphical presentation of results	2.47	1.13	NR	2.82	1.09	HR	2.73	1.10	HR
18	Drawing of line- charts	2.88	1.17	HR	2.93	1.16	HR	2.92	1.15	HR
19	Drawing of bar charts	2.82	1.13	HR	2.87	1.18	HR	2.85	1.16	HR
20	Frequency distribution	2.12	1.22	NR	3.09	1.02	HR	2.82	1.15	HR
21	Obtaining of standard deviation	3.18	1.02	HR	2.80	1.22	HR	2.90	1.17	HR
22	Obtaining of net present values	3.00	0.87	HR	2.73	1.07	HR	2.81	1.02	HR

23	Obtaining of data variance	2.53	1.13	HR	2.93	1.05	HR	2.82	1.08	HR
24	Financial model	2.47	1.07	NR	2.69	1.10	HR	2.63	1.09	HR
25	Result computation	2.82	1.38	HR	2.80	1.14	HR	2.81	1.20	HR
	GRAND MEAN	2.68	1.15	HR	2.77	1.11	HR	2.75	1.12	HR

Data in table 2 showed the mean responses score of male and female students on spreadsheet skills required of male and female computer education students for employment in Enugu State. From the table, male students agreed to items 12, 14, 15, 16, 18, 19, 21, 22, 23 and 25 with mean greater than 2.50 cut off point set for the study. However, they disagreed with items 13, 17, 20 and 24 with respective mean scores of 2.47, 2.47, 2.12 and 2.47 respectively. On the other hand, the female students agreed to all items with mean greater than 2.50 cut off point set for the study except item 12 with mean score of 2.47. The grand total shows that the students agreed to all the items with mean scores greater than 2.50. This shows that the spreadsheet skills required by computer education students for employment in Enugu State include; comparing of data, storage of data, preparation of data reports, presentation of data reports, drawing if pie-chart, graphical presentation of results, drawing of line- charts, drawing of bar charts, frequency distribution, obtaining of standard deviation, obtaining of net present values, obtaining of data variance, financial model and result computation.

Hypothesis One: There is no significant difference in the mean responses scores of male and female computer education students on the word processing skills required for employment in Enugu State.

Table 3: t-test on the mean responses scores of male and female computer education students on the word processing skills required for employment in Enugu State

Group	n	Mean	SD	t	df	Sig	Dec.
Female	17	2.66	0.39	-1.93	60	0.059	NS
Male	45	2.85	0.34				

Table 3 showed that the t-calculated value of -1.93 at 60 degree of freedom, not significant at 0.059 level of significance, which is greater than 0.05 level of significance set for the study. Therefore, the null hypothesis is not rejected as stated. This means that there is no significant difference in the mean responses scores of male and female computer education students on the word processing skills required for employment in Enugu State.

Hypothesis Two: There is no significant difference in the mean responses scores of male and female computer education students on the spreadsheet skills required for employment in Enugu State.

Table 4: t-test on the mean responses scores of male and female computer education students on the spreadsheet skills required for employment in Enugu State

Group	N	Mean	SD	t	Df	Sig	Dec.
Female	17	2.68	0.39	-0.79	60	0.432	NS
Male	45	2.77	0.45				

Table 4 shows that the t-calculated value of -0.79 at 60 degree of freedom, is not significant at 0.432 level of significance, which is greater than 0.05 level of significance set for the study. Therefore, the null hypothesis is not rejected as stated. This means that there is no significant difference in the mean responses scores of male and female computer education students on the spreadsheet skills required for employment in Enugu State.

Discussions

The finding of the study revealed that the required word processing skills by computer education students for employment in Enugu State include; preparation of documents, improvement of typing skills, editing of word documents, formatting of word document, deleting of word documents. The finding upheld the assertion of Zvacek (2016) that the acquisition of word processing skills facilitates text revision and helps to improve the students' computer skills. Hence, the mastering of word processing skills exposes the students to the basic and fundamental of being computer literate (Onah, 2012). The finding of the study is backed up by the observation of Ogundele and Etejere (2013), who observed that computer literacy skills such as word processing skills have significant impact on teacher job effectiveness; word processing skills no doubt play a large role in teaching of computer education as well as achievement of the computer educational goals.

Further analysis revealed that there is no significant difference in the mean responses scores of male and female computer education students on the word processing skills required for employment in Enugu State. This finding refute the report of Okoroafor (2017) observed that the degree of skills acquisition is dependent on gender. This shows that both male and female need this skill for self-reliance.

Another finding revealed that the required spreadsheet skills by computer education students for employment in Enugu State include; comparing of data, storage of data, preparation of data reports, presentation of data reports, drawing if pie-chart, graphical presentation of results, drawing of line- charts, drawing of bar charts, frequency distribution, obtaining of standard deviation, obtaining of net present values, obtaining of data variance, financial model and result computation. The finding agreed with the submission of Tom (2020) that spreadsheet skills is required because it improves the computer education students ability to calculate numbers, compare and analyze data and use the data for report preparation and presentation. The finding shows that spreadsheet skills are requisite in performing action like calculation of numbers, comparing and analyzing data and using the data for report preparation as similarly pointed out by Okorie and Nwangwu (2011) noted that spreadsheet allows for the manipulation of large amounts of data. The finding underscored the highlight of Tokshile (2018) that an excellent mastery of spreadsheets application is among the top computerized office skills in the 21st century skills list for computer education students, hence, making for a convenient and highly methodological way of conducting some of the most pertinent aspect of teaching duty such as result computation.

Further analysis revealed that there is no significant difference in the mean responses scores of male and female computer education students on the spreadsheet skills required for employment in Enugu State. This shows that both male and female students need spreadsheet skills for employment, hence the assertion by Ugwuanyi (2018) that in Nigeria societies, there are differences and inequalities assigned, activities undertaken, access to and control over resources as well as possession of skills might not be true.

Conclusions

Based on the findings of this study and the discussions that followed, conclusions were drawn as follows:

In the world today, computer system has found relevance in virtual every area of human endeavor. Organizations of all types and sizes, including schools, have recognized that the usage of computers in the work environment is important as it presents with unprecedented challenges that help individuals to acquire an inquiring critical and creative mind to capitalize on the opportunities driven by the explosive growth of information knowledge and technology.

Recommendations

Based on the research findings, the following are recommended:

1) School managers should ensure that these skills are taught properly using the requisite device and software packages.
2) Seminars and workshop should be organized to expose students to the importance of the identified skills for self-reliance.
3) Students should be encouraged to explore other opportunities for advancing these skills like watching recommended YouTube tutorial videos.

References

Adeboye J.O (2011). *Development Communication: An Introductory Discourse*. James publisher Lagos.

Alaje .C. (2013) Teacher Sense of Efficacy in Classroom Management and Discipline. *Educational and Psychological Management Journal 51(4) 755-767*

Anikene J.N. (2011) The age of Information and Communication Technology. A paper presented at a 3-day workshop organization by the UNESCO Nigeria. *African Thinking Community of Enquiry college of Education Enugu.*

Azikiwe F.A (2011). A Need Assessment Model for Conducting Follow-up Studies. *Journal of Teacher Education 31(3) 39-42*

Ejiofor C.I, Okeke O.C and Enemouh C. (2016) Basic guide to computer Appreciation and Application. *Enugu Ezu Books Ltd*

Fisher .M. (2017). Student Teacher and Observer Perceptions of the Classroom Environment Before and after the Transition to Junior High School. *Journal of Early Adolescence 8(2) 133-159*

Grace .C. (2013). Teaching Profession Programme, Definition and ICT Adaptation: *Journal of Research and Development in Education 14(1) 46-58*

Jared .L. (2017) Skills list for a Computer Operator. https://bizfluent.com

Mark .C (2016) Philosophy and the Instructional Process in Teaching Profession TESOL, Quarterly 24(4) 270-285

Odi, T.N. (2019) Counselling Strategies for Curbing Maladaptive Behaviours Amongst Secondary School Students in Enugu State. *Unpublished Ph.D thesis* Enugu State University of Science and Technology (ESUT).

Onah, I.F.C. (2012) *Introduction to Management and Information System.* Enugu: SCANN Publishers.

Ogundele M.O and Etejere P.A (2013) Expensive Learning at work. Towards an activity theoretical reconceptualization. *Journal of Education and work 14(1) 133-156*

Okorafor S.D (2017) Utilization of Guidance and Counseling Services in Handling Maladaptive Behaviours of Secondary School Students in Aba Education Zone. *Unpublished M.Ed Dissertation ESUT*

Okorie D.C. and Nwangwu .I. (2011) Teacher Efficacy and Bias in Special Education Referrals. *Journal of Educational Research 86(4) 247-253*

Osuji, U.S (2010). Assessment of the Computer Literacy Level of Open and Distance Learning Students in Lagos State. *Turkish online Journal of Distance Education-TOJDE 11(4) 8-12*

Satharasinghe, L. (2017) Teacher Education and the Teaching Career in the Era of Lifelong Learning OECD Education working paper No.2 Paris

Sequeira.A. (2012) Promoting the Ethical School Professional Ethics for School Administrators. *International Journal of Education 41(11) 50-60*

Taskshile D.C. (2019) Basic Concepts of Computer. Introduction to Computer for Examination. *https://www.taskshilelearning.com.*

Taylor E.I. (2011) Teacher in Pursuit of the Expert Pedagogue. *Educational Researcher* 15(7) 6-14

Tom .G. (2020) Best Computer Skills for a Resume (software skills employers love) *https://zety.com.* Retrieved 2/6/2020.

Ugwuanyi H.E (2018) influence of Social Media on the Study Habit of Students in Secondary schools in Enugu state. *Unpublished M.Ed Dissertation ESUT*

Zvacek S.M. (2016) Word processing and Teaching of Writing. *www.sciencedirect.com.* Retrieved 6/6/2020

CHALLENGES TO TECHNOLOGICAL IMPLEMENTATION BY EXAMINING BODIES ADMINISTRATORS IN ENUGU STATE

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Introduction

This is the age of science and technology. It is clear today that the world is speedily evolving technologically on daily basis and educational assessments done by the examining bodies need to align as well. The world of today is very dynamic and we are the witnesses of series of technological innovations in our day to day life. The contribution of science and technology has been experienced in almost all the spheres of human life including education.

The examining bodies are the agencies, councils and boards whose primary duty is to conduct examinations for various level of education and to assess the extent of academic achievement. In Nigeria, these bodies are West African Examinations Council (WAEC), National Examination Council (NECO), National Business and Technical Examinations Board (NABTEB), Teachers Registration Council of Nigeria (TRCN) and Joint Admissions and Matriculation Board (JAMB).

An examining bodies' administrator such as custodians, supervisors and invigilators in the information digital age is an instructional leader, a visionary leader, and able to use technology for management. However, these key actors may not fully understand their roles and the expectations for successful integration of technology in their examination activities. Beer and Mulder (2020) suggested that technology is changing the way organizations and their employees need to accomplish their work. training in technology, many school principals are not comfortable with technology or knowledgeable enough about technology integration techniques. Because principal training programmes normally do not focus on the skills about technology, administrators should refocus their Professional development programmes. Administrative training courses are not teaching school principals, teachers or central office administrators how to use technology effectively. Despres (2011) suggested education and training for administrators were somewhat inadequate because they did not prepare administrators to meet these standards. Most examining bodies' administrators received their degrees before computer technology made its impact, and many colleges and universities do not have up-to-date courses that cover the scope of administrative functions that can be managed by computers (Richardson, Flora, & Bathon, 2012).

Though this is the age of modern technology, there is little research available on how high school principals use technology in their buildings. Mulder, Messmann, König (2015) opined that training administrators and key actors in the industry is imperative in order to meet up with the age of technology. Tweed (2013) undertook a quantitative study that refers to the implementation of new technologies in the classroom. It was indicated that technology had at least somewhat impacted the way they teach in their classrooms and findings indicated that the self-efficacy of a teacher is significantly positively related to classroom technology use of teachers. Tranvik and Bråten (2017) conducted a study to ascertain what leadership attributes affect the integration of technology to improve teaching and learning. The study focused on the relationship and how it is affected as roles and responsibilities shift. An examination administrator's leadership style affected the implementation of

technology in a school. Facilitative leadership by the principal was seen by teachers as the key to successful technology implementation (Tranvik and Bråten, 2017). Administrators who promote technology as a tool for collaboration and stimulation for authentic assessment can allow for far greater student achievement than ever before (Tranvik and Bråten, 2017). According to Nworgu (2015), assessment of learning is the act of administering test/examination to the students in order to understand and describe their level of learning at the end of a lesson, programmeme or period of schooling for taking certain decisions pertaining their promotion, dismissal or adoption/termination into/of a programmeme. This could also be called summative assessment. This is because it is done at the end of the learning process and not within the learning process which is referred to as assessment for learning by Nworgu (2015). However, assessment of learning could be done through practical task, paper and pencil tests and Computer Based Test (CBT). Serhan (2019) stated that school principals as technology leaders are required to have a long-term vision and commitment to coordinating and allocating required resources for the school. Serhan (2019) focused on principals' attitudes toward the use of technology. Results of this study revealed that principals had positive attitudes toward the use of technology in their schools. If principals are comfortable with using technology, they will enforce the new equipment in their schools. In McKinley's (2014) study, he stated that Banuglu (2011) studied the leadership skills of academic administrators and their ability to coordinate technology integration throughout a school system. The findings showed that principals, both male and female, have performed considerably well in technology leadership proficiency and positive perception of technology use in instruction. Banuglu (2011) stated that many these administrators perform at the expectation level of professional development trainers. Schools and universities were not responding in the recent years fast enough to the need to include technology in educational leadership programmes. However, if technology can be integrated into this professional preparation programmemes, including formal degree coursework as well as in-service seminars, which develop the perspectives and skills necessary for this bottom-up reporting so that it will occur accurately with efficiency and with fidelity (Nkwocha and Onyibe, 2015). Mulder, Messmann, and König (2015) conducted a study of educational leadership programmes that prepare school administrators to use and enhance the use of information technology. They discovered that it is important for educational leadership programmes to prepare future school administrators to facilitate effective technology integration in their schools.

The administrators today face a different set of challenges than their predecessors. Over the years, computers were put in high schools and elementary schools, as well as in central administrative offices. Literature suggests that one of the major challenges is infusing technology into the curriculum. These administrators who can carry out technology implementations in their schools should behave as technology leaders (Demski, 2012). Thus, Bala (2018) rightly pointed out that examination bodies have embraced the use CBT in assessment of candidates as an innovative mode of assessment as against the old pencil and paper mode. Different studies however, have revealed several reasons CBT is fast replacing Paper and Pencil Test (PPT) mode of assessment. These studies explain why public examinations body such as Joint Admission and Matriculation Board (JAMB), institutions like Teachers Registration Council of Nigeria (TRCN), higher institutions such as universities, polytechnics and college of education adopt CBT as their mode of examination in Nigeria. Sanni and Mohammad (2015) argued that it is because of the problems associated with the use of Paper and Pencil Test (PPT) such as tedious process in the conduct of the exam, marking and result publication.

However, several studies have shown that the use of CBT in conducting examination in Nigeria has a lot of weaknesses/challenges that question its desirability for use. For instance, lack of access to internet facilities (Abubarkar and Adebayo, 2014); activities of hackers (Abdulhamid, 2010; Abubarkar & Adebayo, 2014); technical difficulties (Sanni and Mohammad, 2015; Nkwocha, Akanwa & Nkwocha, 2015); computer illiteracy among students (Adebayo & Abdulhamid, 2010; Onyibe, 2015) and poor education funding in Nigeria (Nkwocha and Onyibe,

2015) have continued to be stumbling blocks towards the effective utilization of CBT in assessment of learning in Nigeria.

Technology skills are required of school administrators in order for them to lead in a technology-rich educational environment. One of the major reasons for the lack of technology development for principals has been the struggle to identify the administrator knowledge base needed in technology and the management of technology in the school situation (Brooks-young, 2010). In their study, Gürfidan and Koç (2016) also investigated the relationship between school culture, technology leadership and support services on teachers' technology integration. The results of the study revealed that a positive school climate can result in effective leadership behaviors and adequate support and encouragement for the increased use of technology. This study looked at secondary school administrators and discussed the challenges to technology implementation and the way forward.

Examination administrators think of technology as an essential tool for changing the way teachers teach and the way students learn. However, the dichotomy is that these principals lack the understanding of how technology should be integrated into the learning environment. Among the challenges of technology leadership vary from place to place, they often center around one or more of the following challenges: (a) Problem of funding; (b) teachers' beliefs on the value of technology; (c) inappropriate allocations of existing technologies; (d) lack of understanding in how technologies can accentuate education; and (e) lack of support from school leaders. In the following sections we consider each factor and offer potential solutions, focusing primarily on the school technology leader.

Problem of Funds

Lack of funds to procure current technologies is a common problem. Hardware, software, and network capabilities are constantly changing and improving. Both the examining bodies such as WAEC, NECO NABTEB, JAMB and the stakeholders such as schools, ministries of education that funded major technology purchases five years ago may today find its equipment out-of-date. Poor educational funding has continued to be stumbling blocks towards the effective utilization of technology in assessment of learning in Nigeria (Nkwocha and Onyibe, 2015).
Fortunately, not only have the costs for computer power decreased, but schools are finding new methods to fund technology purchases. Creative methods to obtain technologies include mobilizing parents and parent groups to donate used equipment, purchasing groceries at participating stores that apply receipts toward the purchase of equipment, helping schools apply for grant proposals, or the use of credit cards which allocate a percentage of purchases towards computers. Many schools are also securing donations of used equipment from local corporations and adopting business partners to help cover costs to help reduce cost of buying new ones. Problem of funding by the government and other stakeholders is a salient issue that demands urgent attention.

Funding can indeed be a significant constraint when it comes to examining bodies, particularly in medical or scientific research contexts. Here are some ways in which funding limitations can impact the examination of bodies:

1. Limited Resources: Funding constraints may limit access to necessary equipment, facilities, and materials required for conducting thorough examinations of bodies. This can include imaging technology, laboratory supplies, and specialized tools needed for analysis.
2. Reduced Personnel: Insufficient funding may lead to a shortage of qualified personnel such as pathologists, medical examiners, and researchers who are essential for conducting detailed examinations and interpreting findings.
3. Scope of Research: Funding limitations may restrict the scope and scale of research projects related to examining bodies. Researchers may not have the financial resources to conduct large-scale studies or to explore certain avenues of investigation.
4. Access to Samples: Research involving the examination of human bodies often requires access to tissue samples, biological specimens, and clinical data. Limited funding may hinder efforts to collect and maintain these samples for analysis.

5. Technology and Innovation: Advancements in technology play a crucial role in improving methods for examining bodies and understanding various medical conditions. Insufficient funding may impede the adoption of new technologies and innovative approaches that could enhance the accuracy and efficiency of examinations.
6. Publication and Dissemination: Funding constraints can also affect the dissemination of research findings through publication in scientific journals and presentation at conferences. Limited resources may hinder researchers' ability to share their discoveries with the broader scientific community.
7. Long-Term Studies: Some research questions related to examining bodies require long-term studies to track changes over time or to observe the progression of diseases. Funding limitations may make it challenging to sustain these studies over extended periods.

In conclusion, funding constraints can pose significant challenges to the examination of bodies in various research and medical contexts, potentially limiting the depth, scope, and impact of scientific investigations in this area. Efforts to secure adequate funding support are crucial for advancing our understanding of human health and disease through rigorous examination and research.

Belief Systems of Teachers

Teacher beliefs, both overt and covert, can also undermine the use and impact of technology. Some teachers hold-the view that students access to technology causes discipline problems or diffuses emphasis on traditional 'academic' content Other teachers may suffer from computer anxiety or be afraid of facing the learning challenges inherent in pursuing technology use. Helping teachers keep an open attitude is a useful first step toward proficiency with technology. Helping them to recognize that technology comprehension occurs incrementally often on a 'What do I need to know today' basis can ease the pressure. Establishing informal support groups or mentoring relationships also help teachers more easily accept the potential role of technology in the classroom. One teacher's positive modeling can sometimes do more to change other teachers' attitudes than a year of in-service training.

The beliefs of teachers can indeed influence the examination of bodies, particularly in educational settings such as anatomy labs or medical schools. Here's how teachers' beliefs can act as constraints:

1. Cultural and Religious Beliefs: Teachers may hold cultural or religious beliefs that impact their approach to examining bodies, especially if the bodies are donated for educational purposes. Some may have reservations or ethical concerns about dissecting cadavers or conducting certain types of examinations due to cultural or religious beliefs.
2. Pedagogical Approaches: Teachers' beliefs about the most effective methods of teaching anatomy or medical science can influence how they approach the examination of bodies. Some may prioritize hands-on dissection and exploration, while others may prefer virtual simulations or other non-invasive methods.
3. Ethical Considerations: Teachers' ethical beliefs may shape how they guide students in the examination of bodies. They may emphasize respect for the deceased, the importance of consent for body donation, and the ethical implications of conducting examinations on human remains.
4. Comfort Levels: Teachers' personal comfort levels with examining bodies can impact the depth and rigor of the educational experience for students. Those who are uncomfortable or hesitant may avoid certain aspects of examination or struggle to effectively guide students through the process.
5. Teaching Philosophy: Teachers' beliefs about the purpose and goals of examining bodies in education can influence the content and focus of their instruction. Some may view it primarily as a technical exercise to learn anatomy, while others may emphasize the development of empathy, professionalism, and ethical responsibility in future healthcare providers.
6. Institutional Policies and Guidelines: Teachers' beliefs may align or conflict with institutional policies and guidelines regarding the examination

of bodies in educational settings. They may feel constrained by administrative regulations or ethical standards established by their institutions.

7. Student Diversity and Sensitivity: Teachers' beliefs about student diversity and sensitivity can influence how they approach the examination of bodies in terms of accommodating different cultural backgrounds, religious beliefs, and personal preferences among students.

In summary, teachers' beliefs play a significant role in shaping the approach to examining bodies in educational settings, impacting pedagogical methods, ethical considerations, and the overall learning experience for students. Recognizing and addressing teachers' beliefs as potential constraints can help promote a respectful, inclusive, and effective educational environment for the examination of bodies.

Inappropriate Allocations of Technologies

The way these technologies are allocated even when available is a major issue as well. This is because the examinations conducted by the various examining body is uniform and is regardless of the technological distribution. Abubarkar and Adebayo (2014) opined that even when adequate facilities are found, technology access among student groups may be problematic if specific users are deemed more important than others. This occasionally happens in schools when computers are purchased for one department or select group of students and are then restricted to other groups. Scheduling to maintain full use throughout the school day, and allowing access either before or after school by the general student population, helps ensure that the technologies are being used to their potential.

Understanding the Role of Technologies in Education

More problematic than previously mentioned challenges is when teachers lack specific knowledge and skills in how educational technologies can support learning through active engagement and higher-level thinking. This can be handled by providing teachers with grade-appropriate software and curriculum plans that describe how technologies can be integrated into the classroom, concrete examples of technology implementation in real-world contexts, and a support system to encourage the continual use and development of their skills. Understanding the technological needs for education is essential in today's world, where technology plays a crucial role in enhancing teaching and learning experiences. Here are several aspects to consider:

1. Access to Information: Technology provides students and educators with access to vast amounts of information from around the world. Access to the internet, digital libraries, and online databases allows for broader and deeper exploration of topics beyond what traditional resources offer.
2. Interactive Learning Tools: Educational technology encompasses various interactive tools and platforms that engage students in active learning. These include simulations, virtual laboratories, educational games, and multimedia presentations that cater to different learning styles and preferences.
3. Personalized Learning: Technology enables personalized learning experiences tailored to individual student needs and abilities. Adaptive learning platforms use algorithms to analyze student performance and provide targeted feedback and content to support their learning journey.
4. Collaboration and Communication: Digital technologies facilitate collaboration and communication among students and teachers, regardless of geographical barriers. Online discussion forums, video conferencing tools, and collaborative document editing platforms promote interactive learning environments and peer-to-peer interaction.
5. Data Analysis and Assessment: Technology allows educators to collect and analyze data on student performance, engagement, and progress more efficiently. Learning management systems (LMS) and educational analytics tools provide insights that help teachers identify areas for improvement and adapt their instructional strategies accordingly.
6. Accessibility and Inclusivity: Technology has the potential to make education more accessible and inclusive for students with diverse learning needs

and disabilities. Assistive technologies, such as screen readers, speech recognition software, and captioning tools, enable students with disabilities to participate fully in educational activities.

7. Professional Development: Technology supports ongoing professional development for educators through online courses, webinars, virtual conferences, and professional learning communities. These resources allow teachers to stay updated on best practices, innovative teaching methods, and emerging trends in education.
8. Infrastructure and Support: To effectively integrate technology into education, schools and educational institutions need adequate infrastructure, including reliable internet connectivity, up-to-date hardware and software, technical support services, and professional development opportunities for teachers.
9. Digital Citizenship and Literacy: As technology becomes increasingly prevalent in education, it is essential to teach students digital citizenship skills and digital literacy competencies. This includes understanding online safety, evaluating the credibility of digital sources, and practicing responsible and ethical use of technology.

In conclusion, understanding the technological needs for education involves recognizing the potential of technology to enhance teaching and learning experiences, promote collaboration and inclusivity, support data-driven decision-making, and empower both students and educators to thrive in a digital world. By leveraging technology effectively, educational institutions can create engaging, interactive, and personalized learning environments that prepare students for success in the 21st century.

Support from School Leaders

Although the physical components of technology are required for change, just as important is the manner in which technology is implemented, and implementation is directly affected by the quality of a school's technology leadership. In other words, the ability of school administrators to plan, inspire, and lead technology usage in a school strongly influences the success of any technology plan. Administrators influence technology usage through a variety of methods, including providing and selling the vision to the community and faculty, obtaining resources such as time, personnel, knowledge, materials, and facilities, and providing encouragement and recognition for teachers successfully making the transition. To understand the role of the technology leader in a school, it is helpful to identify the attributes of this type of leader.

Structuring a Solution: Technologies for School Leadership

Authors have begun to examine methods to encourage administrators to become technology advocates. Unfortunately, most training to date has focused on the procedural skills of how to use the technology with little emphasis placed on the conceptual or strategic skills required of effective leaders. To help expose educators to a more comprehensive view of technology leadership, a few universities are now offering courses for educational technologists and school administrators.

Recommendations and Way forward

Authors have grappled with the ideas of what a technology course for examinations administrators and other stakeholders such as school leaders, and ministries of education should contain. From their different perspectives, it is summarily believed that the followings covers the needs of the examinations administrator; helping administrators develop competencies in a variety of technology skills, the knowledge of how technologies can be used to augment the management and education of students, and leadership skills to promote and take the necessary steps to achieve their vision.

Finally, technology leaders must be able to envision and articulate a view of the educational process. Sharing their vision, and including community and school district personnel in the creation of a technology use plan, helps galvanize major stake holders in contributing their knowledge, skills, and positive attitudes toward achieving the vision. Bringing together resources to develop relevant skills, knowledge, and attitudes for a technology

administrator is a major undertaking. Rather than encouraging administrators to gain this knowledge on their own, where potential biases from single vendors or vocal teachers may sway a school district, the authors recommend the creation of in service training formal courses for school administrators.

The following are the recommendations:

- The government and other stakeholders in the private sector should make adequate funds available for educational needs by way of raising their budgets.
- Sensitization programmes and training should be organised for examination administrators in order to familiarise them with the technological need and trends in education.
- Training and retraining of teacher in order to give the needed skills should be conducted at least once in a term.
- The distribution of technological facilities, equipment and devices should be done equitably.
- School leader should be compelled to pay quality attention to supporting examination administrators.

Conclusion

Educational technologies have the potential to alter greatly how schools are run and how students learn. Essential to achieving this outcome, however, is a dedicated and enthusiastic technology leader with the power to envision, articulate, and mobilize a school's population to achieve relevant technology goals. Most states require school administrators to take courses in leadership, management, and the challenges of special education; but none require administrators to be technologically competent only when this oversight is corrected can we hope to prepare our schools and children adequately for their future. Training and retraining of examination administrators should be done often on course outlines which identify some of the topics required to meet the needs for technology leaders. Discussions and sharing of ideas by members of the educational technology community in the hope that it will stimulate changes in the future development of school technology leaders should be encouraged.

References

Abubarkar & Adebayo (2014). Activities of hackers and its effect on the educational Objective in Nigeria. An Opinion paper presented at Benue state University.

Abdulmaid (2010). Academic assessment, challenges and solutions. An opinion paper presented at the University of Agriculture, Makurdi.

Adebayo & Abdulhamid (2010). Effects of Computer illiteracy on academic assessement of Students in senior secondary school in Plateu state. *An unpublished masters thesis*. University of Jos, Nigeria.

Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., & Fooi, F. S. (2018). School leadership and information and communication technology. The Turkish Online Journal of Educational Technology, 7(4), 82-91.

Akanwa & Nkwocha (2015). Effects of technical gaps on students academic evaluation. A case study of JAMB CBTE. An unpublished article.

Autor D. H. (2015). Why are there still so many jobs? The history and future of workplace automation. *J. Econ. Perspect.* 29, 3–30. 10.1257/jep.29.3.3

Bala (2018). Education for administrators and academicians; an assessment of educational needs. Unpublished article, University of Jos.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York, NY: W.H. Freeman.

Banuglu, K. (2011). School principals' technology leadership competency and technology coordinatorship. Educational Sciences: Theory and Practice, 11(1), 208-213.

Beer P, Mulder RH. The Effects of Technological Developments on Work and Their Implications for Continuous Vocational Education and Training: A Systematic Review. Front Psychol. 2020 May 8;11:918. doi: 10.3389/fpsyg.2020.00918. PMID: 32457688; PMCID: PMC7226038.

Brooks-Young, S. (2010). Teaching with the tools kids really use: Learning with web and mobile technologies. Corwin Press.

Cakir, R. & Yildirim, S. (2009). What do computer teachers think about the factors affecting technology in schools? Ilkogretium Online, 8(3), 952- 964.

Cakir, R. (2008). Preservice and in-service basic education computer teachers' professional growth in terms of perceptions of teaching, pedagogical competencies and subject matter knowledge. Unpublished doctoral dissertation, METU, Ankara.

Daniel, P. T. K., & Nance, J. P. (2012). The role of the administrator in instructional technology policy. B.Y.U. Education and Law Journal, 211- 231.

Demski, J. (2012). 7 Habits of highly effective tech-leading principals. The Journal *International Journal Educational Leadership & Management, 7(1) 67*

Despres, B. (2011). Technology education issue in British Columbia. The University of British Columbia Okanagan. Kelowna, BC VIV IV7

Englewood Cliffs: Educational Technology Publications. Office of Technology Assessment, US Congress (1988) Power On! New tools for teaching and learning. Washington: Government Printing Office.

Ertmer, P. A., Bai, H., Dong, C., Khalil, M., Park, S. H., & Wang, L. (2002). Online professional development: Building administrators' capacity for technology leadership. Paper presented at the National Educational Computing Conference Proceedings, San Antonio, TX. Journal of Computing in Teacher Education, 19(1), 5-11.

Flemmer, C. (2007). The positive impact of technology on teaching and learning.Boise State University.

Goktas, Y. & Topu, B. (2012). ICT teachers' assigned roles and expectations from them, Educational Sciences: Theory and Practice, 12(1), 473-478. Retrieved from *http://ocw.metu.edu.tr*

Gosmire, D., & Grady, M. L. (2007). A bumpy road: Principal as technology leader. Principal Leadership, 7(6), p. 15-21). National Association of Secondary Principals. Reston, VA.

Guba, E. G., & Lincoln, Y. S. (1989). Fourth generation evaluation. Beverly Hills, CA: Sage Publications, Inc.

Gürfidan, H., & Koç, M. (2016). The Impact of School Culture, Technology Leadership, and Support Services on Teachers' Technology Integration: A Structural Equation Modeling. Education and Science, 41(188), 99- 116.

Hasselbring, T. S., Smith, L., Glaser, C. W., Barron, L., Risko, V. J., Snyder, C., Rakestraw, J., & Camobell, M. (2000). Literature review: Technology to support teacher development. Washington, DC: Office of Educational Research and Improvement. (ERIC Document Reproduction Service No. ED 448159).

ISTE: National educational technology standards [NETS-A] and performance indicators for administrators, (2006). Eugene, OR: International Society for Technology in Education. Retrieved from http://www.iste.org

Jerald, C. D. (2009). Defining a 21st century education. The Center for Public Education. Retrieved from http://www.centerforpubliceducation.org/LearnAbout/gmnode/270.aspx

McKinley, B. M. (2014). The relationship of faculty demographics and attitudes toward technology integration. (Doctoral Dissertation). Retrieved from ProQuest Dissertations and Theses.

Moeller, B. & Reitzes, T. (2011). Integrating technology with studentcentered learning. Quincy, MA: Nellie Mae Education Foundation. Retrieved from http://www.nmefdn.org

Mulder R. H., Messmann G., König C. (2015). Vocational education and training: researching the relationship between school

and work. *Eur. J. Educ.* 50, 497–512. 10.1111/ejed.12147

Nworgu (2015). Methods of academic assessment for learning evaluations. An Educational Administration Quarterly, 41(1), 49-82.

Nkwocha C. and Onyibe N. (2015). Factors affecting educational assessment and evaluation in Nigeria. Unpublished Opinion paper.

Richardson, J. W. & McLeod, S. (2011). Technology leadership in native American schools. *Journal of Research in Rural Education, 26(7).*

Sanni K. & Mohammad B. (2015). Technical difficulties: factors affecting implementation advanced technologies in examinations. An unpublished article.

Serhan, D. (2007). Schools principals' attitudes towards the use of technology: United Arab Emirates technology workshop. 6(2), 5.

Tranvik T., Bråten M. (2017). The visible employee - technological governance and control of the mobile workforce. *Socio Econ. Stud. 28, 319–337.10.5771/0935-9915-2017-3-319*

Tweed, S. (2013). Technology implementation: teacher, age, experience, self-efficacy,and professional development as related to classroom technology integration. Doctoral dissertation, East Tennessee State University, Johnson City, TN.

SECONDARY SCHOOL STUDENTS' VERBAL AND NUMERICAL ABILITIES AS CORRELATES OF ACADEMIC ACHIEVEMENT IN CHEMISTRY IN ENUGU NORTH LOCAL GOVERNMENT AREA

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Abstract
The study determined secondary school students' verbal and numerical abilities as correlates of academic achievement in chemistry in Enugu North Local Government Area (LGA) in Enugu State. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The researcher adopted a correlation survey research design. The population for the study comprised of all 1,901 senior secondary two (SS 2) Chemistry students in all the nine public schools in Enugu North LGA. The sample size of 331 senior secondary two SS 2 students (121 male and 210 female) were randomly drawn from the population. Verbal Ability Test (NAT), Numerical Ability Test (NAT), and Chemistry Achievement Test (CAT) were the instruments used to collect data for the study. The instrument was validated by three research experts. The reliability of the instrument was established using Kuder Richardson 20 method which yielded .86 for VAT, .81 for NAT and .87 for CAT. The researcher administered the 331 copies of the test to the subjects with the help of two research assistants. The research questions 1 and 2 were answered using Pearson product moment correlation coefficient, and hypotheses 1 and 2 were tested with linear regression. The findings of the study showed that the verbal and numerical abilities of students positively relate with academic achievement in chemistry. Hypotheses tested showed that there is significant relationship between verbal and numerical abilities of students and academic achievement in chemistry. Based on the findings of the study, recommendations were made among others for secondary school students to develop high verbal and numerical skills in order to do well in chemistry. Also, the government, curriculum experts, examination bodies, school authorities to help in developing a curriculum and providing learning materials that will help students to develop high verbal and numerical abilities.

Keywords: *verbal ability, numerical ability, academic, achievement, chemistry*

Introduction

Science allows students to explore their world and discover new things. It is an important part of the foundation for education for all children. Science is most suited to young active children because it is an active subject, containing activities such as hands-on laboratories and experiments. Krstic, Krstic, and Antonovic (2019) stated that science is one of the most perfect forms of accumulation and systemization of knowledge and experience. The problems that face Nigeria as a developing nation today, which range from food scarcity, general insecurity to poor medical health delivery, can be solved to a very great extent with the knowledge of science and technology.

Chemistry is one of the core science subjects. According to Rocke and Usselman (2020), Chemistry is the science that deals with the properties, composition, and structure of substances (defined as elements and compounds), the transformations they undergo, and the energy that is released or absorbed during these processes. It is the science of molecules

and their transformation (Hoffman, 1991, as cited in Okorie, 2018). Wikipedia (2021) defined chemistry as the scientific discipline involved with elements and compounds composed of atoms, molecules and ions: their composition, structure, properties, behavior and the changes they undergo during a reaction with other substances. The knowledge of Chemistry is necessary in the understanding of the composition, properties and behavior changes of matter that form the environment around us (Okorie, 2018). Hence for one to understand his environment and utilize available resources effectively, adequate knowledge of Chemistry is indispensable. Amoke (2020) opined that Chemistry is the catalyst of sustainable national growth and development. Chemistry provides broader knowledge about science in general which is compulsory to every individual that aim to study the environment or courses that are related to climate change.

Chemistry as a subject is universally accepted not only by students but also people who are eager to know about chemicals. Chemistry is offered at the senior secondary classes in order to help students learn important aspects of scientific concepts that would enable them live effectively in their immediate environment (Jimson, 2018). The subject is introduced to the learners for the first time at senior secondary one (SS1). Every science student is expected to achieve a credit pass in Chemistry in Senior School Certificate Examination (SSCE). According to Amoke (2020), despite the importance of chemistry and its education value which is relevant to the need of individual learner, economics and technological breakthrough of a nation and the effort of researchers to improve on its teaching and learning, the achievement of students in the subjects is not still encouraging. This simply means that the level of achievement is still not good enough. This is bad since according to Anazia (2019), the academic achievement of senior secondary school students is an important factor that determines their future academic pursuit.

Studies have revealed that there is poor achievement of students in Chemistry in SSCE in the past years (Ahiakwo, 2015; Nweze, 2017; Amoke, 2020; Ezeliora, Ibe, and Obikezie, 2021). The situation is further exacerbated by the low achievement recorded in NECO/WAEC Annual report for 2014-2018 (WAEC Report, 2014; WAEC Report, 2018) for chemistry. Several factors have been reported to affect students' poor achievement. WAEC Chief Examiner's Reports (2016) also showed that Chemistry students' poor performance in Chemistry paper 2 (theory) over the years, arises from students' having difficulties in tackling questions which required explanation, making logical deductions, calculations, plotting of graph, energy profile diagrams, distinguishing between nuclear and ordinary chemical reactions, chemical symbols and formulae. They lost marks for among other reasons: Inability to write balanced equations with the state symbols; non-adherence to rubrics; poor knowledge of basic chemical principles; poor communication skills; wrong spellings. Subsequently, WAEC Chief Examiners' report (2018) pointed out that Chemistry students have poor knowledge of acids, bases and acid-base reactions and are unable to report results of acid-base titration experiments, unable to make calculations on molar and mass concentration.

Similarly, Nweze (2017) enumerated different factors responsible for the downward in chemistry achievement in public examinations. The factors range from eroded academic interest and distractions of students by mobile phones, i-pads, laptops, lack of incentive for the teachers, poor teaching methods, lack of equipment and poor knowledge to improvise, abstraction of the subject, poor background knowledge, lack of dedication and commitment by teachers among others. Nweze and Uzochukwu (2019) reported that the factors which lead to poor performance of students in chemistry include the student factor, teacher factor, societal factor, the governmental infrastructural problem, language problem, examination body related variables, curriculum related variables, test related variables, textbook related variables and home related variables. Adejimi, Nzabalirwa, and Shivoga, (2020) opined that the verbal ability of students affect the performances of students in science subjects. This agrees with the work of Nweze and Uzochukwu (2019) that language

problem (verbal) is one of the reasons for poor achievement in Chemistry.

Verbal ability is an important part of human existence since no human is an island unto him/herself. Everyone needs to communicate often with a fellow human. According to Adejimi, Nzabalirwa, and Shivoga, (2020), verbal ability is the medium through which feelings and thoughts are communicated. Verbal ability tests are tests used to deduce the ability of an individual to reason with words (Akinboye, 2001). Bloom (1974) averred that verbal ability is a necessity if a child is to learn in school. Adejimi, Nzabalirwa and Shivoga (2020) opined that verbal ability is essential to human learning. Olatoye and Aderogba (2011) stated that verbal ability indicates the acquired capability for comprehension and communication in an official medium like English Language. This will include oral or written mode of response as the case may require.

In the same vein, the numerical abilities of students have a tendency to affect students' achievement in other subjects. Getfeedback (2013) stated that numerical reasoning is important for success in such courses as mathematics, physics, chemistry, and engineering. Numerical ability is the ability to relatively solve problems in number sequencing, make accurate mathematical deductions through advanced numerical reasoning, interpret complex data presented in various graphical forms, deduce information and draw logical conclusions, (Nunnally, 2004, as cited in Olatoye and Aderogba, 2011). According to Ann (2004), numerical ability tests are designed to measure the candidates' capacity to manipulate or use numbers to correctly solve problems, such tests signify basic arithmetic prowess in an individual. Different school examinations in various subjects are broadly speaking types of achievement test of which numerical ability forms one of them. It can be given to candidates or administered as subsets of other tests. Olatoye and Aderogba (2011) stated that numerical ability can be determined by direct teaching and learning of Mathematics. Setidisho in Olatoye and Aderogba (2011) asserted that mathematics is a fundamental subject necessary for understanding of most other fields.

It is therefore worthy of note that the combined verbal and numerical abilities of any student seems to be a powerful measure of general educational aptitude or the ability to learn from books and teachers and to achieve high in academic subjects. There is therefore the need to pay attention to students' verbal and numerical abilities since it has a tendency to affect learning. Hence the intent of this study to find out if the achievement of students in Chemistry relates to their verbal and numerical abilities.

The achievement of students in science subjects generally and Chemistry in particular had witnessed a deplorable trend in the past decades. This has lead to poor enrolment of the subject in West African Examination Council by students since student are afraid of failing. Observations from 2014 to 2021 have consistently revealed poor achievement in Chemistry in senior secondary school certificate examination organized by WAEC. Many studies have been conducted to determine the factors that contribute to students' poor achievement in chemistry. Most of the studies have little focus on the effects of students' verbal and numerical ability on their achievement. The difficulty the students face in conceptual understanding of Chemistry can be said to be related to use of language, poor problems solving skill, and lack of adequate mathematics knowledge. Attributing chemistry students' poor achievement to any one factor is difficult, as numerous studies have associated multiple factors to low scores in chemistry.

In Nigeria, report has shown that students fail in school certificate examinations due to difficulty in understanding instruction accompanying test. The comprehension of demands of questions and instruction require understanding of the language in use. Hence, students are expected to have high verbal skill, but the reverse seems to be the case. Similarly, Students can manipulate concepts in Chemistry with ease when there is sound mathematical knowledge. This is because some concepts and topics in Chemistry can better be appreciated when quantified and interpreted by the use of numbers. Common use of change of subject of formulae, squares, square root, division, multiplication, and graphical representation, are mathematical methods encountered in chemistry.

A good student of Chemistry should therefore handle numerical problems using mathematical knowledge.

Hence, it is the intent of this study to find out if the achievement of students in chemistry can be predicted from their verbal and numerical abilities. Against this background therefore, the problem of this study is to investigate the correlation between secondary school students' verbal and numerical abilities and their academic achievement in chemistry.

The following research questions guided the study:

1. What is the relationship between the verbal ability of students and academic achievement in Chemistry?
2. What is the relationship between the numerical ability of students and academic achievement in Chemistry?

The following hypotheses were tested at 0.05 level of significance:

Ho_1: There is no significant relationship between students' verbal ability and academic achievement in Chemistry

Ho_2: There is no significant relationship between students' numerical ability and academic achievement in Chemistry

Methods

The correlation survey research design was adopted for this study. Correlation survey research design seeks to ascertain relationship between two or more variable (Tan, 2014).

The area of the study is the public secondary schools in Enugu North Local Government Area, of Enugu State.

The population for the study consists of 1,901 senior secondary two (SS 2) students 2020/2021 session in all the nine (9) public secondary schools in Enugu North L.G.A. (Source: Post Primary School Management Board, PPSMB Enugu Zone).

The sample for the study was 331 students drawn from all the senior secondary two SS 2 science students in the nine public secondary schools in Enugu North Local Government area. From each sampled school, simple random sampling Technique, by balloting was used in sampling the class and one intact class was used. The sample size was calculated by using the Taro Yamane formula.

The researcher used three (3) instruments for the collection of data. They include: Verbal Ability Test (VAT), Numerical Ability Test (NAT) and Chemistry Achievement Test (CAT). Each of VAT, NAT and CAT contained 25 items. The VAT was designed to determine the verbal ability of the respondents. The NAT to determine the numerical ability of the students. The CAT to determine the achievement of students in chemistry. Each of the test items has four options (A to D) for students to select one. Each correct option was awarded four marks and zero for incorrect option. The VAT and NAT were adapted from AptitudeTests.org, Getfeedback.uk, and assessmentday.com. The VAT assessed students' ability to understand word meanings, interpret detailed written information, understand word relationship, link words correctly, and use correct grammar. NAT assessed students' ability to handle problems involving addition, subtraction, division, multiplication, ratios and percentages, interpret numerical data, analyze and draw conclusions from data presented in the form of graphs. The CAT was adopted from West African Examination Council (WAEC) past question papers using senior secondary two SS2 Chemistry curriculum as guide. It was designed to test the students' cognitive ability in chemistry. Both calculation and non-calculation topics were covered.

Face validation of the instrument was conducted by three lecturers, one Measurement and Evaluation expert and two Chemistry education experts all in Enugu State University of Science and Technology. The instrument was also given to one secondary school chemistry teacher for suggestions and comment. The items were scrutinized for clarity of instruction, proper wordings, appropriateness for the study, relevance to the purpose of study, research questions and hypotheses and the suitability of the test to the level of the respondents. Their corrections and suggestions were used to produce the final draft of the instrument used for this study.

The reliability of the three instruments were established using Kuder Richardson 20 (K-R 20)

method. The instrument was administered to 30 senior secondary two (SS 2) students in Girls Secondary School Akegbe Ugwu, Nkanu West LGA in Agbani Education Zone who were not used for the study. Their results were obtained and Kuder Richardson 20 was used to determine the internal consistency of the instrument. The choice of using Kuder Richardson is because the test items are dichotomously scored. The VAT, NAT and CAT yielded a reliability coefficient of 0.86, 0.81 and 0.87 respectively. These showed high reliability of the instruments and suitable for the study.

The VAT, NAT and CAT were administered to the SS 2 Science students in their various classes through the assistance of their class teachers and two research assistants. The research assistances were briefed by the researcher on how best to administer and collect the completed copies of the instrument. The researcher collected the instrument at the end of the test through the help of the two research assistants. By summing up the students' responses to all the test items, a total score was obtained for each of VAT, NAT, and CAT.

Research questions 1and 2 were analyzed using Pearson product-moment correlation and hypotheses 1 and 2 were tested using linear regression All the hypotheses were tested at 0.05 level of significance.

Results

Research Question 1: What is the relationship between the verbal ability of students and academic achievement in chemistry?

Table 1: Descriptive Statistics for the relationship between the verbal ability of students and academic achievement in chemistry

Subjects	N	Mean	Std. Deviation	Pearson Product, R
Verbal_ability	331	44.02	11.294	.561
Chemistry	331	55.73	11.386	

Table 1 above provided the solution on the relationship between the verbal ability of students and their achievement in chemistry. The measure of their association was computed as indicated in table 1, hence, the Pearson Product Moment, R was correlated and yielded a positive correlation between verbal ability and academic achievement in chemistry at (R=+0.561).

Research Question 2: What is the relationship between the numerical ability of students and academic achievement in chemistry?

Table 2: Descriptive Statistics for the relationship between the numerical ability of students and academic achievement in chemistry

Subjects	N	Mean	Std. Deviation	Pearson Product, R
Chemistry	331	55.73	11.386	.600
Numerical_ability	331	58.27	12.533	

In table 2 above, the degree of relationship between students' achievement were identified. Pearson Product Moment correlation was computed and the result (R=+0.600) showed that there was a high positive relationship between students' numerical ability and academic achievement in chemistry.

Hypothesis 1: There is no significant relationship between students' verbal ability and academic achievement in chemistry

Table 3: Linear regression analysis on the significant relationship between students' verbal ability and academic achievement in chemistry

Model		Sum of Squares	Df	Mean Square	F	Sig.	Decision
	Regression	732.357	1	732.357	5.730	.217[b]	NS
	Residual	42048.712	329	127.808			
	Total	42781.069	330				

a. Dependent Variable: Chemistry
b. Predictors: (Constant), Verbal_ability

From Table 3 above, a linear regression was calculated to find out the significant relationship between students' verbal ability and academic achievement in Chemistry. A significant regression equation was found ($F(1, 330) = 5.730$, $p < 0.05$) and it was found to be significant at (0.217). The least residual sum of squares (42048.712) as compared to the regression sum of squares of (732.357) suggests that there are significant relationship between students' verbal ability and academic achievement in chemistry.

Hypothesis 2: There is no significant relationship between students' numerical ability and academic achievement in Chemistry

Table 4: Linear regression analysis on the significant relationship between students' numerical ability and academic achievement in Chemistry

Model		Sum of Squares	Df	Mean Square	F	Sig.	Decision
	Regression	63.721	1	63.721	.491	.484[b]	S
	Residual	42717.348	329	129.840			
	Total	42781.069	330				

a. Dependent Variable: Chemistry
b. Predictors: (Constant), Numerical_ability

Table 4 above, regression analysis was calculated to investigate the significant relationship between students' numerical ability and academic achievement in Chemistry. A significant regression equation was found ($F(1, 330) = 0.491$, $p > 0.05$) and it was found to be significant at (0.484). The residual sum of squares (42717.348) as compared to the regression sum of squares of (63.721) suggests that there is significant relationship between students' numerical ability and academic achievement in chemistry.

Discussions

The findings from this study showed that the scores of students in the chemistry test and verbal ability test are positively correlated. This means that the higher a student's verbal ability, the higher the achievement in chemistry. Hence the relationship between students' verbal ability and achievement in chemistry is significant. This is consistent with the research studies of Adejimi, Nzabalirwa, and Shivoga (2020), who discovered that verbal ability is a determining factor of high achievement in sciences though biology was used as a case study. The findings tallies with the statement of Adegbile and Alabi (2007) that students' grades to a large extent are associated with verbal ability. Also, it is in line with the assertion of Nweze and Uzochukwu (2019) that language problem is one of the reasons for students' poor performance in chemistry. Similarly, it agrees with the aversion of Bloom (1974) that verbal ability is a necessity if a child is to learn in school. These are also supported by

findings in this study as achievement in verbal ability translated to similar achievement in chemistry. This implies that a student who has high verbal ability is more likely to learn chemistry better and faster and hence achieve better in chemistry than the one who has low verbal ability.

The findings from this study also showed that the achievement of students in numerical ability test and academic achievement in chemistry test is positively correlated. Hence, the relationship between the numerical ability of students and academic achievement in chemistry is significant. This means that a student with high numerical ability will invariably achieve high in chemistry. This study agreed with Cooke and Canelas (2019), who reported that the mathematical difficulties which students encounter in a chemistry context may not be because of an inability to transfer the knowledge, but may instead be due to insufficient mathematical understanding and/or knowledge of mathematical concepts relevant to chemical kinetics and thermodynamics. It also tallies with this assertion of Redish, (2017) that the ability to integrate mathematical and scientific knowledge is viewed as an important sign of student progress. Similarly, it agrees with the report of Ahiakwo (2015) that numerical questions are analogous to the chemistry questions, any practice at one should transfer some improved ability at the other. Hence, student lack adequate mathematical or numerical knowledge that will enable them to do well in chemistry.

Conclusion

The findings from this research work revealed that both verbal and numerical ability show a significant positive correlation with academic achievement in chemistry. This relationship indicates that one is needed for appropriate interpretation and understanding of the other. This means that for students to do well in chemistry, the student should have high verbal and numerical abilities.

Recommendations

Based on the findings of the study, the following recommendations were made.

1. Since students' verbal and numerical abilities correlate positively with achievement in chemistry, school authorities should provide learning materials that are effective in developing skills of students in numerical and verbal domains as a means of improving the achievement of students in chemistry.
2. Students should be encouraged to be more liberal in their learning by availing themselves of every opportunity to sharpen their reasoning, verbal and numerical skills. They should read widely, consult materials on these variables and pay attention to the learning of English and Mathematics as well as other subjects.
3. The medium of instruction used in the classrooms should be geared towards easy assimilation by the students
4. Authors of textbooks and other books meant for students should be careful of the effectiveness and clarity of words used to convey their messages in the course of writing books. They should explore all areas that will help students to sharpen their verbal and numerical skills.
5. Seminars, workshops and conferences should be organized for science teachers and lecturers on the need to help students develop high verbal and numerical abilities in other for them to do well in sciences.
6. Studies of this nature are recommended to be carried out to provide further empirical evidence on the relationship between students' achievement in chemistry and their verbal and numerical abilities.
7. Curriculum developers, examining bodies, evaluators, researchers and educational practitioners who are stakeholders in the development of suitable curriculum for secondary school students should inculcate activities that will enable students develop high verbal and numerical abilities.
8. It is obvious from this study that both verbal and numerical ability have high correlation, this relationship indicates that one is needed for appropriate interpretation and understanding of the other, hence a balanced approach should be adopted in teaching of both numerical and verbal skills in secondary schools.

9. Researchers in education should place emphasis on ways which will help students to develop high verbal and numerical abilities in other for them to have high achievement in chemistry.

References

Adegbile, J. A. & Alabi, O. F. (2017). Effect of verbal ability on second language writers' achievement in essay writing in English Language. *International Journal of African and American Studies*, 6(1), 174-182. https://doi.org/10.1.1.531.8781

Adejimi, S. A., Nzabalirwa, W. & Shivoga, W. A. (2020). Age, gender and verbal ability as predictors of students' achievement in Biology. *International Journal of Studies in Education and Science (IJSES)*, 1(1), 80-91.

Aderogba, A.A. & Olatoye, R.A. (2011). Performance of senior secondary school science students in aptitude test: the role of student verbal and numerical abilities. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)*, 2 (6); 431-435.

Akinboye, J.O. (2001). *Concepts in Formal Education*, Ibadan: University Press Limited.

Ahiakwo, M. J. (2015). Senior secondary students' performance in selected aspects of quantitative Chemistry. *AJCE*. 5(1); 69-83.

Amoke, M. K. (2020). Analysis of Students' Performance in Chemistry in the West African Senior School Certificate Examination (WASSCE) and National Examination Council (NECO) from 2015-2018. International Journal of Research and Analytical Reviews, 7 (1); 35-49.

Ann, P. S. (2004). Measurement, Assessment and Evaluation, Lagos: Concept publications limited.

Anazia, I.U (2019). Quantitative and Verbal Attitude as Predictors of Senior Secondary Schools Students' Performance in Economics. *IAFOR Journal of Education*, 7(1), 7-18.

AptitudeTests.org, (2020). Numerical Reasoning Test. Retrieved from *www.aptitudetests.org/numerical-reasoning-test*

Assessment Day, (2020). Practice test Experts: Numerical Reasoning Tests. *Html/www.assessmentday.co.uk Accessed on* 02/05/2021

Bloom, S.B. (1974). Implication of IEA Studies for Curriculum and Instruction. *University of Chicago School Review*, 14, 2-6

Cooke, B. P. & Canelas, D. A. (2019). Transition of mathematics skills into introductory chemistry problem solving. *ACS Research on Students' Understanding of Chemistry and Mathematics, 119-133*.

Ezeliora, B. A., Ibe, F. N. & Obikezie, M. C. (2021). Comparative effects of teaching with improvised instructional materials and standard instructional materials on secondary school students' academic achievement in chemistry. *International Journal of Research in Education and Sustainable Development*, 1 (8); 26-40.

Getfeedback (2013). Sample report dat. Retrieved from: *www.getfeedback.net*

Jimson, A. T. (2018). The place of women education in the development of science, mathematics and technology. *42 Annual conference Proceeding of Science Teacher Association of Niger*. 170-173. Retrieved online from https://www.ijsr.net/archive/ v2i6/IJSROFF2013284.pdf on 26/8/2020.

Krstic, M., Krstic, B., & Antonovic, R. (2019). The importance of science for improving competitiveness of National Economy. *Facta Universitatis Economic and Organisation.*16(1); 13-30.

Nweze, B. N. (2017). Effect of locally available instructional materials on students'achievement in chemistry in secondary schools. *IMT International Journal of the Arts and Sciences.* 2(1); 23-32.

Nweze, B. N. & Uzochukwu, B. (2019). The Prediction of Student Performance in Chemistry-based Courses in Public Universities Using University Matriculation Entrance Scores in Chemistry. *American Society for Engineering Education*, 2-19.

Okorie, E. U. (2018). Emerging Issues in Chemistry Education. *Emerging Issues in Science and Vocational Education.* 1(6); 96-108.

Redish, E. F. (2017). Analysing the competency of mathematical modelling in physics. In Greczyło, T. and Debowska, E. (eds). *Key Competences in Physics Teaching and Learning.* Switzerland: Springer, 25–40.

Rocke, A. J. & Usselman, M. C. (2020).Chemistry. Encyclopedia Britannica. Accessed from britannica.com/science/chemistry

Tan, L. (2014). Correlational Study. *Music in the social Bahavioral Sciences: An Encyclopedia, 269-271.*

WAEC Report, (2014). Mass Failure as WAEC release May/June exam result-Vanguard News. Accessed from http://www.vanguard.com/2014/08/mass-failure-as-waec-releases-may june-exam-results. 60.

WAEC (2014). Chief Examiner's Report, 2011, 2012, 2013, 2014, 2015, 2016, 2017, and 2018

Wikipedia, (2021). Chemistry. Retrieved from *www.wikipedia.org/wiki/chemistry*

USE OF INTERNET TOOLS IN TEACHING AND LEARNING OF COMPUTER SCIENCE

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Abstract
The main purpose of this study is on the use of internet tools in teaching and learning of computer science in Colleges of Education in Enugu State. Two specific purposes and two corresponding research hypothesis were raised to guide the study. The literatures related to this study were reviewed under conceptual framework. The research design adopted for this study was survey design. The population of the study consisted of 169 N C E undergraduate students and lecturers in the two (2) colleges of education in Enugu State. There was no sampling, because the population is small. The instrument used to obtain data was a structured questionnaire. The instrument used was validated by three experts in the Department of Mathematics and Computer Science Department from Faculty of Education in Enugu State University of Science and Technology Enugu. The test-retest reliability procedure of 0.84 index were adopted and was highly reliable. The data collected were analyzed using mean and t-test. The findings showed in research question one revealed that e-mail as an internet tool have a great influence in teaching and learning of Computer Science in Colleges of Education in Enugu State. There is no significance difference. The respondents also revealed that Google through its numerous platforms improves students understanding and learning in Computer Science. There is no significance difference. Based on the findings, the researcher recommends among others that Internet facilities should be made available for teaching in Colleges of Education in Enugu State and that government should from time to time organize seminars for both teachers and students on the use of whatsapp, zoom conferencing, smart phones and E-mail as to improve students' knowledge on how to use them positively for teaching and learning.

Keywords: *Internet, Teaching, Tools, learning, Computer Science*

Introduction

In modern times, access to information is more relevant for academic work in all higher institutions. Internet is a platform where millions of people engaged in the creation and exchange of information. Indeed, this fact affects a large and deep to academic achievement and social life. By this, a review of the literature was carried out to explore and investigate the effect of the internet on academic achievement. It is very important for the researcher to know how the authors see the use of the internet and its impact on students. In addition, it aimed at how digital online can help students in their academic. The researcher also wants to see how well the student learning process becomes effective by using Internet as a source of reference information. Furthermore, Oak (2016) revealed that there is a positive and negative effects of Internet usage in the learning process.

The use of Internet has become very popular in many areas as well as in the educational sector. Accordingly, Internet access in schools has increased greatly over the last 20 years (Berson, 2017). This shows that more students are relying on the Internet for their academic needs than any other areas. In recent years the Internet has become a very effective and popular tool used by students for their academic work as well as for other various purposes including entertainment and communication.

Internet provides a collaborative environment for sharing as well as to see information on a wide, divergent and variety of subjects. Consequently, its use has become very popular among the student community which is used by them to supplement their studies. The availability of the Internet and electronic resources may have a negative effect on the use of an institution's library by students, while socio-economic and demographic characteristics of students can also have a significant impact. It is possible that while some students go to the library to use the available services, others may not go to the library, perhaps due to the availability of alternatives like personal e-resources and Internet connection at their service. Franscottiet (2017) are of the view that, libraries are trying to reinvent themselves to be more appealing to students. They are doing this by fostering literacy information through resources and services to encourage their clients to visit and use the library. In spite of this, studies have shown that attitude of students to the use of library and what characterized their use, reasons for using the library, and information need vary, and where there is low use, there are often pedagogic reasons for it.

The use of social media technologies widely used by students can have a positive impact on students and a key factor for the students in achieving summative grade and left the course early (Garcia, 2015). Besides, according to (Ahsan Ul Haq and Sohail Chand, 2012) the use of Facebook by students adversely affect their academic performance. These negative effects are more to male students. This is based on the behavior of male students who are more active and which spend a lot of time on Facebook makes them unable to focus on their academic works. Moreover, (Rouis, Limayem, and Sangari, 2018) argued in their research that many students use Facebook with an extroverted personality can lead to poor academic achievement. It indicates that the personality of a person while using Facebook play a role on whether the academic performance can be achieved or not. Therefore, the present study tends to identify the use of internet tool in teaching and learning of computer science in Colleges of Education in Enugu State.

Internet website, such as facebook, twitter and linkedIn) are currently used by many people to connect with their friends and relative around the globe. The use of the various internet platforms has grown so fast that it has even attracted the attention of higher institution students; they are so engrossed in the site that they have almost completely forgotten about their academic works, higher institution student are considered victims of internet site more than group of people as they negatively impact on their academic performance.

Students easily get tempted to use the various internet platforms when trying to obtain learning materials online. In most cases, the students end up spending almost all their times on the internet and forget about the course materials they originally intended to look for. Internet serve as a significant distraction for academic performance of student. Facebook, the most popular internet site, was specifically designed for undergraduates and is the most frequently used. Therefore, time spent on internet may affect academic performance. For example time spent on facebook may directly affect and/or moderate the relationship between traditional predictors of academic performance (i.e. CAT scores, high school GPA, study time, etc and college GPA vital to the lives of many college student.

In addition, internet increase short attention spans and subverted higher – order reasoning skills such as, concentration, persistence and analytical reasoning among students who frequently use internet; a tendency to overestimate one's ability to multi-task and manage projects; and technology being seen as a substitute for the analytical reasoning process. The risk plays a vital role in student's academic performance to various degrees and at various times.

A college of education is a teacher training institution or a professional training college for teachers. Nigeria has 152 educational institutions. These institutions were established to train qualified candidates to become certified teachers and lecturers. Meanwhile, Enugu State has both private and government owned higher college of education such as; Federal College of Education, Eha-Amufu, Enugu State College of Education (Technical), Enugu, Osisa Tech. College of Education, Enugu, African Thinkers Community of Inquiry College of Education, Peaceland College of

Education, Enugu, The College of Education, Nsukka, Elizabeth Memorial College of Education, Nsukka, Institute of Ecumenical Education (Thinkers Corner). Like other states, Enugu State recognizes that education is the key to development hence the need for collaboration with the private sector for higher educational institutions (college of education) to meet the educational demands of the already teeming population in the state (Okorie, 2021). Meanwhile the present study tends to identify the use of internet in teaching and learning of computer science in colleges of education in Enugu State.

This study sought to assess the use of internet in teaching and learning of computer science in colleges of education in Enugu State. Specifically, the study sought to:

1. Determine the use of e-mail as internet tool in teaching and learning of computer science in colleges of education in Enugu State.
2. Find out the use of Google search Engine in teaching and learning of computer science in colleges of education in Enugu State.

The following research questions are developed to guide the study

1. What are the use of e-mail as internet tool in teaching and learning of computer science in colleges of education in Enugu State.
2. What are the use of Google search Engine in teaching and learning of computer science in colleges of Education in Enugu State?

The following hypotheses was used to guide the study
HO^1: there is no significance difference between the use of e-mail as internet tool and teaching and learning of computer science.
HO^2: there is no significance difference between Google search engine as internet tools and teaching and learning of computer science

Methods

The study was carried out in Colleges of education in Enugu State. Enugu State has two major colleges of Education; Enugu State College of Education (Technical), Enugu (State College) and Federal College of Education, Eha-Amufu, Isi-Uzo L.G.A, Enugu State. The population of the study comprised of one hundred and sixty nine (169) Computer Science lecturers and student in the two public Colleges of Education in Enugu State (Exams and Records, 2023).There was no sampling for the study. This is because the population of the study is small hence the entire population of one hundred and sixty nine Computer Science lecturers and N C E Students was used for the study. The questionnaire was structured according to a modified four point likert scale with response options as Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The response options: Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (D), were assigned nominal values of 4, 3, 2, and 1 respectively. The questionnaire comprises of 15-item questionnaire. The instrument used in this study was subjected to proper validation by three experts from the department of Computer Science and one from measurement and evaluation of Mathematics and Computer Science Department, Faculty of Education, all in Enugu State University of Science and Technology, Enugu. They examined the items in terms of clarity of instruction to the respondents, proper wording of the items and appropriateness and adequacy of the items in measuring what they are supposed to measure. Their corrections and recommendations were used to prepare the final copy of the questionnaire. To ascertain the reliability of the instrument, the researcher conducted a trial test at Federal College of Education, Umunze. The researcher administered 30 copies of the instrument to the lecturers who were randomly drawn from the school. The reason for choosing the school was that the school has similar curriculum with the schools under study and the school trains the students on the use of computer (ICT). The reliability of the instrument was ascertained using Cronbach's Alpha and overall reliability Index (0.84) was determined, and the reliability index of 0.84 showed that the instrument was highly reliable. The researcher administered the instrument on the respondents with the help of students and lecturers in the two Colleges of Education. One hundred and sixty nine (169) copies of the questionnaire were administered and all were collected back.

Mean and standard deviation were used to analyze the data collected with the questionnaire. The formula for mean is given as: $X =$, X= Mean, Σ = Summation, F

= Frequency of the response option, N = number of respondents and X = Nominal Values of the response options. The criterion mean was determined by finding the mean of the nominal values thus: X = 2.50. Thus, based on this result, any questionnaire item whose mean rating was greater or equal to 2.50 was regarded as Agree (A), while any questionnaire item whose mean rating was less than 2.50 was regarded as Disagree (D)

Results

Research Question 1: What are the use of e-mail as internet tool in teaching and learning of computer science in colleges of education in Enugu State.

Table 1: Mean response on the use of e-mail as internet tool in teaching and learning of computer science

s/n	Items on e-mail on students academic performance	SA	A	D	SD	N	EFX	$\overline{X}$ mean	Remark
1	e-mail facilities enable effective teaching and learning	60	40	9	60	169	438	2.59	Agree
2	e-mail helps in storing information for a long time	80	20	30	39	169	479	2.83	Agree
3	e-mail makes learning materials interesting and handy	100	30	20	19	169	549	3.24	Agree
4	Effective use of e-mail helps in easy allocation of resources from teachers to students	150	10	9	-	169	648	3.83	Agree
5	e-mail promotes information of sharing among students	120	25	15	9	169	594	3.51	Agree
	Grand Mean							2.80	Agree

The results of the date analysis in table 1 indicated that items 1,2,3,4 and 5 had mean ratings of 2.59, 2.83,3.24, 3.83 and 3.51 respectively. The grand mean rate was 2.80, and was greater than the cut-off point of 2.50. This implied that e-mail have a positive influence on students academic performance in Colleges of Education in Enugu State

Null Hypothesis 1

HO^1: there is no significance difference between the use of e-mail as internet tool and teaching and learning of computer science.

Table 2: t-test Result of the significance difference between the use of e-mail as internet tool and teaching and learning of computer science.

t-test

Group	N	Mean	SD	SE.	T	P	Dec
E-mail as internet facility	169	2.0000	0.27785	4.35327	3.345	0.029	Sign
Total	169						

Result in this Table revealed significant difference between the mean rating difference between the use of e-mail as internet tool and teaching and learning of computer science. The p-value of 0.029 is less than (<) the alpha level of 0.05. Therefore the null

hypothesis is rejected while the alternate hypothesis is retained. This shows that there is significant difference between the use of e-mail as internet tool and teaching and learning of computer science

Research Question 2: What are the use of Google search Engine in teaching and learning of computer science in Colleges of Education in Enugu State?

Table 3: Mean Response on the use of Google search Engine in teaching and learning of computer science

s/n	Items: Google search Engine on students performance?	SA	A	D	SD	N	EFX	X mean	Remark
11	Google helps in getting information from a wide network	60	52	31	26	169	484	2.86	Agree
12	It improves students online study habit	58	67	23	21	169	500	2.95	Agree
13	Google facilities fast acquisition of materials	56	63	30	20	169	493	2.91	Agree
14	Google serves as a classroom environment for learning	65	45	35	24	169	489	2.89	Agree
15	Google sorts easy access to information on Social issues of the country and all aspect of life.	76	56	20	15	169	529	3.13	Agree
	Grand Mean							2.94	Agree

The results of the date analysis in table 3, indicated that items 11,12,13,14 and 15 had mean ratings of 2.86, , 2.95, 2.91, 2.89 and 3.13 respectively. The grand mean rate was 3.04, and was greater than the cut-off point of 2.50. This implied that Google search Engine on students performance in Colleges of Education in Enugu State is high.

Hypothesis 2

HO^2: there is no significance difference between Google search engine as internet tools and teaching and learning of computer science

Table 4: t-test Result of the difference between Google search engine as internet tools and teaching and learning of computer science

t-test

Group	N	Mean	SD	SE.	T	P	Dec
Google as Internet facilities	169	8.0000	3.36155	3.35327	5.588	.005	Sign
Total							

Result in Table 5 reveals significant difference between Google search engine as internet tools and teaching and learning of computer science. The p-value of 0.005 is less than (<) the alpha level of 0.05. Therefore the null hypothesis is rejected while the alternate hypothesis is retained. This shows that there is significant difference between the mean rating of Google search engine as internet tools and teaching and learning of computer science.

Discussion of Findings

In research question one, on the influence of e-mail tools in teaching and learning of computer science, the researchers observed that e-mail facilities enable for effective teaching and learning, e-mail helps in storing information for a long time, e-mail makes learning materials interesting and handy, Effective use of e-mail helps in easy allocation of resources from teachers to students and that e-mail promotes information of sharing among students. This is in line with the work of Benrson (2017) who opined that internet access in schools has increased greatly over the last 20 years.

In research question two, the findings revealed influence of Google search Engine on students performance. From the findings Google helps in getting information from a wide network, Google serves as a classroom environment for learning, and that Google sorts easy access to information on Social issues of the country and all aspect of life. This has a link with the work of Obashoro (2017), that almost all the students in rural secondary school schools make use of Google facilities in learning.

Conclusions

The Internet provides a collaborative environment for sharing as well as to see information on a wide, divergent and variety of subjects. Consequently, its use has become very popular among the student community which is used by them to complement their studies. The researcher concludes that the use of technology as a learning tool can make a measurable difference in student achievement, attitudes, and interaction with teachers and other students. Interactive, self-directed learning and higher order thinking can be fostered by ICT, and that ICT can have the greatest benefit when the environment is conducive to such experiences. Thus the government at all level as a matter of necessity, should provide a conducive ICT environment in our schools to ensure that the games of ICT are trapped to the fullness

Recommendations

Based on the findings, the following recommendations are made:

1. Internet facilities should be made available for teaching in Colleges of Education in Enugu State.
2. Government should from time to time organize seminars for both teachers and students on the use of whatsapp, zoom conferencing, smart phones and E-mail as to improve students' knowledge on how to use them positively for learning.
3. Steady power supply and mobile network should maintained to facilitate confidence and positive learning in the area.
4. Parents should encourage their children by providing smart phones and other ICT gadget for effecting teaching and learning of Computer Science.
5. Schools should try as much as possible to maintain the already provided ICT facilities by the government.

References

Adekomi A.A. and Oyewusi S.O. (2018). *Effect of violent video games* on aggressive behavior, aggressive cognitive, aggressive affect, physiological arousal and pro-social behavior.

Ahsan U. l H. And Sohail, C. (2012). *Child trends and data bank watching television indictor, retrieved September 14, 2016.*

Anand, S.O. (2017). Media and violence: *intervention strategies for reducing aggressive, media psychology.*

Asemah, S.A. Okpanachi, R.O. and Edegoh, W.E.2018). *Nielsen report on television.* New York: A.C. Nielsen Company.

Bajpaie*t*, H.P. 2016). *Compendium of physical activities: an update of activity codes and MET intensities. Medicine and Science in Sports and Exercise 32*, S498–S516.

Berson, A.O. (2017). *Diagnostic and statistical manual of mental disorders, fourth edition, text revision (DSM-IV-TR).* Washington, DC: American Psychiatric Association.

Bola S.I. and Ogunlade, G.U. (2012). *Unraveling the mystery of health.* San Francisco, CA: Jossey-Bass.

Cray E.W. (2016). Anxiety UK study finds technology can increase anxiety. Retrieved from http://www.anxietyuk.org.uk/2012/07/for-some-with-anxiety-technology- can-increase-anxiety.

Encyclopedia (2018). *Predictably irrational* (1st ed.). HarperCollins Publishers.

Franscottiet G.J. (2017). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist, 55*, 469-480. 40.

Garcia, S.J. (2015). Social integration, social networks, social support, and health. In Berkman, L.F. and Kawachi, I. (eds), *Social epidemiology* (137–173). New York: Oxford University Press.

Israel W.O. and Edesire, S.A (2016). *History of the mass media in the United States: an encyclopedia. Fitzroy Dearborn. ISBN 978-1-57958-012-4.*

Kubey, T.I. (2019). *Mass Media and Historical Change: Germany in International Perspective, 1400 to the Present* (Berghahn, 2015). 212 pp. online review

Nalah A.A. (2019). *Mass Persuasion: A Historical Encyclopedia, 1500 to the Present* (2003) 479 pp; worldwide coverage

Nnadozie, C.O. and Nwosu, A.A (2016). Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. *Journal of the American Medical Association*, 2581–2590.

Oak, O.I. (2016). Amber lenses to block blue light and improve sleep: a randomized trial. *Chronobiology International, 26*(8), 1602-1612.

Odede W.O. and Enakerapo, S.K. (2018). Development in the transition to adulthood: Vulnerabilities and opportunities. In Grant, J. E., and Potenza, M. N. (Eds.), *Young adult mental health* (5-18). New York: Oxford University Press.

Okazie, S.I. (2016). Overweight and obesity in Australia: the 1999–2016 Australian diabetes, obesity and lifestyle study. *Medical Journal of Australia, 178,* 427-432.

Quadri A.O. (2018).“They are happier and having better Lives than I am”: The impact of using Facebook on perceptions of others’ lives. *Cyberpsychology, Behavior, and Social Networking, 15*(2), 117-121.

Steinmyarl, S.I. Meiber, W.J. Weidinger, S.U. & Wirthwein D.A. (2019).

Rouis, A.J. Limayem, A.F. & Sangari, S.U. (2018). The association between social isolation and DSM-IV mood, anxiety, and substance use disorders: wave of the national epidemiologic survey on alcohol and related conditions. *Journal of Clinical Psychiatry, 72*(11), 1468-1476. 41

Shakir. U. (2019). The spread of obesity in a large Social network over 32 years. *The New England Journal of Medicine, 357*, 370–379.

Singh S.P. (2016). Social Relationships and Health. *American Psychologist, 59,* 676–684.

EFFECT OF COMPUTER ASSISTED INSTRUCTION ON UPPER BASIC (JSS) STUDENTS' INTEREST IN HEALTH EDUCATION

BY
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Abstract
The purpose of the study was to investigate the effects of CAI on Upper Basic Education (Junior Secondary School) students' interest in health education. Quasi-experimental design was adopted in the study. Two research questions and three hypotheses guided the study. The study was conducted in Abia state of Nigeria. The population for the study consisted of 16381 Upper Basic Education (Junior Secondary School) students in the 36 public secondary schools in urban and rural areas in Umuahia Education Zone, Abia state. A sample of 414 Upper Basic Education (Junior Secondary School two) students was used for the study. The sample consisted of 229 urban and 185 rural schools' students. Health Education Interest Inventory (HEII) was validated by three research experts. HEII yielded a reliability coefficient of .81 obtained through Cronbach Alpha. The researcher administered the instrument to the respondent's hand to hand and received back the completed copies same way with the help of three trained (3) research assistants. Mean and standard deviation were used to answer the research questions while hypotheses were tested using Analysis of Covariance (ANCOVA). The research discovered that students taught Health Education using CAI significantly had higher interest in Health Education than their counterparts in the control group and there was no difference between the mean interest scores of urban and rural students in Health Education. Based on the findings of the study, the study recommended the Federal/State Ministry of Education should ensure that Periodic practical oriented workshops and seminars are organized for health education teachers on the use of CAI for the teaching of Health Education.

Keywords: *Computer Assisted Instruction (CAI), Health Education, Location, Students' Interest*

Introduction

Health Education is a process of educating people about health. Lema (2012) defined Health Education as the principle by which individuals and groups of people, learn to behave in a manner conducive to the promotion, maintenance, or restoration of health. However, as there are multiple definitions of health, there are also multiple definitions of health education. Health education according to World Health Organization (2008) comprised consciously constructed opportunities for learning involving some form of communication designed to improve health literacy, including improving knowledge and developing life skills which are conducive to individual and community health. Health education as an intervention programme is not only concerned with the communication of information, but also with fostering the motivation, skills and confidence necessary to take action to improve health.

In Nigeria, health education is a subject studied at the basic education level (Basic 1 –Upper Basic 3). Also, a similar subject, health science, is offered at senior secondary level. However, Health Education is studied at tertiary levels up to Doctor of Philosophy (Ph.D) level. In the context of the study, Health Education refers to the health subjects offered at upper basic education (junior secondary school) level. From the discussion above, the role of health education in human development and sustenance cannot be over emphasized. Unfortunately, research evidences from scholars like Obi (2016), Otobo (2014) have consistently shown that students exhibit low interest in Health Education especially at upper basic education (junior secondary school) level. This unfortunate and reoccurring trends have led researchers make case for the use of innovative teaching methods to improve students' interest in Health Education. However, the study is concerned with CAI method of instruction. Computer Assisted

Instruction (CAI) that deals with the use of computers in teaching.

Computer Assisted Instruction (CAI) is the general term used to describe virtually, any learning activity that is promoted by computer or in which a computer is involved (Keko, 2014). Computer assisted instruction has features that offer the learner amusement and pleasure. Yet, these amusement and pleasure are designed to perfectly combine with instruction (intended lesson). Interestingly, as CAI may sound, educators still vary in their opinions as regards its use in teaching and learning. A number of educators believe that computer programs have tremendous potential for the enhancement of the teaching and learning of some concepts (Ellis and Marks, 2014). Others maintain that animations and computer software inhibit students' interest (Tsui & Solloway, 2014). So it is too early to draw definitive conclusions about the effectiveness of computer programs in teaching and learning process. Hence, research such as the study that explored its efficacy on students' interest in Health Education is justified. Kwame and Damte (2013) described interest as a disposition, attitude and feelings of an individual towards an activity which shows behaviorally, the extent the person likes to participate in an activity. Rix (2012) defined interest as inward state of the mind towards something. Hanks (2011) saw interest as that which concerns, involves or draws the attention of or arouses the curiosity of a person.

Solloway (2014) observed that one strategy for enhancing the students' interest in Health Education is to increase the students' sense of control and self-determination by providing choice or locus of control. It has been well documented that individuals offered choice show more interest, better achievement, and greater persistence at a variety of activities due to increased interactivity or controllability (Marks, 2014; Rix, 2012). Controllability and interactivity may differ among different CAI types. It is expected that the controllability and interactivity attributes of the CAI designed for the study should have considerable effects on students' interest in Health Education. Thus, the study seeks to determine this effect and compel it with the effect of lecture method on students' interest in Health Education. This is because there are controversies among scholars on whether Computer Assisted Instruction enhances students' interest in Health Education or not.

The findings of the majority of the scholars like Idowu (2013), Lema (2012), Muyiwa (2012), Ngopi (2012) revealed that students taught Health Education with Computer Assisted Instruction showed more interest than their counterparts who were taught the same health education topics with expository method while the findings of few scholars like Rix (2012), Ukachi (2011) reported that the students who were taught Health Education with lecture method had higher interest more than their counterparts taught with Computer Assisted Instruction (CAI) whereas the findings of scholars like Obi (2016) revealed that there were no significant difference between the students who were taught Health Education with lecture method and their counterparts taught with Computer Assisted Instruction (CAI) on Students' interest in Health Education. Since, none of these scholars have ever investigated such related studies in Abia state, the researcher deemed it necessary to determine the efficacy of Computer Assisted Instruction (CAI) on Students' interest in Health Education.

Apart from effect of CAI, another independent variable of interest to the researcher in this work is influence of location of schools on students' interest in health education when taught with Computer Assisted Instruction. Location in this context would be categorized into two viz; urban and rural. Undoubtedly, urbanization and rural development still pose great challenges to the government of the third world countries such as Nigeria. In the urban areas, barely all the basic infrastructures are inadequate in supply, hence, the struggle for and consequent over stretching of the available few, (Igunma, 2014). The emergence of urban congestions has worsened things and created more unmanageable social problems. The problems of urbanization are many and they constitute a big threat to teaching and learning in our school. This is because learning must take place in very conducive environments.

On the other hand, the situation in the rural areas is not in any way better. Ngopi (2012) reported that although the rural locations may never be known for

over-population, they have definitely suffered neglect and abandonment. Hence, schools in the rural areas are marked by dilapidated buildings, where they even exist at all and lack of necessary equipment to enhance teaching and learning. Lema (2012) added that many rural schools have been deserted by teachers who usually seek transfers to urban areas. All these largely tell on the learners who are the most vulnerable. The status of urban and rural schools described above raised pertinent worry in the mind of the researcher on what could be the effect of computer assisted instruction on the achievement, interest and retention of urban and rural schools' students in health education.

In Nigeria, health education is a subject studied at the basic education level (Basic 1 –Upper Basic 3) that has recorded students' low interest. Many researchers have consistently reported that students exhibit low interest in Health Education especially at upper basic education (junior secondary school) level. This unfortunate and reoccurring trends have led researchers make case for the use of innovative teaching methods to improve students' interest in Health Education. This prompted the researcher to embark on a research to determine whether Computer Assisted Instruction (CAI) could boost students' interest in Health Education since that there are controversies among scholars on whether CAI can boost students' interest or not. Hence, the researcher asks: Can CAI affects upper basic (Junior Secondary School) students' achievement in Health Education? Again, how does location of schools influence upper basic students' interest in health education when taught with CAI?

The purpose of the study was to investigate the effect of Computer Assisted Instruction on upper basic (JSS) students' interest in Health Education. Specifically, the study aimed at determining the effect of Computer Assisted Instruction on upper basic students;

1. interest in health education;
2. interest in health education with regard to location of their schools.

The following research questions guided the study

1. What are the mean health education interest scores of students taught using Computer Assisted Instruction (CAI) (Experimental group) and those taught using Expository method (Control group) in both pretest and posttest?
2. What are the mean health education interest scores of urban and rural schools' students in experimental and control groups in both pretest and posttest?

The following research hypotheses were tested at 0.05 level of significance;

1. There is no significant difference between the mean health education interest scores of students in the experimental and control groups.
2. There is no significant difference between the mean health education interest scores of urban and rural schools' students in the experimental group.
3. There is no significant interaction effect of location and methods on students' interest in health education.

Methods

The research design adopted in the conduct of this investigation was non-equivalent quasi-experimental was used. The researcher deliberately manipulated the independent variable, controlled the extraneous variables and observed the effects on the dependent variables. Area of the study was Abia State of Nigeria. The study was conducted in Umuahia Education Zone of Abia State. The population for the study was 16381 Upper Basic II (Junior Secondary School 2) students in the 36 public secondary schools in urban and rural locations within the Umuahia Education Zone, Abia State. A sample of 414 Upper Basic II students was used for the study. The sample was 229 urban schools' students and 185 rural schools' students. Also, the study sampled 210 students in experimental group and 204 students in the control group. The sample was drawn from eight intact classes in the two urban and two rural secondary schools randomly drawn from Umuahia Education zone. By purposive sampling, the researcher drew all the urban and rural secondary schools in the area of the study with facilities for Computer Assisted Instruction (CAI). Computer Assisted Instruction (CAI) was used because not all schools in the Umuahia education zone that have CAI and CAI is the study's main research variable.

The instrument used for data collection was Health Education Interest Inventory (HEII). HEII was used to collect pretest and posttest interest scores. This instrument was developed by the researcher. HEII was validated by three research experts. Two from Department of Health and Physical Education and one from Department of Mathematics and Computer Education, all from Faculty of Education Enugu State University of Science and Technology (ESUT), Enugu. HEII was administered to 50 Upper Basic II (JSS 2) Students in Agbani Education zone, Enugu State. Cronbach Alpha was used to determine the reliability. A reliability coefficient of .81 was obtained for the instrument. The researcher trained four (4) regular Health Education teachers in the four (4) secondary schools to be used in the study for a period of two weeks on the use of Computer Assisted Instruction. The researcher provided all lesson plans used in training the regular teachers in each school. In addition, all necessary computer software to facilitate the experimental groups' lessons training was also provided. The main experiment procedure lasted for six weeks. The main experimental procedure included

HEII was administered to all the subjects of the study before the commencement of the experiment to collect pre-test data. After six weeks of treatment, HEII was re-arranged and administered to all the subjects to collect post-test achievement scores. HEII was scored 4, 3, 2, 1 for Strongly Agree, Agree and Disagree and Strongly Disagree respectively for positive items and 1, 2, 3, 4 for Strongly Agree, Agree and Disagree and Strongly Disagree respectively for negative items. The individual student interest score was converted to 100 using the following formula;

$$\bar{x}_i = \left(\frac{x}{56} \times 100\right)\%$$

Where x = the individual's total score
56 = maximum score obtainable (4 marks x 14 items)

Research Questions were answered using mean and standard deviation while test of hypotheses was done using Analysis of Covariance (ANCOVA) at 0.05 level of significance. ANCOVA is usually preferred for hypotheses testing in quasi-experimental studies because ANCOVA is statistically designed to take care of the initial differences among subjects of the study especially when intact classes are used (that is no randomization).

Results

Research Question 1

What are the mean health education interest scores of students in the experimental and control groups in both pretest and posttest?

Table 1: Mean Interest Scores of Experimental and Control Groups in Pretest and Posttest

Group	N	Pretest		Posttest	
		Mean	SD	Mean	SD
Experimental	210	38.92	7.1203	88.42	4.2351
Control	204	39.13	7.4018	69.13	6.1024

From table 1, the interests mean scores the pretest mean score of experimental group was 38.92 with the standard deviation of 7.12 while that of control group was 39.13 with the standard deviation of 7.40. In the posttest, the experimental group had an interest mean of 88.42 with the standard deviation of 4.24 while the control group had an interest mean of 69.13 with the standard deviation of 6.10. This result showed that the two groups showed higher interest in Health Education after the treatment. However, the posttest interest mean score of the experimental was higher than that of the control group. More so, a lower standard deviation value of 4.2351 in the posttest for experimental group indicated that there were fewer extreme scores in the experimental group than the control group.

Research Question 2

What are the mean health education interest scores of urban and rural schools' students in experimental and control groups in both pretest and posttest?

Table 2: Mean Interest Scores of Urban and Rural Schools' Students in Pretest and Posttest.

Group	N	Pretest		Posttest	
		Mean	SD	Mean	SD
Urban (Experimental)	113	37.67	7.2254	86.20	3.1333
Rural (Experimental	97	38.40	7.1101	85.85	3.6024
Urban (Control)	116	39.03	6.9202	67.81	6.2004
Rural (Control)	88	38.21	7.1101	68.54	6.1333

In the posttest, the mean interest score of the urban (Experimental) was 86.20 with the standard deviation of 3.13 while that of rural (Experimental) was 85.85 with the standard deviation of 3.60. For the control groups the mean scores were 67.81 with the standard deviation of 6.20 and 68.54 with the standard deviation of 3.13 for urban (control) and rural (control) respectively. Apparently, the mean interest scores did not differ much with regards to school location.

Analysis of Research Hypotheses

Table 3: ANCOVA Analyses of the Students' Interest Scores

Source	Sum of Squares	DF	Mean Square	F	Sig.	Decision
Method	789.450	1	789.450	1.542	0.001	S
Location	20.996	1	20.996	0.041	0.101	NS
Method*Location	5.633	1	5.633	0.011	0.121	NS
Error	210481.320	411	512.120			
Total	211297.399	414				

Table 3 was used to analyze research hypotheses 1, 2 and 3.

Hypothesis 1
There is no significant difference between the mean health education interest scores of students in the experimental and control groups.
From table 1, method gave an f value of 1.542 and this is significant at 0.001. Since 0.001 is less than 1.542 this means that at .05 level of significance, the f value of 1.542 is significant. Therefore, hypothesis 1 is not accepted as stated. This indicates that there is a significant difference between the mean interest scores of the experimental and control groups. Similarly, the sum of squares arising from methods (789.450) when compared with the sum of squares arising from error (210481.320) indicates that the observed difference in the interest scores of the experimental and control groups is due to the treatment administered in the experiment.

Hypothesis 2
There is no significant difference between the mean health education interest scores of urban and rural schools' students in the experimental group.
From table 3, Location gave an f value of 0.041 and this is significant at 0.101. Since 0.101 is greater than 0.041, this means that at .05 level of significance, the f value of 0.041 is not significant. Moreso, the sum of squares arising from location (20.996) was highly insignificant when compared with the sum of squares arising from error (210481.320). Therefore, hypothesis 5 was not rejected as stated, indicating that there was no significant difference between the mean interest scores of urban and rural schools' students.

Hypothesis 3
There is no significant interaction between teaching method and location of schools on students' interest scores in health education.

From table 3, the interaction effect (method*location) gave an f value of 0.011 which is significant at 0.121.

Since 0.121 was greater than 0.011, this means that at .05 level of significance, the f value of 0.011 was not significant. Hypothesis 3, therefore, was not rejected as stated because there was no significant interaction effect of location and methods on students' interest in health education in the experiment. Moreso, the sum of squares arising from location* method (5.633) was not significant in comparison with the sum of squares arising from error (210481.320). Hence, any observed differences may be due to extraneous variable(s).

Discussion of Findings

The findings of the study further revealed that the difference between the mean interest scores of the groups was significant in favour of the experimental group. Simply put, the students who were taught health education with CAI showed higher interest than their counterparts who were taught same content with lecture method. This finding is a sharp contrast with the findings of Ukachi (2011) and Lema (2012). These researchers reported that lecture method elicited higher interest in their separate studies. Those who make case for CAI argue that they only produce emotional interest while lecture method encourages cognitive interest. Cognitive interest is produced by seeing relationship(s) between incoming information and background knowledge (Jerry, 2011). However, Ngopi (2012) and Idowu (2013) reported that CAI promoted higher interest than lecture method. From the fore-going, CAI can elicit both emotional and cognitive interest. Mark (2011) further warned about use of seductive details in CAI. Such details are capable of seducing the learners and taking their attention out of the objectives of the lesson. The study also discovered that there was no significant difference between the mean interest scores of urban and rural schools students in both experimental and control groups. This finding agrees with the reports of Ngopi (2012) who found out that there was no significant difference in the mean health education interest scores of urban and rural school's students. Lema (2012) reported that rural school student showed higher interest in health education when taught with CAI than their urban schools' counterparts. This implied that school location has no effect on students' interest in Health Education.

Conclusion

Based on the findings of the study, the following conclusions were made; CAI elicited higher interest than lecture method. In addition, school location did not significantly affect the students' interest of the students in health education.

Recommendations

From the finding of the study, the following recommendations are made:

1. The Federal/State Ministry of Education should ensure that Periodic practical oriented workshops and seminars are organized for health education teachers on the use of CAI for the teaching of Health Education.
2. The Federal/State Ministry of Education should provide Computer sets, projectors, CAI software, electricity generating sets, impress for petrol or diesel and fortified security networks to all secondary schools (both urban and rural) to assist them use CAI in learning Health Education.

References

Ellis, J. D. & Marks, G. (2014). A rationale for using computer in Science Education. *The American Biology Teacher* 1(46); 200 – 206.

Idowu, O.N. (2013). Effect of Innovative Strategies on Students' Achievement and Interest in Health Education in Oju Local Government Area of Benue state. *Social Science Research Journal* 3(6); 122-138. *http://www.Africanquarters.org*

Igunma, F. S. (2014). Effect of Problem Solving Approach in teaching Health science in Junior Secondary Schools. *Science Journal* 1 (12); 22-27.

Jerry, M. O. (2011). The "Significantly worse" phenomenan: A study of student achievement in different current Areas by school location. *Education and Urban Society* 46 (4), 467-481.

Keko, J. A. (2014) *Meta-analytic studies of findings on computer –based instruction*; *Technology assessment in Education and training.* New Jersey: Lawrence Erlbaum Associates.

Kwame, M. & Damte, A. (2013) *Health science Education: Issues and Trends.* Osogbo: Muyiwa Press Ltd.

Lema, G (2012) Efficacy of Computer Assisted Instruction Strategy in promoting creative and critical thinking among secondary school students in Pankshin Local Government Area of Plateau State. *Journal of Health and Natural Sciences* 5(1), 15–32. *www.jhns.net*

Marks, G. H. (2011). Computer Simulations in Science Teaching: An introduction. *Journal of Computers in Health science and Science Teaching* 1 (1), 18 – 20.

Mayo, A. (2011). *Science and Technology Education for Development: Nigeria Academy of Education.* Lagos: Everlead Printing and Publishing Company Limited.

Muyiwa S.T (2012) Effect of Computer Assisted Instruction Strategy on students, achievement and interest in Health Education in Ado-Ekiti, Ekiti State. *Journal of Health and Natural Sciences* 5(1), 180–193.*www.jhns.net*

Ngopi, C.M. (2012). Effect of Computer Assisted Instruction Strategy on Students' Achievement and Interest in Health Education in Kenya, Central Africa. *Readings in Health Education* 3(2), 410–424. *http://www.healtheducatorsforum.org*

Obi, C. C. (2016). Effects of Two Constructivist Instructional Models on Students' Achievement and Retention in Health Education. *An Unpublished Ph.D. Thesis, ABU*.

Otobo, S. (2014) Effect of simulation game on students' Achievement and Interest in Health science. *Unpublished M.Sc.(Ed) Thesis: Enugu State University of Science and technology (ESUT), Enugu*.

Rix, M. (2012) Educational Technology. *Journal of Research in Science Teaching.*http://www3.interscience,wiley.com /cgibin/abstract/112608296/ ABSTRACT.

Solloway, N. M. (2014) Effect of two Modes of computer aided instruction on Students Achievement and Interest in Statistics and Probability. *Unpublished Ph.D Thesis, University of Nigeria, Nsukka.*

Tsui, C.Y. & Solloway, S.F. (2014). Motivational aspects of learning genetics with interactive multimedia. *The American Biology Teacher*, 67 (1); 277 – 285.

Ukachi, V.I. (2011) Effect of computer assisted instruction strategy on students' achievement and retention in health education in Ikwu-ano Local Government Area of Abia State. *Readings in Health Education* 2(6), 333–347. *http://www.healtheducatorsforum.org*.

THE MONITORING OF IMPLEMENTATION OF ADULT BASIC LITERACY PROGRAMMES IN NORTHERN CROSS RIVER STATE

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Abstract
The study investigated the Monitoring of implementation of adult basic literacy programme in Northern Cross River State, Nigeria. One research question and one hypothesis was formulated. Descriptive survey research was adopted for the study. The sample for the study was 1,996 respondents selected from six (6) Local Government Areas using proportionate stratified random sampling techniques. The instrument used for the study was 6 items titled: Monitoring of Implementation of Adult Basic Literacy Progreammes Questionnaire (MIABLPQ) designed by the researchers. The instrument was dully validated by three experts, two from the Department of Continuing Education and Development Studies while one from the Department of Mathematics and Computer Education (Measurement and Evaluation) unit in Enugu State University of Science and Technology. A reliability coefficient of .74 was deduced as a measure of internal consistency through the use of Cronbach Alpha Statistic. Data collected were analyzed using mean and standard deviation in testing research question while t-test statistic was used in testing hypothesis at .05 level of significance. The findings from the study revealed that monitoring in adult basic literacy programme is significantly inadequately in the study areas. Based on the findings, it was recommended among others that the state agency of adult and non-formal education should put more efforts in the effective supervision and monitoring of the adult basic literacy programme in the state.

Keywords*: Monitoring, Facilitators, Adult, Basic Literacy, Programme*

Introduction

Basic literacy is perceived in different ways by different societies. Hornby (2001) viewed basic as the most important and necessary facts, skills, ideas from which other things develop. It is the simplest and most important thing that people need. According to Merriam (2013), basic is perceived as forming or relating to the most important part of something. Merriam maintained that it is forming or relating to the first or earliest part of something, especially basic literacy. This implies that when referring to basic literacy, it invariably means the most important and simplest skills in literacy. Ozochi (2010) opined that basic literacy deals with teaching only the rudimentary skills of reading, writing and arithmetic. It is essentially used to prepare the masses to become literate. Ozochi further stated that a literate person is one who is able to acquire the skills of reading, writing and numeracy necessary for his/ her effective functioning as an individual and as a member of the society.

Basic literacy involves the learning and acquisition of reading, writing and numeracy skills in order to

enhance future performance. It is normally targeted to the most vulnerable people in the country who by either the incidence of their birth or their social and cultural peculiarities were unable to attend formal schooling. Possession of such basic literacy will enable the beneficiaries to participate and contribute meaningfully to the societies they were born into. Ugwuanyi (2015) posited that basic literacy is the minimum but adequate ability to read and write in any language. It also describes the programme designed to achieve such basic skills needed for worthwhile living and peaceful co-existence through adult basic literacy. In the word of Ugwuanyi, literacy education is a basic component of adult education and even though education is now seen as something far more extensive than literacy alone; virtually all other aspects of adult education presuppose the ability to read and write, or are made much more effective in improving adult basic literacy.

Adult basic literacy programme is the improvement of reading, writing and arithmetic skills needed to keep a job. It is also a preparation for post-secondary courses and admissions testing. Adult basic literacy programme is also a foundation for individual and societal development and plays an important role in poverty reduction. In this regard, adult basic literacy promotion is not only at the heart of EFA and UNLD but also supports the achievement of other related international initiatives including United Nations Education for Sustainable Development (UNESD) and (MDGs). It is impossible to lay down a detailed fixed standard of adult basic literacy which will be applicable to every country in the world, since needs and conditions differ widely from one country to another (Ohio Department of Higher Education, 2015).

Adult literacy programme statistics are based on the number of those who have attended literacy classes for a given period and have gained the appropriate certificate. Delaware (2012) posited that the purpose of the adult basic literacy programme and basic education graduate programme is to increase the knowledge and competence of those who are working or will work with adult learners who lack a high school credential. The organization equally highlighted that the objectives of adult basic literacy programme is the provision of universal access to basic education including adult literacy.

Following the above objectives, the State Agency for Mass Literacy, Adult and Non-Formal Education performs the following functions to the smooth running of adult basic literacy programme such as: implementing the national policy on mass literacy, adult and non-formal education in the state; plan, research, organize, develop and manage state mass literacy, adult and non-formal education programme; monitor and ensure quality control of the state programmes, set up and supervise the activities of the literacy network committees in the state; liaise with non-governmental organizations in the state for the implementation of the mass education programme; and train grassroots personnel and provide support services for adult and non-formal education programmes (Federal Republic of Nigeria, 2004).

The socio-economic significance of adult basic literacy programme cannot be over-emphasized. The socio-economic development of any nation is largely dependent on the quality and productive capacity of its personnel. Adult basic literacy education empowers individuals with knowledge and skills that ensure self-sufficiency and self-reliance. It widens an individual's scope in life, providing divergent channels and opportunities to attain great stride, live comfortably and contribute meaningfully to the socio-economic and political development of his/ her family, community and nation at large (Adida, 2014).

The acquisition of adult basic literacy programme is very vital to human existence. Literacy represents the lifelong intellectual process of gaining meaning from a critical interpretation of written or printed text. The key to adult basic literacy programme is reading development, a progression of skills that begins with the ability to understand spoken words and decode written words, which culminate in the deep understanding of text (Sharan & Brockett, 2007). Adult basic literacy programme is hinged on literacy, numeracy, life-skills and learning-to-learn (Obanya, 2004). According to Obanya, adult basic literacy uses reading and writing for reasoning, communication, exploring the world around us, full participation in societal life and empowerment through ability to

make informal life choices. Numeracy masters numbers, numeration, computation and their applications to decisions and making an analytical reasoning. Life-skills master life challenges in environment and the applications of social, civic and scientific awareness to tackling survival challenges in nutrition, health, and environmental issues, earning a living, participation in civil life and ones human rights, gender sensitivity among others while learning-to-learn involves self-improvement through continued push to acquire knowledge, to gain insights, to be open to new ideas among others.

Monitoring is the systematic collection and analysis of information as a programme or project progresses. It is aimed at improving the efficiency and effectiveness of a programme, project or organisation. It is based on set targets and activities planned during the planning phases of work. It helps to keep the work on track, and can let management know when things are going wrong. If done properly, it is an invaluable tool for good management, and it provides a useful base for evaluation. It enables an organization to determine whether the resources it has available are sufficient and are being well used, whether the capacity is sufficient and appropriate, and whether is doing what is planned to do (Shapiro, 2007).

Monitoring can be defined as the ongoing process by which stakeholders obtain regular feedback on the progress being made towards achieving their goals and objectives. Contrary to many definitions that treat monitoring as merely reviewing progress made in implementing actions or activities, the definition used here focuses on reviewing progress against achieving goals. In other words, monitoring is not only concerned with asking Are we taking the actions we said we would take? but also Are we making progress on achieving the results that we said we wanted to achieve?"The difference between these two approaches is extremely important. In the more limited approach, monitoring may focus on tracking projects and the use of the agency's resources. In the broader approach, monitoring also involves tracking strategies and actions being taken by partners and non-partners, and figuring out what new strategies and actions need to be taken to ensure progress towards the most important results (United Nations Development Programme, 2009).

Monitoring is a continuing function that uses systematic collection of data on specified indicators to provide management and the main stakeholders of an ongoing development intervention with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds (Organisation for Economic Cooperation and Development 2002). The emphasis in monitoring is on checking progress towards the achievement of an objective. In the context of this study, monitoring deals with the process of regular tracking or checkmating of adult basic literacy programme, policies and projects with the intention of ascertaining the degree of progress in order to improve its quality. It is aimed at knowing the areas of strengths and weaknesses with the objective of determining the areas of needs to address.

A good monitoring system will thus give warning, early on in the implementation of a course of action that the end goal will be reached as planned. Monitoring also involves a process of comparison because actual performance is compared with what was planned or expected. A simple example is the monitoring of the completion of the planned activities of a project against the target dates that have been set for each activity. Monitoring is sometimes referred to as "process evaluation" because it concentrates on what is done in the process of running a service or programme, i.e. within. This includes the programme activities, the personnel who perform activities and other matters of implementation (Lemay, 2010).

Monitoring activities focus on programme inputs, such as use of logbooks to record trips undertaken, purpose of the visit and kilometres travelled, in order to assess if they are used as intended. Monitoring also focuses on project activities or processes, in order to determine if activities aimed at achieving objectives are undertaken correctly. For example, in order to determine if feeding of children is carried out correctly you may monitor feeding activities, which includes, the amount of feeds given if they correspond to the amount prescribed, whether the child drinks eagerly or not, whether the child finishes the feeds,

whether the correct amount is recorded on the feeding chart, if left over feeds are reoffered or not. If feeding of children is inappropriate it might lead to weight loss instead of weight gain (Lemay, 2010).

Finally, monitoring focuses on outputs. If you intend to train 20 paediatric staff on the implementation of World Health Organization (WHO) guidelines by the end of the year, you may have to monitor how many staff members are trained per quarter (United States Agency for International Development, 2010). Monitoring reports have shown that more illiterate women than men are taking advantage of these adult basic education classes that have been established in various parts of the country (Federal Ministry of Education, 2007). The national blue print for adult and non-formal education recognises the need for regular monitoring and periodic evaluation as critical factors for the implementation of the blue print. Monitoring should follow the short, medium and long term goals as set in the implementation plan. The blue print mentioned that things to be monitored include training programmes provided for facilitators and programme managers, adequacy of learning materials provided, number of instructors and the regularity of payment (Nwabuko, 2014).

The author further called for an effective way of monitoring and supervision in adult education programmes. He further buttressed that effective monitoring and supervision in adult education must involve the governments, NGOs and donor agencies who are major stakeholders in the provision of adult education programmes. There should be an organ that will always ensure effective adult education programmes. Ugwoegbu (2003) is of the view that it is the duty of the organ to make decisions concerning the nature, content of curriculum, and the organizational pattern and learning facilities that will enhance the progress of such programme and equally help in the evaluation of the programme.

The general purpose of this study is to assess the monitoring of implementation of adult basic literacy programmes in Northern Cross River State. Specifically, the study seeks to:

1. determine the adequacy of monitoring of implementation of adult basic literacy programmes in Northern Cross River State.

The following research question guided this study

1. What is the adequacy of monitoring of the implementation of adult basic literacy programmes in Northern Cross River State?

H_{01}: There will be no significant difference between the mean ratings of facilitators and adult learners on the adequacy of monitoring of the implementation of adult basic literacy programmes in Northern Cross River State.

Methods

The study adopted descriptive survey research design. The population of the study was 19,959 comprising 19812 adult learners and 147 facilitators drawn from thirty adult literacy centres who are involved in the training. Multi stage sampling technique was adopted for this study. Simple random sampling techniques was used to select 6 local government areas from the study area, proportionate stratified sampling technique was used to select 30 literacy centres. The proportionate stratified sampling technique was used to select 1,920 learners and 76 facilitators. A self developed questionnaire was used as an instrument for data collection titled: Monitoring of Implementation of Adult Basic Literacy Progreammes questionnaire (MIABLPQ) designed by the researchers. The instrument had two sections, A and B. Section A contained respondents demographic information, while section B contained 6 items on research questions. The instrument was dully validated by three experts, two from the Department of Continuing Education and Development Studies while one from the Department of Mathematics and Computer Education (Measurement and Evaluation) unit in Enugu State University of Science and Technology. A reliability coefficient of .82 was deduced as a measure of internal consistency through the use of Cronbach Alpha Statistic. The questionnaire were personally administered by the researchers with three research assistants trained for the purpose. Mean and standard deviation was used to answer research question while t-test statistics was used to answer hypothesis. Here, the mean score of

2.50 was used as criterion for accepting and rejecting items. Items with mean score below 2.50 were rejected while mean score above 2.50 were accepted.

Results

Research Question one

What is the adequacy of monitoring of the implementation of adult basic literacy programme in Northern Cross River State?

Table 1: Summary of mean rating and standard deviation showing the adequacy of monitoring of implementation of adult basic literacy programme in Northern Cross River State

		N = 1996		
S/N	Item Statement	$\bar{x}$	SD	Dec.
1	Regular monitoring of adult basic literacy programme.	2.34	1.06	NA
2	Using services of experts in monitoring adult basic literacy programme.	2.40	1.12	NA
3	Providing monitors with enough logistics to enhance monitoring in adult basic literacy programme.	2.14	0.97	NA
4	Poor logistics are provided for monitoring adult basic literacy programme.	2.37	0.92	NA
5	Organizing monitoring at the end of adult basic literacy programme.	2.43	1.11	NA
6	Periodic monitoring of adult basic literacy programme.	2.29	1.05	NA
	Grand Mean	2.17	0.51	NA

Key: $\bar{x}$ - Mean, SD – Standard deviation, DEC – Decision, VHA-Very high adequate, HA- High adequate, A-Adequate, NA-Not adequate.

The result of the study as presented in Table 1, shows the mean and standard deviations of the respondents on the adequacy of monitoring of implementation of adult basic literacy programme in Northern Cross River State. The result of the study shows that items 1-6 have mean ratings of 2.34, 2.40, 2.14, 2.37, 2.43 and 2.29 and with standard deviations of 1.06, 1.12, 0.97, 0.92, 1.11 and 1.05 respectively. The mean ratings are below the criterion level of 0.05 set as benchmark for accepting an item. This means that the respondents disagreed with the items above. The result shows that regular and periodic monitoring of the programme are inadequately carried out. Services of experts are not used, no enough logistics to enhance monitoring and monitoring at the end of the programme are inadequately organized. The grand mean of 2.17 with a standard deviation of 0.51 means that implementation of adult basic literacy programme is inadequately monitored in Cross River State.

Hypothesis one
There is no significant difference between the mean ratings of facilitators and learners of adult basic literacy programme on the adequacy of monitoring of the implementation of adult basic literacy programme in Northern Cross River State.

Table 2: Summary of t-test analysis of the mean ratings of facilitators and learners of adult basic literacy programme on the adequacy of monitoring of the implementation of adult basic literacy programme in Northern Cross River State

Status	N	Mean	Std. Deviation	Df	t-cal	Sig. (2-tailed)	DS
Facilitator	76	2.35	0.51				
Adult Learner	1920	2.34	0.49	1994	3.65	0.24	NS

The result of the study as presented in Table 2, shows the t-test analysis of the significant difference between the mean ratings of facilitators and learners of adult basic literacy programme on the adequacy of monitoring of the implementation of adult basic literacy programme in Northern Cross River State. Result shows that a t-value of 3.65 with degree of freedom of 1994 and a probability value of 0.24 were obtained. Since the probability value of 0.24 is greater than 0.05 set as level of significance for testing the null hypothesis, this means that the result is not significant. The null hypothesis which stated that there is no significant difference between the mean ratings of facilitators and learners of adult basic literacy programme on the adequacy of monitoring of the implementation of adult basic literacy programme in Northern Cross River State is therefore not rejected. Inference drawn is that the responses of facilitators and learners of adult basic literacy programme did not differ significantly on the adequacy of monitoring of the implementation of adult basic literacy programme in Northern Cross River State.

Discussion of findings

The result of this study as presented in Table 1 showed that the implementation of adult basic literacy programme is inadequately monitored in Northern Cross River State. Regular and periodic monitoring of the programme are not adequately carried out. Services of experts are not used, no enough logistics to enhance monitoring and monitoring at the end of the programme is inadequately organized. This result is also in line with the findings of Olojede (2013) who found that the monitoring of the implementation of adult basic literacy programme is very poor. Ugwuanyi (2008) also opined that apart from other logistic problems, eventually all Nigerian states do not have enough qualified monitoring officers yet. The result also revealed that there is no significant difference between the mean ratings of facilitators and learners of adult basic literacy programme on the adequacy of monitoring of the implementation of adult basic literacy programme in Northern Cross River State.

Conclusion

Based on the findings of this study, it was concluded that implementation of adult basic literacy programme is inadequately monitored in Northern Cross River State. Also there is no significant difference between the mean ratings of facilitators and learners of adult basic literacy programme on the adequacy of monitoring of the implementation of adult basic literacy programme in Northern Cross River State.

Recommendations

Based on the findings and conclusions of this study, the following recommendations were made:

1. The state agency for Adult and Non-Formal Education should put more efforts in the effective supervision and monitoring of the adult basic literacy programme in the state.
2. The agency for mass literacy, adult and non-formal education should intensify effort in the

inspection and monitoring of adult literacy centres across the state on a more regular basis and to ensure that functional literacy education exist and operate in all adult education centres in the state.

References

Adida, F. A. (2014). Literacy education: The synergy of government's economic empowerment initiative for rural women in Nigeria. *International Journal of Continuing Education and Development Studies* 2, (3). University of Calabar, Calabar.

Delaware State University (2012). *Adult basic and family literacy education*. http://www.education.pa.gov/Postsecondary. Adult/Adult%20and%20Family%20Literacy %20Education/Pages/default.aspx#tab-1

Federal Ministry of Education. (2007). *Nigeria education sector diagnosis*.

Federal Republic of Nigeria (2004). *National policy on education*. Lagos: Federal Ministry of Education.

Hornby, C. (2001) *Advance learner dictionary new special edition.*

Lemay, N. (2010). Ch 8 – *Managing information: Monitoring and evaluation.* In health systems in action: An handbook for leaders & managers. Cambridge, USA: Management sciences for health. Available: www.msh.org

Merriam, W. (2013). ''*Definition of assessment''*. Retrieved from: *http://www.merriam-webster.com/dictionary/assessment*. on 8th September, 2016.

Nwabuko, L. O. (2014). *Benchmark for partnership in the administration of adult education: The Nigeria perspective*. Enugu: Prince Digital Press.

Obanya, P. A. I. (2004). GEFA: *The education route to year 2020.* Lead paper presented at the national conference of Nigeria education research and development council (NERDC) at the international conference centre, Abuja; Nov. 19-20.

Ohio Department of Higher Education (2015). *Adult basic and literacy education*. Retrieved from: https://www.ohiohighered.org/able/locations

Olojede, A. A (2013). Evaluating access to adult basic literacy skills as determinant of sustainable development in selected rural communities in Oyo and Ondo states, Nigeria. *Sky Journal of Educational Research, 1*(1), 1 - 8, March, 2013.

Organisation for Economic Cooperation and Development (2002). *Glossary of key terms in evaluation and results based management*.

Ozochi, C. (2010). *Introduction to adult education principles.* Cecta Nigeria Ltd.

Shapiro, J. (2007). *Monitoring and evaluation*. Civicus: Johannesburg/Washington. Available: http://www.civicus.org.

Sharan, M. B. & Brockett, R. G. (2007). *The profession and practice of adult education: An introduction*. Jossey-Bass, 2007, p 7.

Ugwoegbu, I. (2003). *Adult education: Principles and programme design* (enlarged edition). Onitsha: Ekumex Publishing Company Webster.

Ugwuanyi, C. C. & Ugwuda, A. O. (2015). Meeting the challenges of implementing universal basic education (ube) programme in Nigeria through science, technology and mathematics (stm) education. *International Journal of Educational Research, 14*(3) 183 - 184.

Ugwuanyi, J. C. (2008). *Extent of implementation of universal basic education programme in Nsukka education zone*. (Unpublished Master's Thesis) Department of education foundation, University of Nigeria, Nsukka.

UNDP (2009). *Report on list of countries by literacy rate*. 3 (4) 171.

United States Agency for International Development (2010) .*M & Fundamentals.*: USAID www.globalhealthlearning.org_.pdf.

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EFFECT OF ACTIVITY-BASED METHOD ON STUDENTS' ACHIEVEMENT IN MATHEMATICS IN UPPER BASIC SCHOOLS IN ENUGU EDUCATION ZONE OF ENUGU STATE

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Abstract
The study determined effect of Activity-Based Method on students' achievement in mathematics in Upper Basic Schools in Enugu Education Zone of Enugu State. The study was guided by two (2) research questions and three (3) research hypotheses. The design of this study was a quasi-experimental design of pre-test, post-test, non-randomized control group design. The population for the study comprised of 5,897 Upper Basic School Two (UBS2) students in the 31 public secondary schools in Enugu Education Zone for 2019/2020 academic session. The sample size of this study was 291 of the UBS2 students in the three (3) out of 21 co-educational secondary schools in the zone. The instrument used for data collection was Mathematics Achievement Test (MAT). MAT was validated, item analyzed and found to be reliable with KR 20 coefficient of 0.82. MAT was administered as pretest on the first week of treatment by research assistants. Scores of the students on the pretests were recorded and kept for use after the experiment. The posttest data was generated after re-administration of MAT to the students on the last week of treatment. Mean ($\bar{x}$) and standard deviations (s) were used to answer the research questions while Analysis of Covariance was used to test the research hypotheses at 0.05 alpha levels. The study discovered that among others that Students in the experimental group achieved higher than those in the control group and there was significant difference in the mean achievement scores of the students in experimental and control groups. Female students in the experimental group achieved higher when compared with their male counterparts. There was significant difference in the mean achievement scores of male and female students in experimental group. The study recommended among others that Policy makers of the Ministries of Education should ensure that Activity-based Method is adopted in the teaching of mathematics. Teachers should actively involve male and female students in learning activities to avoid gender stereotyping so as to help create equal educational opportunities for both male and female learners.

Keywords: *Activity based method, achievement, mathematics*

Introduction

Mathematics is deductive study of numbers, geometry and different dynamic constructs or structures. According to Razia and Abdul (2019), mathematics is that branch of science that utilizes numbers and signs. Numbers and signs are organized utilizing orderly numerical principles. It might be comprehensively defined as the science of space, time, capacity, amounts, shapes, numbers and the association with each other (Olatoye, 2019). Probably because of these interesting natures of mathematics, it is highly valued as a tool for domestic, technological, science and everyday development of nations and individuals.

The value of mathematics to any developing country is not debatable and this is why the supremacy of mathematics over every other subject is extolled by the Federal Republic of Nigeria (2013), when it stated that mathematics should be made a core subject at the primary and secondary school levels. There is hardly

any area of human endeavor devoid of mathematics and its application. Charu (2018) noted that mathematics is the foundation of any meaningful scientific endeavor and any nation that needs development in science and technology should have a strong mathematics knowledge for its youths.

Mathematics remains a service provider for all disciplines and contributes immensely in deciding directions of activities such as economy, banking, market transactions, industrial functions, research, leadership, legal jurisprudence, engineering and other too many to mention (Ugwuanyi, 2014). The development of any nation is dependent on its improved mathematics education which establishes bases for technological advancement. Thus, science is the bedrock that provides the spring board for the growth of technology and mathematics is the gate to the science (Salami, 2013). The pertinent virtue of mathematics in contributing to the development of mankind calls for its improved teaching and learning.

Despite mathematics robustness and utilitarian value, students seem to evade from the subject for many reasons. Some of the factors that may affect students' achievement and retention in mathematics include phobia for mathematics, teacher's attitudes towards the teaching of the subject, influence of gender and instructional methods; which most of the students find uninteresting (Festus, 2013). These are expository methods which are said to be didactic, stereotyped, dull and therefore not result oriented (Olatoye, 2019).

Some methods such as demonstration, guided inquiry, discovery method could be result oriented but have been reported to have made students fail to see the relationship that exists between mathematics topics offered while in school and their real life application (Olaotan, 2019). These methods, according to Flood (2013), do not allow active students participation in mathematics lessons rather, students memorize, regurgitate facts and concepts without the basic understanding of what it is. Consequently, Olaotan (2019) proposed the need for a search of better instructional method for the attainment of improved learning outcomes. Notable among such innovative methods is the activity-based method.

Activity-Based Method (ABM) is the teaching method that enables students to learn with the same vigour that marks their natural activity (Okorie, 2018). ABM is a teaching method adopted by an instructor to facilitate instruction through the task. The learners participate absolutely and bring about efficient learning experiences. It is a technique in which the learner is actively engaged mentally and physically. This approach is based on the core premise that learning should be based on doing some hands-on experiments and activities rather than just listening to lessons. Learning by doing is the fundamental focal point in this method, and the more a person knows the longer he/she retains (Okorie, 2018).

Festus (2013) stated that ABM, which is student-centered in nature, invites the student to participate actively in his or her own learning experiences (discussion, debate, role-play and stimulation and scientific process skills which involve manipulation of materials and equipment). Festus further stated that ABM introduces element of joy, team spirit, respect for each other's opinion and it reduces the abstractness in mathematics concepts. ABM involves reading, writing, discussion, practical activities and engagement in solving problems, analysis, synthesis and evaluation (Mohammed, 2014). The use of ABM in the teaching process can boost a desirable change in students' role from inactive to participative learners. It likely enhances cognitive, affective and psychomotor domains respectively by giving learners enough chances to perform well (Ezubuike, 2018). According to Razia and Abdul (2019), adequate and appropriate use of this method through a rich variety of stimulating experiences, progress from concrete to abstract and then a powerful conceptualization may be achieved.

The ABM of teaching encourages group interactions among students, and if properly used, the spirit of teamwork, exchange of ideas and respect for each other's point of view will be enhanced at early stages of learning. Another feature of activity-based method, according to Celik (2018), is that local resources can be effectively utilized in the teaching process. In typical students' activities, costly scientific equipment is often substituted with locally available teaching

aids. ABM makes students active participants, aids retention of materials learnt, builds confidence, helps students maximize their potential and favour intrinsic motivation (Charu, 2018). This according to Charu, may be fundamental to effective teaching and learning of mathematics in schools and improved academic achievement.

Achievement means to reach a required standard of performance, to carry out something successfully. Achievement is the result of what an individual has learned from some educational experience (Okugo, 2022). In the context of this study, achievement refers to cognitive achievement of students which is measured in terms of passes in teacher-made tests/standardized test in mathematics. Hence, the researcher upholds the view of Akor (2017) that student's academic achievement entails successful academic progress attained through effort and skill. It involves the determination of the degree of attainment of the individuals in tasks, courses or programmes to which the individuals were sufficiently exposed. The achievement of upper basic schools in mathematics in Enugu State, especially in Enugu Education Zone has not been encouraging.

The disparity in mathematics achievement as regards to gender has been a source of worry to mathematics scholars judging by the number of studies done to that effect. While some scholars have opined that there was no significant difference between the mean achievement and retention scores of male and female students in mathematics (Galadima & Okogbenin, 2012; Spence, 2014; Bada & Dokubo, 2011), others have revealed contradictory findings by revealing that there was significant difference between the mean achievement and retention scores of male and female students in mathematics (Meremikwu, 2012; Bosire, Mondoh & Barmao, 2018; Onah, 2015; Razia & Abdul, 2019; Olatoye, 2019). Hence, there is need to determine if there would be influence of gender in using ABM in the Upper Basic School students' achievement in mathematics.

It is important to note that no study ever known by the researcher on the effect of Activity-Based Method on students' achievement in mathematics in Upper Basic Schools has been reported from Enugu Education Zone of Enugu State so far. Hence the need for this study.

The purpose of this study was to determine the effect of Activity-Based Method on students' achievement in mathematics in Upper Basic Schools in Enugu Education Zone of Enugu State. Specifically, the study sought to:

1. determine the mean mathematics achievement scores of students in the experimental and control groups in both pre-test and post-test.
2. ascertain the mean mathematics achievement scores of male and female students in experimental group in both pre-test and post-test.

The following research questions guided the study

1. What are the mean mathematics achievement scores of students in the experimental and control groups in both pre-test and post-test?
2. What are the mean mathematics achievement scores of male and female students in experimental group in both pre-test and post-test?

The following null hypotheses tested at 0.05 levels of significance guided the study

Ho_1: There is no significant difference between the mean achievement scores of the students in the experimental and control groups.

Ho_2: There is no significant difference between the mean achievement scores of male and female students in the experimental group.

Ho_3: There is no significant interaction effect of teaching methods (ABM and expository method) and gender on the achievement scores of students in mathematics.

Methods

The study adopted a quasi-experimental design of pre-test, post-test, non-randomized control group design. The area of the study was Enugu Education Zone of Enugu State. The population for the study comprised of 5,897 Upper Basic School Two (UBS2) students in the 31 public secondary schools in Enugu Education Zone. The sample size of this study was 291 of the UBS2 students in the three (3) out of 21 co-educational secondary schools sampled in Enugu

Education Zone. Two intact classes in each of the three sampled schools were randomly selected, one intact class was assigned to Activity-based Method (experimental group) while the other intact class was assigned to expository method instruction (control group). Hence, the study sampled one hundred and forty five (145) students in experimental group and one hundred and forty-six (146) students in control group. In the experimental group, the study sampled sixty eight (68) male students and seventy seven (77) female students. In the control group, the study sampled seventy one (71) male students and seventy six (76) female students. The instrument that was used for pretest and post-test was the Mathematics Achievement Test (MAT), which was developed by the researcher. The instrument (MAT) was face validated by three (3) research experts, two (2) from mathematics education and one (1) from measurement and evaluation, all from the department of Mathematics and Computer Education, Faculty of Education, Enugu State University of Science and Technology, ESUT, Enugu. The reliability of the instrument was determined by conducting a trial test using 40 JSS2 students from non-target schools in Agbani Education Zone of Enugu State. To ascertain the internal consistency reliability of the instrument, Kuder-Richardson formula 20 (K-R-20) was used and it yielded a coefficient value of 0.82 which means that the items are reliable for the study. Six research assistants were used for the study. They are mathematics teachers teaching in their respective schools. Before the treatment, subjects in both treatment and control groups were given the pre-test by their regular teacher. After the pre-test the regular mathematics teachers started the treatments with their respective schools. At the end of the treatment that lasted for six weeks, the teachers administered the post-test. At the beginning of the treatment in each group, the pretest was administered to the students. The tests were marked according to the marking scheme. Scores of students on pretest were recorded and kept for use. At the end of the treatment, the posttest was administered to the students. The scores of the posttest were also recorded. These recorded scores were analyzed to answer the research questions and test the hypotheses. The research questions were answered using mean and standard deviation while the null hypotheses were tested at .05 level of significance using the Analysis of Covariance (ANCOVA).

Results

What are the mean achievement scores and standard deviation of students in the experimental and control groups in both pre-test and post-test?

Table 1: Mean achievement Scores and Standard Deviation of students in the experimental and control groups in both pre-test and post-test

Groups	Number	Pretest		Post-test		Gained Mean
		Mean	Standard Deviation	Mean	Standard Deviation	
Experimental	145	33.16	11.35	59.61	11.78	26.45
Control	146	33.47	11.66	44.58	5.08	11.11
Total	291					

From Table 1, the pre-test mean achievement score and standard deviation for the experimental group were 3316 and 11.35 respectively, while the post-test mean achievement score and standard deviation were 59.61 and 11.78 respectively. For the control group, pre-test mean achievement score and standard deviation were 33.47 and 11.66 respectively, while post-test mean achievement score and standard deviation were 44.58 and 5.08 respectively.

The table revealed that the students in the experimental group gained higher with the gained mean of 26.45 than those that were taught using expository teaching method with the mean gain of 11.11. From this result, it showed that learning took

place in both groups. This is because the both groups had higher post-test mean scores than their pre-test mean scores. The result also showed that the mean scores of the Control group were more homogeneous than the Experimental group from pretest to posttest. This is because the Control Group had smaller standard deviations than the Experimental group.

What are the mean achievement scores and standard deviations of male and female students in experimental group in both pre-test and post-test?

Table 2: Mean Achievement Scores and Standard Deviations of Male and Female Students in Experimental Group in Both Pre-test and Post-test

Gender	Number	Pretest		Posttest		Gained Mean
		Mean	Standard Deviation	Mean	Standard Deviation	
Male	68	33.25	12.05	65.23	12.08	31.98
Female	77	33.32	13.12	66.94	13.11	33.62
Total	145					

Table 2 showed the mean achievement scores and standard deviations of male and female students in experimental group in both pre-test and post-test. From the results in Table 2, the pre-test mean achievement score and standard deviation for the male students were 33.25 and 12.05 respectively, while their post-test mean achievement score and standard deviation were 65.23 and 12.08 respectively. For the Female students, pre-test mean achievement score and standard deviation were 33.32 and 13.12 respectively, while post-test mean achievement score and standard deviation were 66.94 and 13.11 respectively.

The lower standard deviation in male students showed that the mean score of the male students was homogeneous, which means that the male students had more extreme scores than their female counterparts in the experimental group. The table also showed that the female students gained higher than their male counterparts with the gained mean of 33.62 as against that of the male students of 31.98.

Testing of the Research Hypotheses

Table 3 showed the Analysis of Covariance (ANCOVA) of the Mean Achievement Scores of the Experimental and Control Groups. The Table 3 was used to answer the null hypotheses.

Table 3: Analysis of Covariance (ANCOVA) of the Mean Achievement Scores of the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	18314.422[a]	4	4532.211	50.077	.000	
Intercept	114250.776	1	114250.776	1134.728	.000	
PRETEST	.050	1	.050	.001	.980	
GROUP	17355.620	1	17355.620	183.003	.000	S
GENDER	823.143	1	823.143	8.213	.004	S
GROUP * GENDER	160.350	1	160.350	1.577	.198	NS
Error	25769.669	286	90.429			
Total	1034697.000	291				
Corrected Total	44345.500	290				

a. R Squared = .426 (Adjusted R Squared = .403)
b. WHERE S = Significant at P< .05; NS = Not Significant at P> .05

HO_1: There is no significant difference in the mean achievement scores of the students in the experimental and control groups.

From the result of ANCOVA in Table 3, it was observed that Group (Experimental and Control) gave an F-value of 183.003 and was significant at 0.000. Since 0.000 was less than 0.05, the null hypothesis 1 was rejected as stated. Hence, the study concluded that there was significant difference in the mean achievement scores of students in the experimental and control groups. This implied that the students that were taught mathematics using Activity-based Method significantly achieved higher than their counterparts taught mathematics using the Expository teaching method.

HO_2: There is no significant difference in the mean achievement scores of male and female students in the experimental group.

From the result of ANCOVA in Table 3, it was observed that Group (treatment) gave an F-value of 8.213 and was significant at 0.004. Since 0.004 was less than 0.05, the null hypothesis 2 was rejected as stated. Hence, the study concluded that there was significant difference in the mean achievement scores of male and female students in the experimental group. This implied that the female students significantly achieved higher than their male counterparts taught mathematics using Activity-based Method.

Ho_3: There is no significant interaction effect of teaching method and gender on the achievement scores of students.

From the result of ANCOVA in Table 5, it was observed that Group (treatment and Control) gave an F-value of 1.577 and was not significant at 0.198. Since 0.198 was higher than 0.05, the null hypothesis 3 was accepted as stated. Hence, the study concluded that there was no significant interaction effect of method and gender on the achievement scores of students in mathematics.

Discussion of Findings

The findings of this study were discussed in line with the research questions that guided the study and hypotheses tested.

Mean Achievement Scores and Standard Deviations of Students in the Experimental and Control groups in both Pre-Test And Post-Test

It was found that students in the experimental group achieved more than those in the control group. This finding agreed with Ezemdi (2018) which stated that, to learn mathematics and to use it requires mastery, and to master a skill requires practice, repetition, drill and concentration. On the contrary Yusuf (2017) observed that some of the problems centered on frequency and type of teacher/students interactions, bias and views of staff, intimidation of girls by boys within lessons, nature of mathematics, and assessment techniques used.

The comparison between the mean achievement scores of the students in experimental and control groups showed that the significant difference in the mean achievement scores of the students in experimental and control groups was statistically significant.

This findings is in line with Waziri (2016) which also revealed that activity-based method was significantly more effective than the expository method in enhancing students' achievement in Basic Science.

Mean Achievement Scores and Standard Deviations of Male and Female Students in Experimental group in both Pre-Test and Post-Test

It was found that female students in the experimental group achieved more when compared with their male counterparts. This finding contradicts with Razia and Abdul (2019) which observed that boys exert better mathematics achievement than the girls because the boys from the beginning are encouraged to be more independent than the girls, therefore differential treatment of sex has given the boys more confidence than girls and this enhances better performance in favour of boys, in mathematics. Comparison of mean achievement scores of male and female students in experimental group showed gender was a significant factor as regards students' achievement in experimental group.

Conclusions

Based on the findings of the study and the discussions that followed, conclusions were drawn as follows:

1. Students in the experimental group achieved higher than those in the control group with mean difference of 30.15. And there was significant difference in the mean achievement scores of the students in experimental and control groups.
2. Female students in the experimental group achieved higher when compared with their male counterparts. There was significant difference in the mean achievement scores of male and female students in experimental group.
3. Significant interaction effect of teaching method and gender on the achievement scores of students indicated that significant interaction effect of gender and method of instruction on students' mean achievement scores of students was not rejected.

Recommendations

Based on the findings and implication of the results, the following recommendations are made;

1. Policy makers of the Ministries of Education should ensure that Activity-based Method is adopted in the teaching of mathematics.
2. Teachers should actively involve male and female students in learning activities to avoid gender stereotyping so as to help create equal educational opportunities for both male and female learners.
3. Government educational agencies like Nigeria Education Research and Development Council (NERDC), Science Teachers Association of Nigeria (STAN) and the educational non-governmental organizations like Mathematics Association of Nigeria (MAN), Science Teachers Association of Nigeria (STAN) should sponsor and organize workshops and seminars on how to use the Activity-based Method (ABM) in teaching mathematics.

References

Akor, P.A.E. (2017). Effect of Achievement Motivational Instructional Approach on primary six pupils' numerical aptitude and retention in mathematics. *http://hdl.handle.net/123456789/4674.*

Bada, R.A. & Dokubo, O. O. (2011). Age and gender as determinants of academic achievement in college mathematics. *Astan Journal of Natural and Applied Sciences, Oyama, Japan: Leana and Luno International, 1(2), 232-241.*

Bosire, J., Mondoh, H. & Barmao, A. (2018). Effect of streaming by gender on students' achievement in mathematics in secondary schools in Kenya. *South Africa Journal of Education EASA 28(1); 595-607.*

Charu, T. (2018). Application of mathematics in real life. *International Journal of Computer and Mathematics Sciences, IJCMS 7(1), 165-178.*

Çelik, H. C. (2018). The Effects of activity-based learning on sixth grade students' achievement and attitudes towards mathematics activities. *Eurasia Journal of Mathematics, Science and Technology Education, 14(5), 1963-1977.*

Ezemdi, O. (2018). Nigerian System of Education. Issues and Analysis. *Yola: Hanza Press.*

Ezubuike, E.I. (2018). Exploring factors affecting students' performance in mathematics in Secondary Schools in Enugu Education Zone. *Mediterranean Journal of Social Science, 5(6), 213-218.*

Federal Republic of Nigeria (2013): National Policy on Education. *Lagos: NERDC press.*

Festus, A. B. (2013). Activity-Based Learning Strategies in the Mathematics Classroom. *Journal of Education and Practice, 8-14. 4(13).*

Flood, F. (2013). The Queen of Mathematics. *http://www.gresham.ac.uk/lecturersandevents /thequeenofmaths retrieved 29/02/2018.*

Galadima, I. & Okogbenin, A.A. (2012). The Effect of Mathematical Games on Academic Performance and Attitude of Senior Secondary Students Towards Mathematics in Selected Schools in Sokoto State. ABACUS: *The Journal of Mathematical Association of Nigeria (MAN), 11(2), 354-366.*

Meremikwu, A. N. (2012). Gender differences and Mathematics achievements among Secondary School Students. Unpublished M. Ed. Thesis of the University of Calabar.

Mohammad, B.G. (2014). Academic Achievement in Science with Suggested Solution in Selected Secondary Schools in Kano State. *International Journal of Education and Research, 2(11) 215-224.*

Okorie, I.M. (2018). Mathematics teaching methods: Effective methods. *Lagos: Springsfield Books,37 (1), 30-36.*

Okugo, D. N. (2022). Effect of Activity-Based Method on Students' Achievement in Mathematics in Upper Basic Schools in Enugu Education Zone of Enugu State. *An unpublished M.Sc Dissertation of Enugu State University of Science and Technology.*

Olaotan, O.K. (2019). Effectiveness of frequency of testing on students' study habits in mathematics among senior secondary school students in Ogun State. *Journal of Humanities, 7(2),179-192.*

Olatoye, R.A. (2019). Study habit, self-concept and science achievement of public and private secondary school students in Ogun State, Nigeria. *An International Multi-Disciplinary Journal, Ethiopia,* 2(4), 211-223.

Onah, E. N. (2015).Effect of Multimedia Projection on Senior Secondary School Students' Achievement and Interests in Sets. *Ph.D* Thesis of the Department of Science Education, University of Nigeria, Nsukka.

Razia, N. & Abdul, M.K. (2019). Activity-based teaching versus traditional method of teaching mathematics at elementary level. *Bulletin of Education and Research, 41(2),145-159.*

Salami, C.G.E. (2013). Gender academic achievement in Delta State University, Asaba. *Universal Journal of Education and General Studies, 2(3),276-290.*

Spence, D. J. (2014). Engagement with Mathematics courseware in traditional and online learning environments: relationship to motivation, achievement, gender and gender orientation. Unpublishede Ph.D. Dissertation, Emory University.

Ugwuanyi, C.C. (2014). Meta-analysis of studies on effect of teaching methods on students' achievement, interest and retention in mathematics. *A Ph.D thesis of University of Nigeria, UNN Virtual Library.*

Waziri, S.A. (2016). Effect of activity-based method on students' achievement in Junior Secondary School Basic Science. *Journal of Technical Teacher Education, 12(9)344-353.*

Yusuf, M. (2017). Effects of an Assessment Supported Instructional Model (ASIM) on Students' Academic Achievement and Interest in Secondary School Mathematics in Niger State. *Unpublished M.Ed Thesis University of Nigeria, Nsukka.*

EFFECT OF CONVERGENT THINKING STRATEGY (CTS) ON SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN QUADRATIC EQUATION IN ENUGU EDUCATION ZONE

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Abstract
The study investigated into effect of Convergent Thinking Strategy on Senior Secondary school students' achievement Quadratic Equation. The study was guided by two (2) research questions and three (3) research hypotheses. The design of this study was pretest-posttest non-equivalent control group quasi-experimental design. The population for the study was 5442 Senior Secondary One (SS 1) students in the 30 secondary schools in Enugu Education Zone for 2021/2022 academic session. The sample size was 294 SSS 1 students from the 3 out of the 21 coeducational secondary schools. The instrument used for data collection was Quadratic Equation Achievement Test (QEAT). Quadratic Equation Achievement Test (QEAT) was validated and found to be reliable with KR 20 coefficient of 0.83. QEAT was administered as pretests on the first week of treatment by research assistants. Scores of the students on the pretests were recorded and kept for use after the experiment. The posttest data was generated after re-administration of QEAT to the students on the last week of treatment. Mean ($\bar{x}$) and standard deviations (s) were used to answer the research questions while Analysis of Covariance was used to test the research hypotheses at 0.05 Alpha levels. It was discovered among others that students taught Quadratic Equation using CTS achieved better than their counterparts taught Quadratic Equation using the Expository method and the differences were statistical significant and the female students taught Quadratic Equation using CTS achieved higher than their male counterparts and the differences were statistically significant. It was recommended that Mathematics teacher should endeavor to use CTS in teaching Quadratic equation, government, educational agencies and the professional bodies like Mathematics Association of Nigeria (MAN) and Science Teachers Association of Nigeria (STAN) should sponsor and organize workshops and seminars on how to use the CTS in teaching different topics in Quadratic Equation.

Keywords: *Convergent thinking strategy, achievement, quadratic equation, mathematics.*

Introduction
Mathematics can be defined as a subject that is the study of quantity, structure, space, relation, change and various topics of pattern, form and entity. It is also a science of number and shapes (Okorie, 2021). Okorie also asserted that Mathematics is the study of numbers, symbols, counting, measuring, number, patterns and relationships of quantities. Mathematics is defined as a body of knowledge which is concerned with the logical language of expressing ideas, shapes, quantities, sizes, other change and dynamic in the system, and for explaining the complexities of modern society in the business, economics, academic, engineering and medical setting (Al-Hassan, 2016).

The importance accorded to Mathematics in the school curriculum from primary to secondary levels reflects accurately the vital role played by the subject in contemporary society. It is a core subject in the primary and secondary school curriculum. Also a

credit pass in Mathematics at the senior secondary school certificate examination is needed as a pre-requisite for admission into the tertiary institutions in Nigeria. It is in realization of this that many Nigerian mathematical scholars resort to making specially comprehensive research and well-programmed efforts towards the effective teaching and learning of Mathematics at all levels of the educational system through the development and implementation of innovative teaching methodologies (Okorie, 2021).

Unfortunately, students' achievement in Mathematics has not been impressive. To support this assertion, Okorie (2021) lamented that in spite of all the important roles Mathematics plays in the development of mankind; its achievement has been very poor. In the same vein Ugwuanyi (2009) stated that even though the indispensability of Mathematics in the development of our society has been universally acknowledged, the output of its teaching and learning is still not encouraging. Anibueze (2020) showed that the average percentage of students that obtained credit and above for the past nine (9) years (2010 – 2019) West African Senior Secondary School Certificate Examination was 34.37%. Also, the results of 2018, 2019 and 2020 (private) West African Senior Secondary School Certificate Examination revealed the percentages of students that obtained credit passes and above in Mathematics 49.98%, 26.08% and 43.49% respectively, which are very dishearten and alarming poor achievement of students in Mathematics (WAEC Records, 2018, 2019 & 2020). Al-Hassan (2016) revealed that the major factors that cause students' poor achievement in Mathematics are: Mathematics teachers have not been able to teach some aspects of Mathematics concept such as algebra, geometry, trigonometry and Statistics

The WAEC (2010) Chief Examiners Report revealed persistent failure in Mathematics was because of the candidates' lack of skill in answering almost all the questions asked in algebraic processes. Also, the WAEC (2010) Chief Examiners Report also revealed that candidates' weakness in algebraic expression and word problems among others that led to poor achievement of students towards the subject. It was also observed by the WAEC (2013) Chief Examiners that some questions especially the algebraic questions at the West African Senior Secondary School Certificate Examination (WASSCE) Mathematics are avoided by the students and are the difficult areas for students, an indication that the algebraic topics, from which the questions were set, may not have been taught well by the teacher. This neglect by students in Algebraic questions has prompted the researcher to investigate on the effects of Convergent Instructional Strategy on Academic Achievement in Algebra.

Algebra, as a branch of Mathematics has been reckoned with as an important concept in Mathematics. In other words, Algebra is a branch of Mathematics that deals with symbols and the rules for manipulating those symbols (Coolman, 2019). It is a generalized arithmetic which requires the use of known and unknown quantities (Osta and Laban, 2017). Osta and Laban (2017) defined Algebra as that branch of Mathematics in which situation of life are represented with a first degree equations where the unknown appear in both sides of the equal sign. In elementary algebra, those symbols represent quantities without fixed values which are known as variables. Mashooque (2010) disclosed that algebra uses symbols, letters and signs for generalizing arithmetic which have different meanings and interpretations in different situations.

Algebraic usage and applications to effective acquisition of knowledge, skills and understanding the tidbits of other concepts in Mathematics (measuration, geometry, inequalities, indices, statistics etc) sciences, social sciences, maritime, medicine, defense and vocations among others (Mashooque, 2010), attest to the crucial ordinal placement of this multidimensional branch of Mathematics in solving problems. Demme (July 18, 2018) revealed that Algebra opens up whole new areas of life problems such as graphing curves that cannot be solved with only fundamental mathematical skills. It helps one to master other branches of Mathematics. According to Demme (2018), Algebra aids a person to master statistics and calculus. It reinforces logical thinking. Oshin (2015) revealed that Algebra is one of the earliest Mathematics inventions that transited from arithmetic's and got separated from it when equations

and methods for reducing them were introduced. Oshin (2015) proffered Algebra as the science of transposition and cancellation.

Deductively, Algebra is wide in concept, forms, structure and applications, since it is studied virtually at all levels of education. It is popularly known as Arithmetic in the primary schools, where pupils are taught the tidbits and rudiments of counting, simple equations on sum, difference, product, divisions and word problems (Cooley, Martins, Vidakovic and Loch 2017). Algebra with its subdivisions retains its name at the secondary and tertiary schools with dissimilarities in concept sequence, classifications, technicality and application. For instance, at the senior secondary schools, Algebra is divided into equations (simple, simultaneous and quadratic), set theory, inequality and variation with distinctive techniques for solving their problems (Macrae, Kalejaiye, Chima, Garba, Ademosu & Channon 2011) whereas Mashooque (2010) classified Algebra as (Linear, Simultaneous and other accessories). According to Mashooque (2010), Algebraic Linear equation has three types; Single Linear Equation, Quadratic equation and Polynomial; Simultaneous equation has two types; Linear and Complex Simultaneous equations while other accessories are set theory and inequalities.

Nevertheless, no matter the type of classification of Algebra done by any mathematical scholar, one thing is clear that all these concepts are taught and learnt at the senior secondary schools to facilitate proficiency of students in applying the techniques therein to solve problems in other subjects. According to Ndukwe (2018), despite the importance of Algebra, secondary school students' achievement in Algebra is still poor. According to Mashooque (2010), secondary schools students have not explored the resourcefulness of algebraic concepts, evident in their poor achievement in algebraic sections of Mathematics examination (Mashooque, 2010). This development is traceably linked to the problems associated with teaching and learning algebraic concepts at the senior secondary schools (Ndukwe, 2018).
Osta and Laban (2017) and Oshin (2015) in their separate studies revealed that most of the teachings and learning of Algebra, it is the Mathematics teachers that do the greater works by exposing tidbits, algorithms and structures of algebra to students; thereby, leaving the students to nothing for self discovery, attitudes of appreciation, which invariably discourage curiosity for further learning. Adebayo (2010) revealed that teachers preferred using the expository method because of the tedious nature and time consuming of these innovative teaching methods and the funds that will be spend in the implementation. Adebayo (2010) and Ndukwe (2018) in their separate studies stated that this expository method that Mathematics teachers use is a method where the teacher dominates the class session, does all the talking and the students do all the listening. This method is simply complete explosive of information, which is presented to students systematically, with no degree of independence (Adegbule, 2020). This affects the true essence of self development (Catherine and Vistro, 2015).

Thus, Piaget (1964) revealed that the teaching method/strategy which Mathematics teachers should be using in teaching in Algebra should make learning an active process, where the learner is being able to monitor and control his learning process. The students are expected to actually control their attention, acquisition, storage and retrieval of subject matter (Piaget, 1964). According to the Lagoke, Jegede and Oyebanji (2013), there is no best generally recommended teaching methodology but the best for a Mathematics teacher should be the teaching methodology that the Mathematics students need in order to have meaningful learning. These assertions may have directly or indirectly prompted many Mathematics scholars and researchers to introduce some innovative teaching methods for secondary school teachers which are discovery, laboratory, concept mapping, computer-aided instruction, constructivism, gaming and analogy methods.

Yet, there seems to be no significant improvement in students' achievement in Algebra. This is because according to Chukwu (2010), Mathematics teachers still prefer using the expository method of teaching than the innovative teaching methods despite having full knowledge of the innovative teaching methods.

Chukwu (2010) revealed that the Mathematics teachers prefer using the expository teaching method in teaching Algebra because it is convenient to use, cheap and fast in covering Algebraic concepts. Thus, there is need for researchers to develop or discover the teaching method/strategy that can be less tedious to use, cheap, faster in covering Algebraic contents and can make Algebraic learning an active process, where the learner is being able to monitor and control his learning process. One strategy the researcher thought that may have satisfied these requirements is a Convergent Thinking Strategy.

The process of figuring out a concrete solution to any problem is called Convergent Thinking. In other words, Convergent Thinking Strategy is the process of using one's sense to narrow ideas until a single best solution is solved. Convergent Thinking Strategy was discovered by an American Psychologist, Joy Paul Guilford in 1950 and modified in 1982 (Guilford, 1982). Yet, according to Nezhad (2013), convergent thinking is a term proposed by Hudson in 1967. Williams (2013) defined convergent or linear thinking as that, which deals with learning facts, following instructions and solving problems with one right answer. According to the researcher, many tests that are used in assessing students such as multiple – choice tests, quizzes and standard tests are measures of convergent thinking. Kelly (2011) revealed that Convergent Thinking Strategy requires the ability to assemble and organize information and direct it towards a particular goal in the achievement of an effective solution to a problem.

There are also controversies among scholars on whether Convergent Thinking Strategy is a teacher-centered or student-centered strategy. Olutola, Ogunjimi, Daramola and Sheu (2017) regarded the Convergent Thinking Strategy as a Teacher centered strategy. This is because according to the authors, the Convergent Thinking Strategy is highly structured and teacher-centered; the students are passive recipients of knowledge transmitted to them and learning achievements are measured by standardized tests and Convergent thinking stands firmly on logic that is not significantly creative while according to Bar-Yam, Rhoades, Sweeney & Bar-Yam (2012), convergent thinking strategy encourages that the students to be typically assessed by a formal written test where the only right answer is the one that is being given to them by the teacher.

The researcher decided to determine the efficacy of Convergent Thinking Strategy on students' achievement and in Quadratic Equation is because Quadratic Equation is the epicenter of Algebra (Anibueze, 2018). According to Anibueze (2018), Quadratic equation is the foundational course of study of Algebra. One cannot fully understand the concept of Algebra without first knowing the concept of Quadratic Equation (Mashooque, 2010). Asamoah (2012) defined Quadratic equation as the life-wire of Algebraic Equation and it is the foundational and intermediate knowledge of Algebraic Equation.

According to Ibrahim (2017), Quadratic Equation is a branch of Algebra in which one on which the variable is squared. Anibueze (2018) revealed that Quadratic Equation is an algebraic linear equation that has two possible solutions. According to Adu (2004), Quadratic Equation is an expression of the form $ax^2 + bx + c = 0$ in which a, b, c are numerals and also the highest power of x is 2 and that the power of x will neither be fractions nor negatives. Hence, there is still need to determine the efficacy of Convergent Thinking Strategy on Senior Secondary School students' achievement in Quadratic Equation. This is because once, Convergent Thinking Strategy proves effective in the knowledge of Quadratic Equation, it tend follows that it will prove effective in any branch/course content of Algebra. This assertion is tailored from the assertions of Michael Seth in Asamoah (2012) that any method that proves abortive in the Knowledge of Quadratic Equation will prove abortive in other branches of Algebra but any method that proves effective in Quadratic Equation will prove effective other branches of Algebra.

Finally, disparity in Mathematics achievement especially in Quadratic Equation as regards to gender has been a source of worry to Mathematics scholars judging by the number of studies done to that effect. While some scholars have opined that there was no significant difference between the mean achievement and retention scores of male and female students in

Algebra (Galadima & Yusha'u, 2017; Olutola, Daramola and Bamidele, 2016; Spence, 2014; Bada and Dokubo, 2011), others have revealed contradictory findings by revealing that there was significant difference between the mean achievement and retention scores of male and female students in Algebra.

Among the scholars that had contradictory findings, some scholars like Meremikwu (2012) and Bosire, Mondoh and Barmao (2018) in their respective studies revealed that the Mathematics achievement and retention of female students were significantly better than their male counterparts while others like Onah (2015) and Juhun and Momoh (2001) in their respective studies revealed the opposite by indicating that the male students achieved and retained better than the female students. Hence, there is need to determine if the efficacy of CTS on achievement and retention of secondary school male and female students in Quadratic Equation.

The WAEC Chief Examiners Report showed persistent failure in Mathematics was because of the candidates' lack of skill in answering almost all the questions asked in algebraic processes. WAEC (2020) Chief Examiners Report showed that candidates' weakness in algebraic expression and word problems among others that led to poor achievement of students towards the subject. This neglect by students in Algebraic questions has prompted the researcher to investigate on the effect of Convergent Thinking Strategy on Achievement in Quadratic Equation despite the fact that there are numerous methods (like Discovery, Constructivism, Laboratory, concept mapping, computer-aided instruction, analogy method, Programmed Instruction, gaming and Computer Assisted Instruction methods) developed by Mathematics scholars in Quadratic Equation but yet there seems to be no effect in the Senior Secondary School students' achievement in Quadratic Equation.

The study determined the effect of Convergent Thinking Strategy on the Senior Secondary School students' achievement in Quadratic Equation. This is because the Convergent Thinking Strategy (CTS) ensures proper thinking, proper thinking directs and guides learning. Also, there are so many controversies surrounding the use of Convergent Thinking Strategy (CTS) and there is need to settle the controversies in the teaching and learning of Quadratic Equation. One cannot fully understand the concept of Algebra without first knowing the concept of Quadratic Equation. In addition, the study determined the efficacy of CTS on male and female senior secondary school students' achievement in Quadratic equation.

This study found out the Effect of Convergent Thinking Strategy (CTS) on Senior Secondary School Students' Achievement in Quadratic equation. Specifically, the study aimed at determining the:

1. mean achievement scores and standard deviations of Senior Secondary One (SS 1) students taught Quadratic Equation in the experimental and expository groups.
2. mean achievement scores and standard deviation scores of male and female SS 1students in the Experimental group.

The following research questions guided the study

1. What are mean achievement scores and standard deviations of SS 1 students taught Quadratic Equation in the experimental and expository groups?
2. What are mean achievement scores and standard deviations of SS 1 male and female students taught Quadratic Equation in the experimental group?

The following null hypotheses tested at 0.05 levels of significance guided the study

1. There is no significant difference between the mean achievement scores of SS 1 students taught Quadratic Equation in the experimental and expository groups.
2. There is no significant difference between the mean achievement scores of male and female SS 1 students in the experimental group.
3. There is no significant interaction effect of method and gender on the achievement scores of SS 1 students in Quadratic Equation.

Methods

The researcher adopted the pretest-posttest control group quasi-experimental design. The area that was used for this study was Enugu Education Zone of Enugu State. The population for the study was 5442 Senior Secondary One (SS 1) students in the 31 secondary schools in the zone. The sample size of the study was 294 Senior Secondary One (SS 1) students in the 3 out of 21 coeducational secondary schools in Enugu Education zone. In each of the schools sampled, simple random sampling method through balloting was used to sample an intact class for the Expository group and another intact class for Experimental group. Hence, the study sampled 148 students in Experimental group and 146 students in Expository group. In the Experimental group, the study sampled 75 male students and 76 female students. In the Expository group, the study sampled 72 male students and 74 female students. The instrument that was used for pretest and posttest is the Quadratic Equation Achievement Test (QEAT), which was developed by the researcher. The instrument (QEAT) was face validated by three (3) research experts, two (2) from mathematics education and one (1) from measurement and evaluation, all from the department of Mathematics and Computer Education, Faculty of Education, Enugu State University of Science and Technology, ESUT, Enugu. The instrument, QEAT was subjected to trial testing after face and content validation to obtain the stability of the instrument. The researcher administered the instrument to 40 SS1 students in Army Day Secondary School, Awkunanaw Enugu in Agbani Education Zone in Enugu State who were not part of the study. The reliability estimate for Quadratic Equation Achievement Test (QEAT) was determined using Kuder-Richardson formula method (K-R 20). A reliability coefficient of 0.83 was obtained, which showed that Quadratic Equation Achievement Test (QEAT) was highly reliable. QEAT was administered respectively as pretest on the first week of treatment by research-teachers. Scores of the students on the pretest were recorded and kept for use after the experiment. The posttest data was generated after re-administration of QEAT to the students on the last week of treatment. Means and standard deviations were used in analyzing the research questions while the Analysis of Covariance (ANCOVA) was used in testing the research hypotheses at 0.05 alpha levels.

Results

What are mean achievement scores and standard deviations of SS 1 students taught Quadratic Equation in the experimental and expository groups?

Table 1: Mean Achievement Scores and Standard Deviations of students taught Quadratic Equation in both pretest and posttest

Groups	Number	Pretest		Post-test		Gained Mean
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)	
Experimental	148	35.26	12.63	65.41	12.64	30.15
Expository	146	35.42	12.96	49.77	5.38	14.35

Table 1 above displayed the result of Mean Achievement Scores and Standard Deviations of students taught Quadratic Equation in both pretest and posttest. From the results in Table 2, the pre-test mean achievement score and standard deviation for the experimental group were 35.26 and 12.63 respectively, while the post-test mean achievement score and standard deviation were 65.41 and 12.64 respectively while for the control group, pre-test mean achievement score and standard deviation were 35.42 and 12.96 respectively, while post-test mean achievement score and standard deviation were 49.77 and 5.38 respectively.

The table showed that the Secondary School students taught Quadratic Equation using the Convergent Thinking Strategy (CTS) gained higher with the gained mean of 30.15 than those that were taught using expository teaching method (ETM) with the mean gain of 14.35. From this result, it showed that learning took place in both groups. This is because the both groups had higher posttest mean scores than their pretest mean scores.

What are mean achievement scores and standard deviations of SS 1 male and female students taught Quadratic Equation in the experimental group?

Table 2: Mean Achievement Scores and Standard Deviations of Male and Female Students in Experimental Group

Gender	Number	Pretest		Posttest		Gained Mean
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)	
Male	75	35.20	12.00	63.07	11.73	27.87
Female	73	35.35	13.33	67.81	13.17	32.46

Table 2 showed the mean achievement scores and standard deviations of male and female students in experimental groups. From the results in Table 2, the pre-test mean achievement score and standard deviation for the male students were 35.20 and 12.00 respectively, while the post-test mean achievement score and standard deviation were 63.07 and 11.73 respectively while for the Female students, pre-test mean achievement score and standard deviation were 35.35 and 13.33 respectively, while post-test mean achievement score and standard deviation were 67.81 and 13.17 respectively.

The lower standard deviation in male students showed that the mean score of the male students was homogeneous, which means that the female students had more extreme scores than their female counterparts in the experimental group. The table also showed that the female students gained higher than their male counterparts with the gained mean of 32.46 as against that of the male students of 27.87.

Testing of the Research Hypotheses

Table 3: Analysis of Covariance (ANCOVA) of the Mean Achievement Scores of the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	18904.831[a]	4	4726.208	51.067	.000	
Intercept	112330.579	1	112330.579	1213.741	.000	
PRETEST	.052	1	.052	.001	.981	
GROUP	18055.570	1	18055.570	195.092	.000	S
GENDER	779.180	1	779.180	8.419	.004	S
GROUP * GENDER	161.450	1	161.450	1.744	.188	NS
Error	26746.669	289	92.549			
Total	1022525.000	294				
Corrected Total	45651.500	293				

c. R Squared = .414 (Adjusted R Squared = .406)
d. WHERE S = Significant at P< .05; NS = Not Significant at P> .05

Table 3 above showed the Analysis of Covariance (ANCOVA) of the Mean Achievement Scores of the Experimental and Control Groups. The Table 3 was used to answer null hypotheses 1 to 3.

HO_1: There is no significant difference between the mean achievement scores of SS 1 students taught Quadratic Equation in the experimental and control groups

From the result of ANCOVA in Table 5, it was observed that Group (Experimental and Control) gave an F-value of 195.092 and was significant at 0.000. Since 0.000 was less than 0.05, the null hypothesis 1 was rejected as stated. Hence, the study concluded that there was significant difference between the mean achievement scores of SS 1 students taught Quadratic Equation in the experimental and control groups. This implied that the students that were taught Quadratic Equation using Convergent Thinking Strategy significantly achieved higher than their counterparts taught Quadratic Equation using the Expository teaching method.

HO_2: There is no significant difference between the mean achievement scores of male and female students in the experimental group.

From the result of ANCOVA in Table 5, it was observed that Group (treatment and Control) gave an F-value of 8.419 and was significant at 0.004. Since 0.004 was less than 0.05, the null hypothesis 2 was rejected as stated. Hence, the study concluded that there was significant difference between the mean achievement scores of male and female students in the experimental group. This implied that the female students significantly achieved higher than their male counterparts taught Quadratic Equation using Convergent Thinking Strategy.

Ho3: There is no significant interaction effect of method and gender on the achievement scores of SS 1 students in Quadratic Equation

From the result of ANCOVA in Table 5, it was observed that Group (treatment and Control) gave an F-value of 1.744 and was not significant at 0.188. Since 0.188 was higher than 0.05, the null hypothesis 3 was accepted as stated. Hence, the study concluded that there was no significant interaction effect of method and gender on the achievement scores of SS 1 students in Quadratic Equation.

Discussions

Discussion of the findings was done based on the following two (2) sub-headings:

1. Students' achievement in Quadratic equation with respect to method
2. Achievement in Quadratic equation by Male and Female students

The study discovered that the SS 1 students taught Quadratic equation using the Convergent Thinking Strategy achieved better than their counterparts taught Quadratic equation using the Expository method and the differences was statistical significant. This finding tallied with the findings of these scholars, Olutola, Ogunjimi, Daramola & Sheu (2017) who revealed that there was significant effect of convergent and divergent learning strategies on secondary school student's performance in biology, Ahiauzu (2017) who revealed that there was a significant joint influence of field dependent/independent and convergent/divergent cognitive styles on the academic achievement of students and Kelly (2011) who revealed that Convergent Thinking strategy enhances students' academic achievement and retention. This is because according to Kelly (2011), Convergent Thinking Strategy requires the ability to assemble and organize information and direct it towards a particular goal in the achievement of an effective solution to a problem.

The higher significant achievement scores of SS 1 students taught Quadratic equation using Convergent Thinking Strategy was because Convergent Thinking Strategy tends to focus on the teacher transmitting the knowledge of Quadratic Equation that they know to the students (Bar-Yam, Rhoades, Sweeney, & Bar-Yam, 2012). No student can learn Quadratic Equation effectively if he does not think effectively and no teacher can succeed in teaching Quadratic Equation successfully if he does not stimulate the student to think in a convergent way (Okorie, 2021). Hence, the findings of this study provide a guide for Mathematics teachers teaching Quadratic Equation to use Convergent Thinking Strategy in teaching Quadratic Equation. This is because it exposes the students to be self-regulatory in learning Quadratic equation, which they will overtime begin to take responsibility for and control over their learning of Quadratic equation.

Students will then monitor their own achievement by checking steps along the way the learning progresses. It will equip the students with better knowledge of

Quadratic Equation and how best to study Quadratic Equation better. It will provide the students with the self-assessment guides. Based on the findings, relevant governments and professional bodies as Mathematics Association of Nigeria (MAN), Science Teachers Association of Nigeria (STAN) should sponsor and organize workshops and seminars on how to use the Convergent Thinking Strategy (CTS) in teaching different topics in Quadratic Equation to enhance better achievement of students in Quadratic Equation.

The study discovered that the female students taught Quadratic Equation using the Convergent Thinking Strategy (CTS) achieved higher than their male counterparts and the difference was statistically significant. This finding is in line with the findings of Meremikwu (2012) and Bosire, Mondoh & Barmao (2018) in their respective studies who revealed that the Mathematics achievement and retention of girls were significantly better than their male counterparts. The findings contradicted the finding of Onah (2015) and Juhun and Momoh (2001) in their respective studies who revealed that the male students achieved and retained better than the female students.

The female students achieved more Quadratic Equation knowledge than their male counterparts was because according to Okorie (2021), the female students had better memories than male students and not because of the treatment provided. This implied that the Convergent Thinking Strategy (CTS) favours both genders equally. This finding is in line with the assertions of other scholars like Olutola, Ogunjimi, Daramola & Sheu (2017) and Achimugu & Onojah (2017) that disclosed in their separate studies that disclosed that there was no significant interactive effect of gender and instructional strategy (Convergent Thinking Strategy).

Since one can only achieve in what one had learnt in the past, it follows therefore, that the female students who had acquired more Quadratic Equation knowledge would be expected to achieve such knowledge more than their male counterparts. This is because it follows naturally that one can achieve in what one has learnt and vice versa. In Convergent Thinking Strategy (CTS), male and female SS 1 students are allowed to advance through the instructional process in a particular order as they provide the correct answers. The implication of this finding to the Mathematics teachers is that Mathematics teachers should be to provide equal opportunity for both male and female students irrespective of gender that achieves well. The utmost purpose of the Mathematics teachers should be that both male and female students achieved better.

Conclusions

This study examined the Effect of Convergent Thinking Strategy (CTS) on Senior Secondary School Students' Achievement in Quadratic Equation. From the findings of the study, it was discovered that students taught Quadratic Equation using Convergent Thinking Strategy achieved better than their counterparts taught Quadratic Equation using the Expository method and the differences were statistical significant, the female students taught Quadratic Equation using Convergent Thinking Strategy achieved higher than their male counterparts and the differences were statistically significant and there was no significant interaction effect of method and gender on the achievement scores of SS 1 students in Quadratic Equation.

Recommendations

Based on the above implications and findings of the study, the following recommendations are made:

1. Mathematics teacher should endeavor to use Convergent Thinking Strategy in teaching Quadratic equation.
2. Government educational agencies like Nigeria Education Research and Development Council (NERDC), Science Teachers Association of Nigeria (STAN) and the educational non-governmental organizations like Mathematics Association of Nigeria

(MAN), Science Teachers Association of Nigeria (STAN) should sponsor and organize workshops and seminars on how to use the Convergent Thinking Strategy (CTS) in teaching different topics in Quadratic Equation.

3. Curriculum developers should inculcate the findings of this study into the Mathematics curriculum especially in the area of Quadratic Equation.
4. Policy makers of the Ministries of Education should ensure that Convergent Thinking Strategy is adopted in the teaching of Quadratic equation in Mathematics.
5. Mathematics authors of should in the act of writing their Mathematics textbook for secondary schools incorporate the use of Convergent Thinking Strategy is adopted in the teaching of Quadratic equation in Mathematics.
6. Mathematics teachers should be to provide equal opportunity for both male and female students irrespective of gender.

References

Achimugu, L. & Onojah, P.K. (2017). Comparative Effectiveness of Convergent and Divergent Teaching Methods on Senior Secondary Students' Achievement in Stoichiometry. *International Educational Scientific Research Journal* 3(8); 17 – 21.

Ahiauzu S.C. (2017). Relationships among Field Dependent/Independent, Convergent/Divergent Cognitive Styles and Academic Achievement of Secondary School Students in Rivers State- Nigeria. *Journal of Education and Practice* 8(24); 183 – 191.

Al-Hassan S.I. (2016). Impact of Inquiry-Demonstration Method on Remediating Newman Errors and Enhancing Performance in Algebra among Senior Secondary School Students, Kaduna state, Nigeria. *An Unpublished Masters of Science Degree of the Department of Science Education, Ahmmadu Bello University (ABU), Zaria.*

Anibueze C.O. (2020). Differential effects of Mathematics card, chess and scrabble games on senior secondary school students' achievement, interest and retention in trigonometry. *A Faculty of Education Seminar of the Department of Mathematics and Computer Education, Enugu State University of Science and Technology (ESUT), Enugu.*

Anibueze, C.O. (2018). The Fundamental Knowledge of Trigonometry and Algebra. *An Unpublished Handbook.*

Bar-Yam, M., Rhoades, K., Sweeney, L. B., & Bar-Yam, Y. (2012). *Changes in the teaching and learning process in a complex education system*. www.necsi.edu/research/management/education/teachandlearn.html

Bosire J., Mondoh H. & Barmao A. (2018). Effect of streaming by gender on student achievement in Mathematics in secondary sch in Kenya. *South African Journal of Ed on EASA* 28(1); 595-607

Guilford, J.P. (1950). Creativity. *American Psychologist*, 5 (1); 444 – 454.

Guilford, J.P. (1982). Cognitive psychology's ambiguities: Some suggested remedies. *Psychological Review*, 89(1); 48 – 59.

Juhun S.O. and Momoh, S.D. (2001). Effect of environment and sex on the Mathematics achievement of JSIII students. *Delta Journal of Educational Development.* 2(2); 45 – 50.

Kelly, M. (2011). *Testing and evaluation. http://vceit.com/p/PSM-testing.htm*

Meremikwu, A.N. (2012). Gender differences and Mathematics achievements among Secondary School Students. *Unpublished M. Ed. Thesis of the University of Calabar*.

Nezhad, G. (2013). *The Impact of Task Type and Divergent Thinking or Reading Proficiency.*

Tehran Press: University of Social Welfare and Rehabilitation Sciences.

Okorie, R. I. (2021). Effect of Convergent Thinking Strategy (CTS) On Senior Secondary School Students' Achievement and Retention in Quadratic Equation in Enugu Education Zone. *Unpublished M.Sc Dissertation of Enugu State University of Science and Technology.*

Olutola A.T., Ogunjimi M.O., Daramola D.S. & Sheu A.L. (2017). Effects of Convergent Learning and Divergent Learning Strategies on Students' Academic Performance in Biology in Ilorin, Nigeria. *African Journal of Interdisciplinary Studies* 10(1); 33 – 39.

Onah E.N. (2015). Effect of Multimedia Projection on Senior Secondary Students' Achievement and Interest in Sets. *Ph.D. Theses of the Department of Science Education, University of Nigeria, Nsukka.*

Ugwuanyi J.N. (2015). Effects of Peer Education on Awareness and Attitude towards HIV and AIDS among In-School Adolescents in Nsukka Education Zone of Enugu State. *Unpublished Doctorate thesis of the Department of Educational Foundation, University of Nigeria Nsukka*.

Williams, Y. (2013). Convergent thinking definitions, examples and quiz. *Educational Portal,* 13 (3); 7-15.

PRINCIPALS FINANCIAL MANAGEMENT CONSTRAINTS IN SECONDARY SCHOOL IN ENUGU STATE

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Abstract
Principals are chief executives of secondary schools. They place human beings according to their specialties, make available facilities and as chief account officers, they manage resources including finance. Managing finance is at the root of all major business decisions.This role is crucial to the success of organizations in a range of sectors. Effective financial management is key to the success of all businesses; education inclusive. It is against the above, that this study was set to determine principals' knowledgeability on financial management principles vis-a-visthe extent to which training platforms on financial management are provided for secondary school principals in Enugu State. The study found that principals are skilled to a little extent on the task of financial management in secondary schools in Enugu State. Based on the findings, it was recommended among other things as follows: classes on financial management skills (by the way of workshop, seminar and conferences) should be regularly held for both the serving and would be principals. At the end of which, a qualifying certificate would be issued to the attendees. 2) Financial management skill should be prioritized in the selection of school principals.

Keywords: *Education, Secondary School, Management, financial resources management, principals,*

Introduction

Education is the socially organized and regulated process of continuous transference of socially significant experience from previous to present generations. It seeks to develop the innate capacities of man. By educating an individual we attempt to give him some desirable knowledge, understanding, skills, interests, attitudes and critical thinking. That is, he acquires knowledge of history, geography, arithmetic, languages and sciences (Naziev, 2017). This implies that the primary aim of education is to nourish the good qualities in man and draw out the best in every individual.

Human beings don't fold their arms and watch things happen they make efforts to coordinate and direct their activities. In the words of Aichinger (2014), man has to think critically about various issues in life and take decisions on them, being free from bias and prejudices, superstitions and blind beliefs; thus, he has to learn all these qualities of head, hand and heart through the process of education. Peters in Ozoagu (2015) saw education as the transmission of what is worthwhile to those who become committed to it, be they adults or youths. It could be observed that, the key words in Peter's definition are desirability and worthwhileness. On his own, Ocho in Ene and Chidiobi (2017) captured the centrality of worthwhile-values of education when he stated thus; "The main function of education is to refine our sensitivity to the existence of others, to lessen our preoccupation to self and to know that a shared life, a shared responsibility is more productive in happiness than the life of selfish aggrandizement". The above implies that education in broad sense

includes all the worthwhile activities through which a person interacts in other to become a contributing member of the society to which he belongs. Therefore, education is not an activity we undertake just for its own sake, but always because we want to achieve something or bring about something. There are quite different views about what education should be, not only depending on people's understanding of what education 'is' but also, and more importantly, depending on the values they hold and the views they have about what education ought to achieve (Biesta, 2010). Aligning with the above, Science Direct (2019) posited that one major function of education particularly the formal is that of *qualification.* This has to do with providing children, young people, and adults with the knowledge, skills, and understanding and often also, with the dispositions and forms of judgment that allow them to 'do something; a doing which can range from the very specific (such as in the case of vocational or professional education) to the much more general (such as the role of education in preparing children and young people for life in highly complex societies). A second major function of education is that of *socialization*, which has to do with the ways in which, through education, we become initiated into existing social, cultural, political, professional, or religious communities, practices, and traditions. Ukeje in Ani (2009) opined that education is the process of transmitting, preserving, developing and advancing the culture of a people. Here, Ukeje in Ani (2009) likens education to cultural transmission. In Nigeria, it is of general view that education is the tool per excellence in the transformation of economy. This accounts for the reason why many nations including Nigeria, declared it free and compulsory at least to junior secondary level.

Principals are chief executives of secondary schools. They partly plan, organize, staff, direct, coordinate and make school budgets alongside the government. According to Eneh and Chidobi (2017) they develop and implement educational programmes. They place human beings according to their specialties, make available, facilities and manage resources including finance. Request for equipment, keep school records and also create environment that promotes teaching and learning. In a nutshell, Principals are chief account officers of secondary schools. Management is the complex of continuously coordinated activity by means of which any undertaking administration whether public/private service conducts its business (International Labour Organization, ILO in Isah, 2014). To manage is one of the most important activities of human life. It is very essential in ensuring the coordination of individual efforts and effective utilization of material resources. Management is required not just in all kinds of organizations but also, in every operation of such organizations, whether it is a manufacturing company or handlooms, engineering, civil services, trading in consumer goods or provision of services and even in non-formal organizations. No matter what the setup is, or what its goal may be, they all have something in common; management and managers (Clark, 2010).

Management consists of a series of interrelated functions that are performed by all managers. In simple words, Management is the art of getting things done through people. It is an organizational process that includes strategic planning, setting objectives, managing resources, deploying the human and financial assets needed to achieve objectives and measuring results (Knowledge Management Terms, 2009).Thus, the management of secondary schools and the resources therein are the sole responsibility of principals. Therefore, this study focused on Principals financial management constraints in secondary in Enugu State.

Education does not exist in vacuum; it requires a combination of various educational resources to flow. Ifedi in Nzegbulem (2013) asserts that where resources are scarce and working conditions difficult, educational quality may fall victim and examples of inefficiency, mismanagement and poor performance will appear to be more numerous than performance. Resource is anything which contributes to economic activities (block in Nzegbulem, 2013). Educational resources can be classified into two major groups, namely; human and none-human resources, where human resources refer to the three categories of human elements in the school system, which are teachers, supportive staff (non-teaching) and students. The none-human resources include finance, physical, material and information resources (Chidobi & Eneh,

2018). In another development, Cheechi (2006) argued that educational resources are of four major parts, namely; human, physical material and financial resources.

Managing finances is at the root of all major business decisions; that of education inclusive. This role is crucial to the success of organizations in a range of sectors. Effective financial management is key to the success of all businesses. According to Industrial and General Insurance IGI Global (2021), financial resources are the resources from which the enterprises obtain the funds they need to finance their investments; capital and current activities. An enterprise obtains the funds it needs from three general resources; Financial Institutions, Capital Markets, Owners Equity (Capital Stock), (IGI Global asserts further). Similarly, Management Mania (2019) saw financial resources as one type of resources, respectively, inputs into the production process. It is from an economic perspective, part of the assets (property) of the organization. Financial resource could be said to be the term covering all financial funds of the organizations as schools, manufacturing companies, business outfits. This being the case, a financial manager should have the requisite knowledge with which to provide financial guidance and support to his subordinates, so they can make sound business decisions. Relating to school system, Okeke (2005) posits that Principals as chief account officers need good head for figures and for dealing with complex modeling and analysis, as well as sound grasp of financial systems and procedures. It is in the best interest of the system, if the principal had at one time or the other taken charge of organization's finance so as to have gathered experience and be abreast of financial principles. Expertise could equally be gained through training as most principals are not account experts. Thus, a principal that had been subjected to financial tutorial through a well packaged/ organized seminar- workshop or conference will perform better. According to Cheechi (2006), money matters can be intimidating for even the smartest of all people. However, having a solid understanding of basic financial terms and methods is crucial to the success of every career. Supporting the above, Ogbonnaya (2005) stated that; effective financial management is core to all successful businesses including education and the demand for financially literate school heads, has never been higher. It is on this count, that IGI Global (2021) reiterates that, successful businesses need people with financial acumen. It is important therefore, that principals are made to understand/learn skills and knowledge they need to plan, organize and control finances and make good financial decisions. It is in this same line of thought, that Ozoagu (2015) proclaims that regular Budget and Financial management workshop will arm the school administrators with the magic wand for effective financial management. The issue of proficiency on the part of the Principals with regards to financial management must be seen as an emergency. Thus, they (principals) should be made to develop thorough knowledge of financial decision-making, analytical skills and learn how to manage money and use funds effectively for educational results. It is on grounds of the above, that this study was set to ascertain principals' level of preparedness (by the way of training) in managing school financial resource.

Financial mismanagement has been topical in virtually all sectors of the Nigerian economy, including education. There has never been any time when finance is considered adequate for projects in Nigerian schools, not to talk of surplus. In our schools today especially the secondary, there are lots of half-hazzardly done projects. Things are rarely complete and are usually in insufficient numbers. It is either school is in shortage of personnel for effective teaching and learning/ lacking sufficient materials or such facilities as office buildings, classrooms, examination halls, computer sets, laboratory equipment and/or other school plants; as generator set/house are not on ground, half-hazardly built or dilapidated. It is however, pertinent to note that most of these problems do not necessarily border on financial inadequacy, but on mismanagement. This mismanagement could result from couple of factors; ranging from the principal's personality, proficiency in financial management, experience, knowledgeable in financial accounting and choice of decision with respect to finance. In the face of economic hardship, a period when money is not enough to cater for its own needs. It is necessary that high consideration is placed on funds-management in schools. Therefore, schools'

finances must be trusted with people that have the requisite knowledge, experience, exposition and capacity to manage it for goals achievement. It is on this ground, that this study determined the level of principals' preparedness in the task of financial management in secondary schools in Enugu State.

The general purpose of this study was to find out financial resource management constraints in secondary schools in Enugu State. Specifically:

1. The study ascertained the extent to which principals in secondary schools in Enugu State receive trainings on financial management principles

This study was guided by the following question

1. To what extent do principals receive trainings on financial management principles in secondary schools in Enugu State

This research hypothesis guided the study. It was tested at 0.05 level of significance.

H01: there is no significant difference in the mean responses of male & female principals on the extent to which principals receive trainings on financial management principles in secondary schools in Enugu state.

Methods

The study adopted a descriptive survey type of design. The area was Enugu State. The population for this study was 314 principals serving in the public secondary schools in Enugu State (source: State Ministry of Education). Due to the fact that this population was a sizeable one, the researcher utilized the entire population for this study. This act was supported by Uzoagulu (2011) who notes thus; when it is of few hundreds, use the entire population. Instrument for data collection was questionnaire titled "financial Resource management constraints in Secondary Schools in Enugu State (FRMCSS)". The instrument was developed by the researcher. It has two sections, where section "A" is concerned with personal information of the respondents, section "B" contains items on extent of principals' preparedness in managing school finance in secondary schools in Enugu State. The B part of the questionnaire was based on four points rating scale of Very Little Extent (1point), Little Extent (2points), Great Extent (3points) and Very Great Extent (4points). The instrument was face validated by two experts in educational management and one in measurement and evaluation unit, all of faculty of education, Enugu State University of Science and Technology (ESUT), Agbani. Both to ease stress and to ensure 100% retrieval, copies of the questionnaire were personally administered by the researcher in conjunction with 4 trained research assistants. Mean and standard deviation were used to answer the research question, while t-test statistics was used to test the hypothesis at 0.5 level of significance.

Results

Table 1: Mean responses of male and female principals on the extent to which principals are trained in financial management principles in secondary schools in Enugu State.

S/N	Principals are trained in the following financial management principles	Male= 189			Female= 116		
		Mean	SD	Dec.	Mean	SD	Dec.
1	Providing and interpreting financial information	1.52	0.49	LE	1. 44	0.50	LE
2	Developing financial management risk	199	0.60	LE	1.98	0.60	LE

3	Conducting reviews and for cost-reduction opportunities	200	0.62	LE	1.99	0.68	LE
4	Arranging new sources of finance for debt facilities	2.93	0.75	GE	2.84	0.78	GE
5	Formulating strategic and long-term Financial plans	2.02	0.46	LE	2.00	0.46	LE
6	Producing accurate financial reports to specific deadlines	200	0.62	LE	1.98	0.60	LE
7	Liaising with auditors to ensure annual monitoring is carried out	3.01	1.01	GE	3.08	1.06	GE
8	Managing budgets	200	0.47	LE	2.02	0.46	LE
9	Managing financial accounting, Monitoring and reporting systems	200	0.45	LE	2.02	0.46	LE
10	Guidance/supervision of bussar/ accountants	2.66	0.55	GE	2.76	0.49	GE
	Grand Mean	2.23	0.28	LE	2.22	0.28	LE

It was discovered that out of ten items, only three which are item numbers 4, 7 and 10 are rated great extent. This is because their respective means are beyond the criterion mean of 2.50 which is the benchmark. The other 7 as items number 1,2,3,5,6,8 and 9 are rated little extent because their mean scores are below the benchmark of 2.50.

Furthermore, the table also shows grand mean of 2.23 for the male principals and 2.22 for their female counterparts. This indicates that the extent to which principals are prepared for financial management in secondary schools in Enugu State is little, as the grand means of both male and female principals are below 2.50 which is the point for acceptance.

Table 2: t-test analysis of difference in the mean ratings of male and female principals on the extent to which principals are trained in financial management principles in Secondary Schools in Enugu State.

Group	N	Mean	SD	DF	t-cal	t-critical	Decision
Male	189	2.23	0.28	312	0.88	1.96	Do not reject
Female	116	2.22	0.28				

Table 2 showed that the calculated value of t is 0.88 while t- critical value is 1.96. As a result of the above, the null hypothesis is not rejected. The above decision further shows that there is no significant difference in the mean responses of male and female principals with respect to the extent to which principals of

secondary schools in Enugu State are trained in financial management principles.

Discussion of results

It was discovered in this study that what impedes principals' efficiency/effectiveness in the management of financial resource in secondary schools in Enugu State is inadequate training in the area of financial management principles. Principals lack knowledge of the guiding principles for managing finance. It is observed in table one above that school principals have to a little extent requisite knowledge/skills to perform the financial management roles in secondary schools in Enugu State. This finding accounts for the major reason Okeke (2005) opines that Principals as chief account officers, need good head for figures and for dealing with complex modeling and analysis, as well as sound grasp of financial systems and procedures. Submission of Okeke above is also supported by the view of Cheechi (2006), who notes thus, money matters can be intimidating for even the smartest of all people. However, having a solid understanding of basic financial terms and methods is crucial to the success of every career. Also, the findings reveal that principals are found to be proficient in the areas of: 1) arranging new sources of finance for debt facilities; 2) liaising with auditors to ensure annual monitoring is carried out and 3) guidance/supervision of school bursar/accounts because these are the areas where principals agreed they are given training on financial management. A critical look at the analytical table above will acquaint us with the fact that due consideration is not given to the issue of acquisition of the knowledge of financial management principles for both principals' financial efficiency and prudence in secondary schools in Enugu State. The above point is because even the areas where principals are believed to have had trainings on, are not thorough, considering their means scores. For instance, item no.10 (guidance and supervision of school bursar/accountants) scored 2.66 and 2.76 for both male and female principals respectively. These scores though beyond the criterion mean of 2.50 cannot be said to be high enough to denote sufficiency. Therefore, this finding amplifies the need for regular training of principals in the area of financial management principles for result achievement.

Furthermore, the result of table two reveals that no significant difference exists between the responses of male and female principals on the extent to which principals are trained in financial management principles. This is in-tandem with the early submission of the researcher who noted that the issue of proficiency on the part of the Principals with regards to financial management must be seen as an emergency. Thus, they (principals) should be made to develop thorough knowledge of financial decision-making, analytical skills and learn how to manage money and use funds effectively for educational results.

Conclusions

From the discussion made on the data which was analyzed for the research question and hypothesis, the following conclusions were made:

1. Financial management is rudimentary to/in the survival of every business; including school education.

2. Principals lack the requisite knowledge to manage school finance effectively.

Recommendation

1. Classes on financial management skills (by the way of workshop, seminar, conferences etc) should be regularly organized for both the serving and would be principals. At the end of which, a qualifying certificate would be issued to the attendees.
2. Would be principals should be encouraged to embark on self-development studies, especially in the area of financial management skill acquisition while on the job.
3. Financial management skill should be prioritized in selecting schools principals

References

Ani, C.I. (2009).*Nigeria Education System: Concepts, Issues and Emerging Problems*. Enugu: His Glory Publications

Aichinger, I. (2014) The Bound Man, And Other Stories. https://www.goodreads. com/book/show/ 2026661.

Biesta, J.J. (2010). Good Education in an Age Measurement. Retrieved 20/06/21 from www.researchgate.net/publication/262778887

_Good_Education_in_an_Age_of_Measurement

Clark, A.J (2010). Empathy: an integral model in the counseling process. Journal of counseling & development, 88(3), 348-356

Checchi, D. (2006). *The economics of education, human capital, family background and Inequality*. U. S. A. Cambridge University Press

Eneh, F.N & Chidobi, R.U (2017). Physical resource management constraints in public secondary schools in Enugu: implication for principals of secondary schools. *Nigerian Journal of Educational Administration and Management (NJEAM). 2 (1) 111-121*

George, G. R. (2009). *Contemporary Management* (Sixth ed.). (B. Gordon, Ed.) New York, NY, USA: McGraw-Hill/Irwin.

Industrial and General insurance IGI Global (2021). What is financial resources. Retried 20/6/21 from https://www.igi-global.com/dictionary/financial-problems-of-the-small--and-medium-sized-enterprises-and-solution-suggestions/45245

Isah, J.J (2014). *Poverty Alleviation and Students' Academic Performance in Public Senior Junior Secondary Schools in Lagos State Education District* (V).Unpublished M.Ed Dissertation.Lagos State University, Ojo.

Knowledge Management Terms. (2009).from Stuhlman Management Consultants :http://home.earthlink.net/~ddstuhlman/defin1.htm. Retrieved 12/7/23

Managementmania (2019). Financial Resources. Retrieved from https:// managementmania.com/en/financial-resources-finance

Naziev A. (2017). What is an Education.https://www.researchgate.net/publication/317545698 What_is_an_education. Retrieved 21/7/23

Nzegbulem, P.S.C (2013). Education budgeting processing and problems, the base of equality secondary education in Nigeria.*African Journal of Allied Education (AJAE). 1(1), 110-115*

Ogbonnaya, N.I (2005). *Foundations of education finance. Nsukka*: Hallman Publishers

Okeke F. (2005). Strategy for effective funding of secondary schools in states. *Unpublished M.ed dissertation, University of Nigeria, Nsukka.*

Ozoagu G.C (2015). Alternative sources of financing secondary sducation in Enugu State.*Unpublished M.ed dissertation, ESUT, Agbani.*

SccienceDirect (2010). Concept of Education. https://www.sciencedirect.com/topics/social-sciences/concept-of-education. Retrieved 21/7/23

Uzoagulu, A.E (2011). *Practical guide to writing research project reports in Tertiary Institution*. Enugu: John Jacob's Classic Publishers.

COMPARATIVE ASSESSMENT OF MULTIPLE-CHOICE AND MULTIPLE TRUE-FALSE TESTS ITEMS ON UPPER BASIC STUDENTS' ACHIEVEMENT IN CHRISTIAN RELIGIOUS STUDIES IN DELTA STATE

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Abstract
This study was designed to assess the multiple-choice and multiple true-false test items on Upper Basic (UB) students in Christian Religious Studies (CRS) in Delta State. The study compared two teacher-made multiple-choice and multiple true-false CRS test items. The purpose was to determine which testing mode would result to greater achievement in CRS. Two research questions and two hypotheses were formulated to guide the study. The population of the study comprised 2,207 Upper Basic students in Oshimili South LGA of Delta State. A sample of 200 UB2 students drawn from four of the public secondary schools in Oshimili South LGA formed the subjects of the study. The sample was obtained through simple random sampling technique. The students were randomly assigned to multiple-choice group and multiple true-false group. A comparative research design was used. 25 CRS Multiple-Choice (CRSMC) and 25 CRS multiple true-false (CRSMTF) items were developed, validated and used by the researcher in the study. A trial test was carried out in two of the schools within the Aniocha South LGA, to ascertain the reliability of the instrument. Kuder-Richardson 20 (K-R 20) was used to establish the reliability of the CRSMC and CRSMTF test items. The reliability coefficients were 0.85 and 0.72 respectively. The data generated from the study were analyzed using mean and standard deviation. Hypotheses were tested using ANOVA and Independent Samples T-test. The result of the study showed that students who were examined with multiple-choice achieved higher than students who were examined with multiple true-false items. Based on the findings of the study, it was recommended that multiple choice items with the application of the six levels of the cognitive domain (Remembering, Understanding, Applying, Analyzing, Evaluating and creating) is more adequate to test students at the Upper Basic level.

Keywords: *Assessment, Christian Religious Studies, Multiple-choice items, Multiple-true-false items*

Introduction

Positive attitude and character moulding are crucial in the education of every child. These cannot be achieved without a discipline such as the Christian Religious Studies. Positive attitude and character building are emphasized in the National Policy on Education as the focus of Nigerian education system (Federal Republic of Nigeria 2014). Christian Religious Studies (CRS) is one of the major subjects in the Basic and Senior Secondary School curriculum which would help to achieve these goals. Christian Religious Studies (CRS) as the name implies is a school subject that has its based on the Christian Bible. CRS is inculcated by the means of religious education in schools, and religious education is the teaching of a specific religion or teaching of religions in general and its varied aspects, its beliefs, devotion, rituals, customs, rites and personal roles. These make religious education differ from rigorous academia which guards religious beliefs as a fundamental tenet and operating modality (Anyebe, 2018). CRS is a discipline that is capable of instilling in the young people the required and desired knowledge, values, behaviours, attitudes and skills that would ensure their effective adaptation in an ever-changing multi-faith and multiethnic society like Nigeria (Eluu &

Ikwumelu 2014). CRS is designed mainly to achieve many goals in the lives of the learners beginning from teaching them about God to the teaching of moral values which is aimed at shaping human behaviour. These values are drawn from the stories and events recorded in the Bible (Njoku and Njoku 2015).

Christian religion is an instrument for the development of spiritual, moral and mental growth of children being taught. It exposes them to an understanding of the universe and the interpersonal relationship between human beings and God (Eluu (2016). The importance of Christian religion in inculcating value is found in the claim of personal and spiritual knowledge of God through Jesus Christ, the son of God. It is a stabilizing factor in the individual personality. Through Christian religious education, students acquire moral training and it imbues in them the desire to do good and be virtuous. The religious values inculcated in the students help them to raise fundamental questions relating to life and existence. These are the reasons why CRS subject is being taught in the school. It is a subject that helps to streamline the thought, character, moral and aspiration of the students. It also offers hope for the future, integrate, discipline, harmonious and progressive society (Ntama, Owulu and Monity 2016).

Like any other subject offered in school, CRS can be designed as test to assess students' performance. Tests are designed to measure the quality, ability, skill or knowledge of a sample against a given standard, which usually could be deemed as acceptable or not. In educational practice, tests are methods used to determine the students' ability to complete certain tasks or demonstrate mastery of a skill or knowledge of content. Tests can take the form of multiple choices or a weekly spelling (Adom, Menser & Dake 2020).

CRS is a subject that has a large content area which ranges from the Old Testament to the New Testament Bible and writings. Apart from the fact that test is used to measure students' learning, it can also be used to find out the extent to which the subject contents have been covered. There could be a way of presenting as much cognitive content as possible without overstraining the examinee. This is where multiple-choice item format becomes applicable.

Multiple-choice items are mostly used for test because they can be more reliable in terms of scoring and analysis of examinees' scores. Though, they are not easy to develop. To test the students/learners in CRS, multiple-choice items can be used as test or instrument. Multiple-choice tests can be a simple and straightforward way to measure learning. Shin, Guo & Griel (2019) It is a form of educational assessment used to measure diverse types of types, skills, and competencies. Multiple-choice items (MCI) are efficient to administer, they are easy to score objectively, and they can be used to sample a broad range of content, and they require a relatively short time to administer.

Multiple Choice items are used as an assessment tool in education, either for formative assessment or summative assessment. Though it is widely used for summative assessment especially in standardized testing. Mckenna (2018) noted that multiple-choice items as a well-known instrument used for summative assessment, they typically require students to select a correct answer from a list of alternatives. Most typically, there will be a single correct answer among two, three or four options; though variations can include selection of a single best-possible answer, or of multiple possible answers ('multiple response').
Multiple-choice test items may be free response test items known as structured response test items or objective test items. In essay type, testees are expected to construct their response while the structured type involves the recognition and recall of already known information. According to Anigbo (2014), multiple choice items "are tests where problems or questions are presented in the stem and the examinee required to select the best answer or options." The options contain a most correct answer while others are distracters or foil. Its main purpose is to identify examinees that do not have complete command of the concept or principle involved. For this purpose, to be accomplished, the foils or distracters must look as almost real as the correct answer to students who have not mastered the materials.

The stem must be explanatory enough. It should not be ambiguous, rather it should promote direction of what is expected from the testee. Therefore, the stem and options must agree grammatically (Orji 2003). Multiple choice items are mostly operational in testing at the application, synthesis, analysis and evaluation levels of the cognitive domain (Anigbo 2014). Multiple choice can take different forms, such as, question/right answer, incomplete statement or best answer option. Multiple-choice can be used to measure some levels of learning outcomes, such as knowledge, comprehension, etc. Lopes, Babo and Torres (n.d), noted that multiple-choice cannot measure certain learning outcomes, such as capable of communication and articulate explanations, organization of the information, and creativity. Such learning outcomes are measured by short answer or essay questions, or by performance tests.

Multiple-choice tests comprise of different number of options, though most multiple-choice tests contain questions with four options for every item. Different authors have made suggestions on the number of options each item should contain. According to Budiyono (2019), multiple-choice questions can be five-option or four-option depending on the purpose of the test. Researches through empirical evidence have shown that multiple-choice items using three response options is preferable to four-options or more. Dehnad, Nasser & Hosseini (2014) suggest that three-option multiple-choice questions save time for covering more content and items in the test, thereby increasing test validity and reliability. Rodriguez (2007) asserted that three-option items can be administered than four- or five-option items per testing time while improving content coverage, without detrimental effects on psychometric quality of test scores. Also, Loudon & Macias-Muñoz (2018) said that the probability of attaining a perfect score on an exam by randomly guessing is minimized with three options (while holding the total number of options in the entire exam constant). However, multiple-choice items irrespective of the type of option format used are easily and accurately scored and can be reliable. The same is applicable to multiple-true-false items.

Multiple true-false items (MTF) are a type of closed-ended question format. MTF items comprise a question stem and true or false statements which students choose from. MFT questions function like MC questions whereby students select the options the apply, except that MTF items involve marking of both correct and incorrect statements. In its format, MFT has many of the benefits and grading proficiencies of the MC format (Couch, Hubbard & Brassil, 2018). The major difference between MC and MTF is that in the former students are required to select just one answer while the later gives students room to evaluate before they make a choice of either true or false (Brassil & Couch, 2019). However, MC items with one correct response and three distractors are operationally like MTF items with one true statement and three false statements, and these items can be exchanged by reorganizing the response input while leaving the item text the same (Couch, Hubbard & Brassil, 2018).

Two scoring methods can be used in MTF format; cluster scoring and primary scoring. In cluster scoring method, items are scored in the same way the traditional MC items are scored. In other words, each cluster has a score based on the number of options correctly pinpointed, true or false, for its stem. Whereas in the primary scoring, the test is scored based on the total number of correct responses, regardless of the clusters (Mobalegh & Barati, 2012). MFT and MC are therefore, two testing formats that can be used to test students' achievement after they have been exposed to learning.

It is not just enough to develop MC items or MTF items in CRS and administer to examinees especially for a large-scale assessment. The assessment of the adequacy of each item that make up the instrument is required. The reason for this is to ensure that the test or instrument is valid and reliable. The assessment of these items is done through item analysis. MC items can be scored objectively with the use of modern technology without rater's bias. This allows for the inclusion of a broad range of topics on a single exam thereby effectively testing the breath of student's knowledge (Weimer, 2018). The same is applicable to MTF in terms of objectivity of scoring, and MTF

gives more room to the examinees to think and evaluate the true/false response options.

The researcher discovered that in Oshimili South LGA, the achievement of UB students in CRS has been low over the years. Could it be that the test format being used in the administration of examination in the schools were faulty? It is based on this that the researcher sought to assess the multiple-choice item and multiple true-false item formats on UB2 students' achievement in Christian Religious Studies (CRS) in Delta State. A cursory look at the chief examiner's report of students' achievement at Basic Education Certificate Examination (BECE) depicted low performance CRS in the previous years, "The general performance of the candidates was a little higher than that of the previous years." The Chief Examiner further noted that some candidates could not answer questions on some of the topics in the Bible (WAEC Chief Examiner's Report BECE 2021). Also, the Chief Examiner's report of students' achievement at Senior Secondary School Examination (SSCE) depicted low performance in Christian Religious Studies (WAEC Chief Examiner's Report 2018 - 2020). The choice of UB2 students as the subjects of this research is that they are the candidates for BECE.

The main purpose of the study was to investigate into comparative assessment of multiple-choice items and multiple true-false formats on Upper Basic students' achievement in Christian Religious Studies (CRS) in Delta State. Specifically, the study was designed to find out:

1. the mean achievement scores and standard deviation of the students tested with CRS multiple-choice and those tested with CRS true-false test items
2. the difference in the mean achievement scores and standard deviation of students tested with CRS multiple-choice and those tested with CRS true-false test items

The following research questions and corresponding hypotheses guided the study:

1. What are the mean achievement scores and standard deviation of students tested with CRS multiple-choice and CRS true-false test items?
2. What is the difference in the mean achievement scores and standard deviation of students tested with CRS multiple-choice and CRS true-false test items?

$H0_1$: the mean achievement scores of students tested with CRS multiple-choice and CRS true-false test items are not statistically different.

$H0_2$: there is no significant difference in the mean achievement scores and standard deviation of students tested with CRS multiple-choice and CRS true-false test items

Method

The study employed a comparative research design. The population of the study consisted of 2,207 Upper Basic students got from 13 public secondary schools in Oshimili LGA of Delta State (source: Post Primary Education Board, Asaba 2022). The sample comprised 200 UB2 students obtained through simple random sampling technique through balloting.

The instrument used for data collection was a CRS multiple-choice (CRSMC) and CRS multiple true-false (CRSMTF) items drawn from Upper Basic syllabus. The instruments were used to assess the students' cognitive achievement in CRS. The instrument was validated by two specialists in Measurement and Evaluation, and one specialist in Christian Religious Studies respectively. The reliability of the instrument was determined using Kuder Richardson 20 (K-R 20) to estimate its internal consistency coefficient. This is in line with Abonyi (2011) who said that that K-R 20 is applied to tests that are scored dichotomously. The researcher, with the help of two research assistants administered the instruments and were collected on the spot. For the four selected schools, 100 students were tested with CRSMC items in two schools while 100 were tested with CRSMTF items. There were two UB2 classes in each of the schools. From each school, 50 students were randomly chosen through disproportionate stratified random sampling before the administration of the items. Then the items were collected, marked and scored. Scores obtained after the administration of

the instruments were analyzed using mean and standard deviation to answer the research questions, while ANOVA was used to test the hypotheses.

RESULTS

Table 1: Mean achievement and standard deviation scores of students tested with CRS multiple-choice and CRS multiple true-false test items

No. of students	Mean	SD
100	40.42	5.44
100	30.34	6.04

From the data in Table 1 above, the CRSMC achievement scores and standard deviation (SD) are 40.42. and 5.44 respectively, while the CRSMTF achievement scores and standard deviation (SD) are 30.34 and 6.04 respectively. Students tested with CRSMC have higher mean achievement score and smaller SD than students tested with CRSMTF

Table 2: The difference in the mean achievement scores and standard deviation of students tested with CRS multiple-choice and CRS true-false test items

Groups	Mean		SD
CRSMC	40.42	CRSMC	5.44
CRSMTF	30.34	CRSMTF	6.04
Mean diff	**10.08**	**Diff**	**0.6**

The mean difference between the CRSMC and CRSMTF is 10.08, indicating that students who were tested with CRSMC achieved higher than students tested with CRSMTF. The mean difference is relatively high. It suggests a substantial gap in achievement between CRSMC and CRSMTF.

The SD of CRSMTF suggests a greater spread in the test scores while the SD of CRSMC shows more consistent performance across students. The difference is small, and it, therefore, shows that the data points in both groups are similarly dispersed around their respective means. The difference of 0.6 represents how much larger CRSMTF SD is compared to CRSMC. It is a small difference because it falls within a reasonable range. CRSMTF has a slightly greater spread in its data points compared to CRSMC. The data points in CRSMTF are more dispersed from their mean.

Hypotheses

$H0_1$: *The mean achievement scores of students tested with CRS multiple-choice and CRS true-false test items are not statistically different.*

Table 2: Test of Between-two test formats CRSMC and CRSMTF
Dependent Variable: Achievement

Sources	Sum of Squares	df	Mean Square	F	Sig	Dec
Between groups	119.264	15	7.951	.792	.683	NS
Within Groups	843.326	84	10.040			
Total	962.590	99				

The data in Table 2, above, tested the hypothesis of no statistically significant difference between CRSMC and CRSMTF test items. The F-calculated of 0.792 has an associated probability score (p-value) of 0.683 which is greater than 0.05. Since the p-value is greater than 0.05, it means there is insufficient evidence to conclude that there is not statistically significant difference between the means of the groups. Therefore, based on the given data, the null hypothesis is not rejected.

$H0_2$: *There is no significant difference in the mean achievement scores and standard deviation of students tested with CRS multiple-choice and CRS true-false test items*

Table 3*:* Independent Samples T-test

	Levene's Test for Equality of variances		t-test for equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig	t	df	Sig (2 tailed)	Mean Diff	Std. Error Diff	Lower	Upper
CRSMCI, CRSMTF									
Equal variances assumed	2.466	.118	10.675	198	.000	5.04000	.47212	4.10897	5.97103
Equal variances not assumed			10.675	194.829	.000	5.04000	.47212	4.10887	5.97113

The data in Table 3, above, tested the hypothesis of no significant difference in the mean achievement scores and standard deviation of students tested with CRSMC and CRSMTF items. The Levene's test for equality of variances showed the F-statistics of 2.466, and the significant level or p-value of 0.118 which is greater than 0.05. This indicates that the variances are equal across both groups of students tested with CRSMC and CRSMTF items.

In CRSMC, calculated t-statistics is 10.675, degrees of freedom are 198, significant level is 0.000, mean difference is 5.040, and standard error difference is 0.472. The 95% confidence interval for the mean difference ranges from 4.10897 (lower bound) to 5.97103 (upper bound). In CRSMTF, calculated t-statistics is 10.675, degrees of freedom are 194.829, significant level is 0.000, mean difference is 5.040, and standard error difference is 0.472. The 95% confidence interval for the mean difference ranges from 4.10887 (lower bound) to 5.97113 (upper bound). Based on the t-test result there is a significant difference in the means between CRSMC and CRSMTF. The positive mean difference showed that

CRSMC has a higher mean than CRSMTF. The p-value of 0.000 is less than 0.05, therefore, the hypothesis of no significant difference is rejected.

Discussions

The findings of the study showed that multiple-choice items are more effective in enhancing students' achievement in CRS at the Upper Basic level. This is in line with Nair and Feroze (2022) whose study revealed that multiple-choice items cannot only be considered an assessment tool but as a learning enhancer. Also, Lee (2022) noted that multiple-choice questions uphold efficiency and increase objectivity of student learning measurement. Although, multiple-choice tests may not be appropriate in all circumstances but Rodriguez (2005) noted that it is a mainstay of achievement testing. Multiple true-false items cannot be dismissed completely, as noted by Couch, Hubbard and Brassil (2019), MTF can enhance students' achievement by providing them with an opportunity to think critically and apply their knowledge to real world situations. However, to adequately cover the content domain to certify achievement proficiency by producing meaningful precise scores requires many high-quality items. Following the findings of this study, CRSMC were more effective in measuring UB students' achievement.

Conclusion

Based on the findings of this study, it was concluded that students' achievement in CRS, using multiple-choice tests format yielded more encouraging results than the CRSMTF. The outlined options of the CRSMC helped students to recall the correct answer. So, the CRSMC format can be used to measure UB students' achievement in CRS.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Teachers should be encouraged to use multiple-choice in classroom assessments of UB students' achievement.
2. Teachers should be taught how to write good multiple-choice that can enhance cognitive learning and thinking in the UB students.

References

Abonyi, O. S. (2011). Instrumentation in Behavioural Research: A Practical Approach. Enugu: Fulladu Publishing Company.

Anigbo, L.C. (2014). *Teacher's Handbook on Measurement and Evaluation*. Enugu: Executive Press Resources Limited.

Anyebe A (2018). Contribution of Christian Religious Education to National Unity in Nigeria. *EPRA International Journal of Economic and Business Review* 6 (6) 26-28. www.eprawisdom.com

Adom, D., Menser, J.A., & Dake, D.A. (2020). Test, measurement and Evaluation: Understanding and use of the Concepts in Education. *International Journal of Evaluation and Research in Education (IJERE)*, 9 (1) 109-119.

Budiyino, B. (2018). Multiple Choice Questions (MCQs) vs. Short Answer Questions (SAQs) for Inferential Comprehension. *Journal of English Teaching and Research,* 3 (2), 2503 – 4405

Brassil, C.E., & Couch, B. C. (2019). Multiple-true-false questions reveal more thoroughly the complexity of students' thinking than multiple-choice questions: a Bayelsian item response model comparison. International Journal of STEM Education, 6(16). https://doi.org/10.1186/s40594-019-0169-0

Couch, B. C., Hubbard, J.K., & Brassil, C.E. (2018). Multiple–True–False Questions Reveal the Limits of the Multiple–Choice Format for Detecting Students with Incomplete Understandings. *BioScience*, Volume 68, Issue 6, June 2018, Pages 455–463, https://doi.org/10.1093/biosci/biy037

Dehnad, A., Nasser, H., & Hosseini, A.F. (2014). Comparison between Three- and Four-Option Multiple Choice Questions. *Science Direct* 98, 398-403. https://www.sciencedirect.com

Eluu, P.E. (2016). The Role of Religion in Value Education in Nigeria. *British Journal of Education*, 4 (9) 64-69. http://www.eajournals.org

Eluu, P.E., & Ikwumelu, S.N. (2014). Effective Teaching of Christian Religious Knowledge

at the Senior Secondary School Level for Curbing Insurgency in Nigeria: Some Impediments. *The Intuition*, 6 (1) 1-8. https://www.globalacademicgroup.com

Eluu, P.E. & Ikumelu, S.N. (2019). Effective Teaching of Christian Religious Knowledge at the senior Secondary School Level for Curbing Insurgency in Nigeria: Some Impediments. *IOSR Journal of Humanities and Social Science* (IOSR-JHSS), 24 (10), 55-58. www.iosrjournals.org

Lee, C. (2022). What is the history of multiple-choice exams? What is its impact on education? https://www.turnitin.com

Loudon, C. & Macias-Muñoz, M. (2018). Item statistics derived from three-option versions of multiple-choice questions are usually as robust as four- or five-option versions: implications for exam design. *Advances in Physiology Education*, 42 (4) 565-575. https://journals.physiology.org

McKenna, P. (2018). Multiple Choice Questions: Answering Correctly and Knowing the Answer. *International Conference e-Learning*. http://files.eric.ed.gov

Njoku N.C. and Njoku D.I., (2015). Challenges and Implementation of Christian religious Studies Curriculum: A Study of Secondary School Pupils in Ebonyi State of Nigeria. *Journal of Education and Practice*, 6 (18) 176 – 180. www.iiste.org

Ntama G.U, Owulu E.E. and Monity F.M (2016) Students' Variables and Academic Performance in Christian Religious Studies in Calabar Municipality, Nigeria in *International Journal of Social Science and Humanities Invention*, Vol 3. http://wwwvalleyinternational.net

Nair, G.G. and Feroze, M. (2022). Effectiveness of Multiple-choice Questions (MCQS) Discussion as a Learning Enhancer in Conventional Lecture Class of Undergraduate Medical Students. *Medical Journal of Dr. D.Y. Patil Vidyapeeth DOI:* 10.4103/mjdrdypu.mjdrdypu_192_22

Oji J.O. (2003). Educational measurement and Evaluation. Benin: Ayo-Mat Printers.

Post Primary Education Board (2022), Asaba, Delta State

Rodriguez, M.C. (2005). Three Options Are Optimal for Multiple-Choice Items: A Meta-Analysis of 80 Years of Research. https://www.highpoint.edu

Shin, J., Guo, Q., & Griel, M.J. (2019). Multiple-Choice Item Distractor Development Using Topic Modeling Approaches. https://www.frontiersin.org

West African Examination Council (2021), *Chief Examiner's Report BECE 2021*

West African Examination Council (2018-2020), *Chief Examiner's Report, Lagos - WAEC*

Weimer, M. (2018). Multiple-Choice Tests: Revisiting the Pros and Cons. https://www.facultyfocus.com

IMPACT OF POST-MODERN INSTRUCTIONAL DESIGN ON STUDENTS' ACADEMIC ACHIEVEMENT IN ENGLISH LANGUAGE IN SECONDARY SCHOOLS

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Abstract
The study sought to investigate the impact of post-modern instructional design on students' academic achievement in English language in secondary schools in isi-uzo local government area of Enugu state. Two research questions and two hypotheses guided the study. The researcher adopted a non-equivalent quasi-experimental design. The population for the study was all the 5,195 SS 2 students in Enugu Education zone of Enugu State. A sample of two hundred and fifty four (254) SS 2 students was drawn from the three secondary schools used; one intact class was then sampled using simple random sampling technique. One intact class was assigned to the Experimental Group I taught using post-modern instructional design delivery method and the other intact class was assigned to the group II taught using conventional methods of teaching. Relevant data for the study were collected using English Language Achievement Test (ELAT). The instrument was face validated. The reliability of the instrument was determined using Kuder Richardson 20 which was 0.87. Research question was answered using mean and standard deviations while hypothesis was tested using Analysis of Covariance (ANCOVA). It was found that the use of post modern instructional design methods in teaching English language was found to be better than teaching English language without instructional. Based on the findings the researcher recommended among others that teachers adopt the post modern instructional design system during teaching.

Keywords: *Impact, Post-modern, Instructional design, Students' academic achievement, English language, Secondary School.*

Introduction

The certification system have raised the status of English language in Nigeria to a very enviable height. This is because knowledge and understanding of languages are imperative to the achievement of any nation's transformation agenda especially in Nigeria, a developing country that has adopted English langauge as her lingua franca. This was what inspired and remained the brain-child of the education ordinance of 1882 which made English a compulsory subject in all Nigerian schools. It was made the main channel of instruction and a vehicle for the training of the much needed manpower required to run the fledging government services. Since then English language had continued to spread in the country mainly through the schools (Ebuoh, 2018). According to Anukam (2011), the far -reaching result was the total acceptance and implantation of English Language and its roles in the body politics of Nigeria. Ullyelle (2009) considers English language as a subject that encroached into all aspects of human endeavours and further described it as the life wire in the study of various disciplines. Furthermore, English language can be described as subject of study. Alternatively, English language is a system of communication in speech and writing.

Instructional design, and also instructional systems design (ISD), is not a totally new concept. Its origins can be found in numerous earlier efforts to improve instruction. It has even been suggested that its roots can be traced to the early Greek philosophers. Over the years, numerous experts in the fields of education and psychology have made significant contributions to the science of instructional design. Instructional designers today consider the work of E.L. Thorndike, who introduced his instructional strategies in 1913, as very valuable. Thereafter, in 1924, Bobbitt introduced his work on job analysis, and Tyler followed in 1942 with his work on objectives and criterion referenced testing (Brown & Green, 2016). During World War II, the US Military made extensive use of technological devices for training. During the 1960s, the focus turned to work on systematic application of behavioural psychology to the design of instruction

(e.g. Skinner) with particular emphasis on self-paced individual interaction

Deciding how to design and develop instruction often depends on the organizational setting in which the instructional design professional finds him- or herself. Organizations that have established traditions of delivering instruction may demand that certain forms be followed. For example, universities in North America and Europe traditionally require that, for each course offered, a syllabus be created beforehand and students receive evaluation in the form of letter grades (an evaluation strategy developed at Cambridge University in the early 1800s). University courses traditionally require weekly 3-hour meetings (or semiweekly 1.5-hour meetings). These requirements necessarily affect the way college professors design their instruction.

Today, most instructional design teams consist of a variety of specialists including artists, writers, subject-matter experts, programmers, project managers, assessment specialists, and evaluators (Gibbons, 2014; Green & Brown, 2002). At the same time, many teachers, human-resource specialists and media producers design and produce instruction on their own or in very small groups. The approach you take to designing instruction will of course depend heavily on your professional setting and available resources.

Solomon (2010) pointed out that post modernism is concurrently an historical epoch, an intellectual movement, and a general social condition. Postmodern approach to instructional design recognizes that the instructional designer must take four societal factors into account:

1. Society is past the point where there are a limited number of authorities available to a classroom student. The modern classroom had two authoritative sources: the teacher and the textbook. This situation no longer exists because students have access to many other sources, including the internet, television, and, in some cases, friends and family who are more educated than the teacher is.
2. No longer can there be an agreed-upon, single type of well-educated individual. Determining a curriculum and including all important artistic and scientific works that would be appropriate for all individuals is impossible.
3. The currently popular cognitive paradigm—constructivism—does not recognize or advocate a traditional, linear educational sequence. With information available from a variety of sources outside the classroom, learners will inevitably deviate from a linear instructional model by observing and reacting to other examples, non-examples, and divergent examples of the concepts they study in school.
4. No single, objective truth exists. Truth is a construct that is based on an individual's personal interpretation or on the consensus of a group of people for their purposes.

The truth – also known as "the right answer"—may change depending on the context and the individuals involved. It can easily lead them to take an eclectic approach, picking and choosing the better aspects of any number of design procedures and recommended practices. An eclectic approach allows the designer to choose specific elements from a variety of sources. This approach can be viewed both as "taking the best there is to offer" and "taking things out of context." It is easy to see why this approach might make scholars of instructional design uncomfortable; if not carefully considered, articulated, and evaluated, the linking science that so many worked to create might be seen as changing to a less rigorous, less scientifically sound activity.

However, just as some well-established, dedicated educators were dismayed at the advent of a science of instructional design at the end of the 19th century, some well-established, dedicated instructional designers are dismayed at the advent of a change in the science of instructional design at the beginning of the 21st century. A heightened awareness of the greater complexity of systems and the new, increasingly ubiquitous, computer-based media production tools have created a situation in which instructional designers must adapt their views and practices.

The federal republic of Nigeria (2013) states that the broad goals of secondary education is to prepare

individuals for "useful living" within the society. The curriculum designed for senior secondary schools is comprehensive and broad based, aimed at broading students' knowledge. The central purpose of teaching English language at all level of education is to bring about a positive outcome in the educational behavior of the learner. Despite the importance placed on the study of English language by the education system, researchers and English language teachers have observed a wave of almost total dislike for the subject among secondary school students. Possible explanation could be that the subject is generally assumed erroneously to be too abstract and far too removed from practical life. This observation isn't surprising at all considering the poor manner in which English is presented to students in the classroom.

Achievement in English language has worried scholars in the field of English language. WAEC (2017) report on students' performance reveals a decline in English language achievement.

The achievement of students in English languages is closely related to the use of instructional materials and technologies. For instance, Mcluhan and Flore (2009) pointed out that no real education may take place without appropriate instructional materials. Consequently, the present work investigated the level of students' achievement when post-modern designed instruction are used in the teaching of English-language students in Secondary Schools in Isi-uzo Local Government Area.

According to Blair (2009) to achieve is to accomplish, gain, reach by effort or do something successfully with an effort and skill. Love (2013) asserted that academic achievement concerns mental health. He explained that mental health has its basis, physical health and intellectual skills, which lead to satisfactory means of adjustment, social sensitivity and adequate self-concept.

The outcomes of the Nigeria secondary school student examination in English language have been consistently poor. For instance, in May/June 2015, Senior Secondary School certificate Examination in Enugu Education zone student continued to record low achievement and retention which may have resulted to poor academic achievement in the subject (WAEC, 2017). On the instructional side, the pace of adoption and use of various instructional materials and technologies in schools and institutions is considerably slower (Muhammad, 2019). It appears that in Nigeria, teachers are more conversant with teaching without systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction which is regarded as (conventional) traditional method of teaching. This unfortunate situation of failing to perform analysis of learning needs and goals of the study to help them develop a delivery system to meet those needs has contributed to the students dwindling performance in English language examinations as observed by researchers and English language teachers. Thus, the research sought to investigate if the use of the conventional method of teaching is better than the use of post-modern approaches to design instructions or teaching process in achieving higher performance in English language in senior secondary schools?

The purpose of the study was to find out the impact of post-modern approaches to instructional design on students' academic achievement in English language in secondary schools in isi-uzo local government area of Enugu state. The objective of the study is to find out:

1. The mean achievement scores of students taught English Language using post-modern designed instruction and those taught without any instructional design (conventional methods).
2. The mean achievement scores of male and female students taught English Language using post-modern designed instruction

The scope of the study was to find out the impact of post-modern approaches to instructional design on students' academic achievement in English language in secondary schools in isi-uzo local government area of Enugu state. It was to find out the level of difference in the mean achievement scores of students taught using post-modern instructional delivery method in teaching English language.

The following research questions guided the study:

a. What is the difference in the mean achievement scores of students taught English Language using post-modern designed instruction and those taught without any instructional design (conventional methods)?
b. What is the mean achievement scores of male and female students taught English Language using post-modern designed instruction?

The following hypotheses guided the study:

1. There is no significant difference in the mean achievement scores of students taught English language using post-modern designed instruction and those taught without post-modern designed instruction?
2. There is no significant difference in the mean achievement scores of male and male students taught English language using post-modern designed instruction.

Methods

The design for this study is quasi-experimental. The design is specifically a pretest post-test, non equivalent group design. The choice of this design agreed with Blair (2009) and Abimbade in Okafor (2000) who observed that this design was often used in classroom experiments when experimental and non-control groups are naturally assembled groups, such as intact classes, which may be similar in the level of education. This study was carried out in Isi-uzo LGA of Enugu State, which is mainly a rural area with few semi-urban areas. The rural areas are mainly occupied by isi-uzo indigenous and few non-indigenous persons - Most of them are farmers, a good number are pretty traders while few are civil servants. The choice of this area is because of logistical convenience and the researcher saw the zone as thickly populated zone in terms of SS2 students.

The populations considered of all the twelve (12) secondary schools in isi-uzo local government area. The population was 5,195. (PPSMB, 2018).

Stratified simple random sampling was used to draw three schools from the twelve secondary schools in isi-uzo LGA Local Government Area. In each of the sampled schools, purposive sample, simple random sampling was used to pick three intact classes of SS2 in each school.

Two intact classes were randomly assigned to the experimental group I and II. A total of one hundred and twenty seven (127) students were used for experimental group while one hundred and twenty five (127) were used as control giving a grand total of two hundred and fifty-four (254) SS 2 students that was used as research subjects in the study.

English language Achievement Test (ELAT) developed by the researcher was used for data collection which consisted of forty seven objective test items. The choice of objective test items was to allow the researcher to cover more topic areas. Thirty seven objectives test items were at the lower cognitive level (that is knowledge and comprehension) while 10 items were in higher thinking process (that is application). The instrument was used for pretest and posttest. The items for the ELAT were written to reflect the specification in test blue print prepared. The scoring guide for the ELAT was prepared in order to guide the teachers that scored the ELAT.

The instrument went through both face and content validity. The items of ELAT and experimental packages were subjected to face validation by one expert in English language education, one expert in educational technology and one expert in Measurement and Evaluation. The instrument and experimental packages were validated in terms of clarity, appropriateness of the language used and also if any item is ambiguous. Their corrections and comments were useful in modifying the items of the tests and experimental packages. The surviving items, therefore, possessed adequate face validity of the instrument for data collection. The English Achievement Test after scoring guide was also "face" validated by the experts that validated the same English language Achievement Test. Forty-six questions survived out of sixty questions after validation.

The reliability of ELAT was determined using test re-test method. The choice is because it is most suitable and appropriate in determining the correlation between sets of scores from two administration of the test. To determine the reliability of ELAT for the study, the ELAT was trial tested in community secondary school Amandim Olo in Ezeagu LGA of

Enugu State. Then the sets of scores from the test administration of ELAT were correlated using Pearson Product moment correlation coefficient (γ) and is 0.86. The measure of internal consistency was determined using Kuder Richardson 20. (K-20). The value of Kuder Richardson value was 0.868. The choice of Kuder Richardson's 20 was the most appropriate because the items were dichotomously scored.

Three English Language teacher (research Assistants) from each of the sampled schools received briefing for a period of one week from the researchers on the use of simulations and teaching without simulations in teaching English Language respectively. Prior to the treatment, the English language teachers / research Assistants in the sampled schools who received briefing on how to use the research instrument administered the ELAT respectively to their SS2 students. At the end of the testing, the question papers and the answer script were collected from each student who took the pretest. There were some extraneous or confounding variable that the researcher felt could constitute potential threats to the validity, reliability and generalization of the results of the study. Such variable included inter-group variable, teacher variables and Hawthorne effect. ELAT was administered as pretest on the first week of treatment by research assistants. Scores of the students on the pretest were recorded and kept for the use after the experiment. The post test data were also generated after re-administration of ELAT to the students on the last week of treatment. For each for the groups, data for pretests and post tests were recorded separately. The test item on ELAT was scored two marks each to give a maximum mark of one hundred percent.

Mean ($\overline{x}$) and standard deviation were used in answering the research questions. Mean was used because it is the most appropriate statistical tool to use for such situation because such takes all measurement (observations) into consideration. Analysis on covariance was used to test the hypothesis. Analysis of covariance (ANCOVA) was used because intact classes were used and as such corrected the errors of initial differences in the ability levels among the students used in the study. Rejected the null hypothesis (Ho) if the F-calculated is greater than F-table at 0.05, then fall to reject the null hypothesis at 0.05 if F-calculated is less than F-table.

Results

Research question 1

What is the difference in the mean achievement scores of students taught English Language using post-modern designed instruction and those taught without any instructional design (conventional methods)?

Table 1: Mean achievement scores of students taught English Language using post-modern designed instruction and those taught without any instructional design

	Mean (X)		Standard Deviation		N
Groups	Pretest	Posttest	Pretest	Posttest	
Experimental Group 1: (taught using post-modern designed instruction)	29.18	56.69	11.69	10.25	127
Group 2: (conventional group)	24.67	29.93	9.54	11.74	127
Total					254

Table 1 above showed that the experimental group 1 taught English language using post-modern designed instruction obtained mean achievement scores of 29.18 and 56.69 in pretest and posttest respectively. The group 1 equally had standard deviation of 11.69 and 10.25 in pretest and posttest respectively. Alternatively, the Group 2 taught English Language using conventional method got mean achievement scores of 24.67 and 29.93 in pretest and posttest respectively. The group also had standard deviation of 9.54 and 11.74 in pretest and posttest respectively. Table 2 therefore showed that the experimental

Group 1 taught English Language using post-modern designed instruction achieved higher than those taught English Language without using any instruction designed.

Research question 2

What is the mean achievement scores of male and female students taught English Language using post-modern designed instruction?

Table 2: Mean achievement scores of male and female students taught English Language using post-modern designed instruction

	Mean (X)		Standard Deviation		N
Groups	Pretest	Posttest	Pretest	Posttest	
Male	28.85	56.04	12.33	9.94	53
Female	29.42	57.15	11.28	10.51	74
Total					127

Table 2 above showed that the male students taught using post-modern designed instruction obtained mean achievement scores of 28.85 and 56.04 and standard deviation of 12.33 and 9.94 in pretest and post-test respectively. The females obtained pretest and posttest scores of 29.42 and 57.15 and standard deviation score of 11.28 and 10.51 respectively.

Hypothesis

1. There is no significant difference in the mean achievement scores of students taught English language using post-modern designed instruction and those taught without post-modern designed instruction.

Table 3: Analysis of Covariance of mean achievement scores of students taught English Language using post-modern designed instruction and those taught without post-modern designed instruction.

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	47984.436[a]	2	23992.218	214.259	.000
Intercept	42746.897	1	42746.897	381.744	.000
Pretest	2514.112	1	2514.112	22.452	.000
Group	39274.142	1	39274.142	350.731	.000
Error	28106.436	251	111.978		
Total	552507.803	254			
Corrected Total	76090.873	253			

a. R Squared = .631 (Adjusted R Squared = .628)

It was discovered from the result of Analysis of Covariance (ANCOVA) in table 3 that the p-value obtained is 0.000 which is less than 0.05 which is a significant value. This implies that, the null hypothesis of no significant difference in the mean achievement scores of students taught English language with using post-modern designed instruction and conventional was rejected at 0.05 level of significance. This means that there was a significant difference in the mean achievement scores of student taught English language using using post-modern designed instruction and those taught with conventional method in favour of those taught using post-modern designed instruction.

2. There is no significant difference in the mean achievement scores of male and male students taught English language using post-modern designed instruction.

Table 4: Analysis of Covariance of mean achievement scores of male and female students taught English Language using post-modern designed instruction

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	48383.558[a]	4	12095.889	108.703	.000
Intercept	42314.203	1	42314.203	380.269	.000
Pretest	2540.054	1	2540.054	22.827	.000
Group	38817.882	1	38817.882	348.848	.000
Gender	299.111	1	299.111	2.688	.102
Group * Gender	96.117	1	96.117	.864	.354
Error	27707.315	249	111.274		
Total	552507.803	254			
Corrected Total	76090.873	253			

a. R Squared = .636 (Adjusted R Squared = .630)

The result of Analysis of Covariance (ANCOVA) in table 4 shows that the p-value obtained when the effect of gender on the posttest scores were tested is 0.102 which is greater 0.05. Furthermore, when the interaction between Group and gender was tested, a non-significant p value (0.354) was also obtained. This implies that there's no significant difference in the mean achievement scores of male and female students taught English language using postmodern designed instruction. Therefore, the null hypothesis of no significant difference in the mean achievement scores of male and female students taught English language with using post-modern designed instruction and conventional was rejected was not rejected at 0.05 level of significance.

Discussions

The result showed that the experimental group 1 taught English language using post-modern designed instruction did better than those taught without. Furthermore, the females had slightly higher mean scores than the males in the pretest and posttest.

The result of the hypothesis revealed that there was a significant difference in the mean achievement scores of students taught with using post-modern designed instruction and those taught using without designed instruction (conventional methods) in favour of the use of using post-modern designed instruction. In addition, there was no significant difference in the mean achievement scores of male and female students taught English language using postmodern designed instruction. Thus, this shows that students gender didn't affect their performance in the test. The result of the study is in agreement with the findings of Andrews and Goodson (2008) who found out that instructional design promote learning by improving evaluation processes (including learner performance), test and build learning or instructional theory by means of theory-based design within a systematic instructional model.

The better achievement observed with the use of post-modern designed instruction is the linking of science that applies logic and scientific methods to the problems involved in designing and developing instruction. This helps simplify abstract content, allows for differences from individuals and allows for coordination of diverse representation with a different perspective. Thus, there's no doubt that properly designed instruction using the post-modern approach about improvement in teaching and learning.

Conclusions

There was a significant difference in the mean achievement scores of students taught with post-modern designed instruction and those taught without any instructional design (conventional methods) in favor of the use of post-modern instructional design.

Recommendations

The following recommendations were made based on the findings of the study.

1. Periodic workshops and sensitization through seminars and workshops should be organized to educate and remind teachers the importance and ways to adequately design instructions.
2. English language teachers should ensure that instructional materials should adequately pass through instructional design processes before teaching English lessons.
3. Principals should enforce the use of only adequately designed instructions in teaching English language.

References

Andrews, D. and Goodson. A. (2008). Comparative Analysis of Models of Instructional Design. *Journal of Instructional Development*, 3 (4) 2-16.

Anukam, L. L. (2011). Assessment of learning achievement. *Abuja: Federal Ministry of Education.*

Blair, G. M. (2009) *Educational psychology,* New York Macmillian

Ebuoh, M. M. (2018). Effects of flat pictures and models on students' academic achievement and retention in English language in secondary schools in Enugu Education zone. *Unpublished thesis*

FGN-NPE, (2013). *Federal Government of Nigeria, Policy of Education (2006- 2013)* Federal Ministry of Education Abuja.

Gibbons, A. (2014). Eight views of instructional design and what they should mean to instructional designers. In B.Hokanson & A. Gibbons (Eds.), *Design in educational technology: Design thinking, design process, and the design studio*. Cham, Switzerland: Springer International Publishing.

Green, T., & Brown, A. (2002). *Multimedia projects in the classroom: A guide to development and evaluation.* Thousand Oaks, CA: Corwin Press.

Green, T., & Brown, A. (2016). Instructional Design: Connecting fundamental principles with process and practice. *3rd Edition.* Taylor and Francis. New York.

Hlynka, D. (2004). Postmodernism in educational technology: Update 1996–present. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology* (2nd ed.) (pp. 243–246). Mahwah, NJ: Lawrence Erlbaum Associates

Love, B. S. (2013) *Innovation in teaching learning process.* India: Vikal publishing House.

Mcluhan, M & Flore O, (2009): *Mediums the message*. New York: Bantham Books Inc

Muhammad A. (2019). Utilization of close circuit television in teacher education programme in Nigeria; opportunities for microteaching, laboratory surveillance and instruction. *ADECT 2019 proceedings*

Okafor G. (2000). Effect of note-taking patterns on students' academic achievement, interest and retention in geography. *Published Thesis science and computer department, University of Nigeria Nsukka*

Solomon, D. L. (2010). Toward a post-modern agenda in instructional technology. In *Annual Proceedings of Selected Research and Development Papers Presented at the National Convention of the Association for Educational Communications and Technology* (pp. 415–428). Bloomington, IN: AECT.

Ullyelle, U. A. (2009). Historical view of the English Language. *Ibadan:* Potan Press

West African Examination Council (2017). *Chief examiners report in English language.*

PROBLEMS ASSOCIATED WITH POOR PERFORMANCE IN ALGEBRA AMONG SECONDARY SCHOOL STUDENTS IN ENUGU NORTH LOCAL GOVERNMENT AREA OF ENUGU STATE

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Abstract
This study investigated problems associated with poor performance in algebra among senior secondary school students in Enugu North Local Government Area of Enugu State. The research design used for this study was a survey research design. The instrument used for data collection was structured questionnaire. The instrument was face validated by two experts in mathematics education and one in measurement and evaluation. The reliability of the instrument was established using test-retest method which yielded reliability estimate of .8. A sample of 200 SSS2 students, drawn by simple random sampling technique, was used for the study. The data for the research questions were answered descriptively using mean and standard deviation and the research hypotheses were answered using the t-test statistics. The findings of the study revealed that there is insufficient time allotment to the teaching of algebra. It was recommended to government to train and retrain teachers on the use of instructional materials to teach algebra when they are available in schools.

Keywords: *poor performance, algebra, mathematics*

Introduction

Mathematics was defined as a science that studies and explains numbers, quantities, measurement and relationship between them. Onwuka (2016) defined mathematics as the study of numbers and measurement of properties and relationship of quantities. According to Eze (2010), mathematics is the study of size, numbers and patterns. Based on these definitions, it appears to suggest that mathematics is indispensable in human endeavours.

Mathematics education is a key to increase post-school and citizenship of young people. According to Okafor (2014), it is clear that mathematics, science and technology have become part and parcel of the world's culture, and every person and nation now want to use them maximally for adequate development and improvement of the society. Mathematics has a key role to play in job creation, wealth generation, poverty alleviation, economics and finance, management, business and enterprise, information technology, agriculture and natural resources which are the core components (Perry, 2004).

Despite the fact that the subject is important, students are performing poorly in it. For instance, evidence from WAEC and NECO Chief Examiners reports (2018) indicated that all is not well in the teaching and learning process in mathematics. Poor performance of students in mathematics is on the rise. On an average scale, more than 40% of students who sat for mathematics in the senior secondary school examination failed. Poor performance as recorded by WAEC is also collaborated by the result from

National Examination Council (NECO). These reports show that students are finding mathematics difficult.

Among areas of mathematics identified to be difficult to students and in which they performed poorly include algebra. For instance, Fakuade (2001) noted lack of qualified mathematics teachers as one of the factors responsible for students' dismal performance in senior secondary school mathematics in Nigeria. Fakuade (2001) suggests that mathematics teachers have important roles to play towards their students. More so, Olarewaju (2010) concluded that lack of competent and dedicated mathematics teachers are responsible for failure of students in mathematics in Nigeria secondary schools. Eze (2000) and Obikwere (2008) reported that the poor performance in mathematics by students was due to the teaching methods and time allotment to the teaching of the subject by teachers rather than difficult nature of the subject. Eze (2014) reported that time allotted to the teaching of mathematics constitute a problem to the poor performance in mathematics among students. Lack of time allocated to mathematics teaching makes it difficult for teachers to build games, simulations and effective use of mathematics laboratory in teaching mathematics, especially algebra aspect. Obviously, these factors may have a link to the problems associated with poor performance of students in mathematics particularly on algebra aspect.

Algebra is a branch of mathematics that uses mathematical statements to describe relationships between things that vary. These variables include things like the relationship between the supply of an object and its price. When we use a mathematical statement to describe a relationship, we often use letters to represent the quantity that varies since it is not fixed amount (Prescott, 2001). According to Usman and Musa (2015), algebra is an aspect of mathematics which involves the use of letters and numbers. When combined with figures bring a lot of confusion to the students. More so, with the letters changing values or one letter replacing another letter at intervals. This notion may contribute to students' poor performance in algebra and mathematics generally. Although, algebra is considered as one of the most important aspect of school mathematics; it does not only play an important role in mathematics but functions as a gatekeeper to future educational and employment opportunities (Silver, 1997). For students to understand and possess the mathematical skills of problem-solving, communication, reasoning and making connections that are necessary in human daily living, they need algebra. This is so because, algebra is the language through which most of the mathematics is communicated (Iji, Abakpa & Takon, 2015). Ebras in Jegede (2002) opined that without algebra advancement into most aspects of mathematics, the study of other disciplines requiring mathematical abstraction and modeling will suffer loss of relevance. Thus, knowledge of algebraic concepts and skills are considered as providing a foundation for developing higher order thinking as well as providing needed problem-solving skills, seriously needed in today's technological development era and Information and Communication Technology compliance.

Despite the above aforementioned importance of algebra, performance of students on it has been observed to be poor. Rainic (2001) and Aguele (2004) indicated that the general performance of students in algebra have been observed to be poor. Similar report was made by some other eminent scholars (Agwagah, 2000, Ekele, 2000 & Kurume, 2004), who all noted that students' performance in algebra is not encouraging. This situation cannot be allowed to continue escalating without proper check.

It becomes pertinent therefore to conduct this study to investigate the problems associated with poor performance in algebra among senior secondary school students.

The main purpose of the study is to find out the problems associated with poor performance in algebra among secondary school students. Specifically, the study is aimed at inverting:

1. Time allotment problems associated with the poor performance of students in the subject.
2. Teachers' methods of teaching problems associated with the poor performance of students in algebra.

The study was guided by two research questions. They are as follows:

1. What are the time allotment problems associated with the poor performance of students in the subject?
2. What are the teachers' methods of teaching problems associated with the poor performance of students in algebra?

These hypotheses were formulated by the researchers to guide the study:

1. There is no significant difference between the mean ratings of male and female students with respect to time allotment problems associated with the poor performance of students in the subject.
2. There is no significant difference between the mean ratings of male and female students with respect to teachers' methods of teaching problems associated with the poor performance of students in algebra.

Method

The survey research design was adopted in the study. The study was carried out in Enugu North Local Government Area of Enugu State. The population for the study consisted of 6,798 students of senior secondary school II in the zone. A sample of 200 students of senior secondary school II (SSS 2) were gotten through simple random sampling technique (balloting). Instrument used for data collection was a structured questionnaire on the problems associated with poor performance in algebra among secondary school students. It was organized into two sections (A and B). The instrument was a four-point scale type with options: Strongly Agree (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagree (SD) = 1 point.

The research instrument was validated by three research experts, one of whom was a specialist in measurement and evaluation and the other two specialists in mathematics education. The reliability of the instrument was established using Cronbach Alpha statistical method. The choice of using Cronbach Alpha (α) was to determine the internal consistency of the instrument and the reliability coefficients (r) of 0.79, 0.88 and 0.82 were obtained for the three clusters of the instrument. Consequently, the overall reliability coefficient of 0.81 was obtained for the instrument. This reliability coefficient is considered adequate for the internal consistency of the instrument. Data obtained from research questions were analyzed using mean and standard deviation. A cut-off point of 2.50 which is the mean of the weight given to the response options was used for determining how far the response options were covered by the items. Items whose mean is 2.5 or more was accepted while items with mean less than 2.50 was tagged disagree. The hypotheses were tested with t-test statistics at 0.05 probability level of significance.

Results

The results were presented in tables according to the research questions and hypotheses that guided the study.

Research Question 1

How far does time allotted to the learning of algebra constitute students' performance in learning of algebra?

TABLE 1: Mean ratings and standard deviations of how far time allotted to the learning of algebra constitute students' performance in learning of algebra.

N= 200

SN	ITEM	SA = 4	A = 3	D = 2	SD = 1	MEAN	SD	DEC
1	Number of periods assigned to teach algebra in a week is insufficient to cover the content, thereby making it difficult for teachers to build in practical activities in algebraic instruction. Algebra is usually taught in the afternoon hours rather than in the morning hours.	72	66	32	30	2.90	1.12	Accept
2	When algebra is taught in the afternoon hours in hot weather, I do not concentrate.	75	63	41	21	2.99	1.11	Accept
3	Time allotted to teaching of algebra in a period is not enough to cover the content, thereby giving no room for teachers to make effective use of mathematics laboratory.	66	64	42	28	2.84	1.14	Accept
4	GRAND MEAN	71	69	33	27	2.92	1.06	Accept
						2.91	**1.10**	**Accept**

From the above table, the students agreed that number of periods assigned to teach algebra in a week is insufficient to cover the content, thereby making it difficult for teachers to build on practical activities in algebraic instruction with a mean score 2.90. They agreed that algebra is usually taught in the afternoon hours rather than in the morning hours with the mean score of 2.99. More so, they agreed that when algebra is taught in the afternoon hours when the weather is hot, they do not concentrate in learning it with a mean score of 2.84. They agreed that time allotted to teaching of algebra in a period/lesson is not enough to cover the content, thereby giving no room for teachers to make effective use of mathematics laboratory with a mean score of 2.92. The total or grand mean score is 2.91. The grand mean of 2.91 clearly indicated general agreement of the respondents across the five items on the table 3 above. The table also showed that the standard deviation in all the items are low, signifying that the respondents' scores are closely clustered around the mean.

Research Question 2

How far does the teacher's method of teaching algebra affect students' poor performance in learning algebra?

TABLE 2: Mean Ratings and standard deviations of responses on how teacher's methods of teaching algebra affect students' poor performance in learning algebra.

N= 200

SN	ITEM	SA = 4	A = 3	D = 2	SD = 1	MEAN	SD	DEC
5	The teacher is impatient to carry students along in teaching algebra, thereby making it difficult for students to understand mathematics.	81	63	36	20	3.03	0.99	Accept
6	The teacher does not explain algebraic concepts very well while solving problems in algebra, thereby frustrating students in learning the subject.	74	60	34	32	2.88	1.08	Accept
7	The teacher is fast when teaching algebra, thereby making students lose interest.	67	63	36	34	2.82	1.08	Accept
8	Teacher's demonstration in teaching algebra is poor.	65	67	35	33	2.82	1.06	Accept
9	Teacher does not use instructional materials in teaching algebra.	62	69	37	32	2.81	1.05	Accept
10	Teacher does not attend to students' questions during algebra class.	31	35	78	56	2.21	1.02	Reject
11	Teacher's voice is not loud enough for all students to hear him/her.	62	66	42	30	2.80	1.04	Accept
12	Teachers do not make use of mathematics laboratory in teaching algebra.	73	67	42	18	2.98	0.97	Accept
	GRAND MEAN					**2.79**		**Accept**

From the above table, the students agreed that the teacher is impatient to carry students along teaching algebra, thereby making it difficult for students to understand mathematics with a mean score of 3.03. They agreed that the teacher does not explain algebraic concepts very well while solving problems in algebra, thereby frustrating students in learning the subject with the mean score of 2.88. They agreed that the teacher is fast when teaching algebra, thereby making the students loose interest on the subject with a mean score of 2.82. They agreed that teacher's demonstration in teaching algebra is poor with a mean score of 2.8. They equally agreed that teacher do not use instructional materials in teaching algebra with mean score of 2.81. They disagreed that teacher does not attend student's questions during algebra class with a mean score of 2.21. They agreed that teacher's voice is not loud enough for all students to hear him/her with mean score of 2.80 while the students also agreed that teachers do not make effective use of mathematics laboratory in teaching algebra with a mean score of 2.98. The grand mean of 2.79 clearly indicated general agreement of the respondents across seven items while they disagreed on one item on table

2 above. Also, the standard deviation in all the items are low, indicating that the respondents' scores are closely clustered around the mean.

Hypothesis one

There is no significant difference between the mean ratings of male and female students with respect to time allotment problems associated with the poor performance of students in the subject.

Table 3: The mean ratings of male and female students with respect to time allotment problems associated with the poor performance of students in algebra.

Groups	N	mean	std. deviation	t-cal	t-crit	df	dec.
Male	93	55.0	21.8	3.694	1.658	118	s
Female	107	40.0	22.7				

The result in table 3 showed that t-calculated (3.694) is greater than t-critical (1.658). Therefore, the hypothesis is rejected based on the result. Hence, there is a significant difference between the mean ratings of male and female students with respect to time allotment problems associated with the poor performance of students in the subject.

Table 4: The mean ratings of male and female students with respect to teachers' methods of teaching problems associated with the poor performance of students in algebra.

Groups	N	mean	std. deviation	t-cal	t-crit	df	dec.
Male	93	53.20	20.7	3.042	1.776	118	s
Female	107	42.34	22.4				

The result in table 3 showed that t-calculated (3.042) is greater than t-critical (1.776). Therefore, the hypothesis is rejected based on the result. Hence, there is a significant difference between the mean ratings of male and female students with respect to teachers' methods of teaching problems associated with the poor performance of students in algebra

Discussion of Findings

The findings of Research Question 1 shows that the respondents agreed that the number of periods assigned to teach algebra in a week is insufficient to cover the content. Also, the respondents made mention of not concentrating when algebra is being taught in the afternoon hours. The findings show that the time allotted to the teaching of algebra is insufficient as shown with the grand mean of 2.91.

Based on the result of Research Question 2, the teacher's methods of teaching algebra have not improved the performance of students in learning algebra with the grand mean of 2.79. Additionally, the hypothetical analyses revealed that significant difference exists in the mean ratings of male and female students with respect to time allotment problems associated with the poor performance of students in algebra and teachers' methods of teaching problems associated with the poor performance of students in algebra. These findings equally supports the opinion of Eze (2014), Rainic (2001) and Aguele (2004) who posited that the time allotted to algebra and mathematics in general is very poor, and the teacher's method of teaching has not been improved upon, hence, the poor performance of students in algebra.

Conclusion

From the findings of the study, the researcher concluded that the problems associated with poor performance in algebra among senior secondary school students include: there are the time allotted to the teaching of algebra and the teacher's methods of teaching algebra. The researcher therefore concludes that the above mentioned problems are associated with poor performance in algebra among senior secondary school students.

Recommendations

Recommendations were made based on the findings of the study as follows:

1. The time allotted to the teaching of algebra should be increased to enable teachers have enough time to cover the whole content.
2. Teachers should adopt methods that are effective for teaching algebra.

References

Aguele, G. (2004). Perspectives on the design and development of school mathematics curricula. Lagos state: national council of teachers of mathematics.

Agwagah, O. (2000). The case of connected mathematics: perspectives on the design and development of school mathematics curricula, Lagos: university press.

Ekele, D. (2002). Teaching mathematics with a new curriculum: changes to classroom organization and interactions. Mathematical thinking and learning, 4(10); 163-195.

Eze, K. (2010). Descriptions of two novices' secondary teachers' planning. Curriculum inquiry, 23(1), 63-84.

Eze, N. (2014). Performance standards of students of secondary schools in Nigeria: charting a course for academic excellence. Journal of mathematics, 1(20); 101-110.

Eze, P. (2000). Similarities and differences in the types of algebraic activities in two classes taught by the same teacher. Teachers college record, 2(4); 4-6.

Fakuade, O. (2001). National indicators of quantitative literacy. In L. Steen (Ed.), why numbers count: quantitative literacy for tomorrow, 1(4); 45-59.

Iheanacho, A. I. (2009). The use of instructional materials in teaching secondary school mathematics. Educational studies in mathematics, 5(2) 78-94.

Iji, O., Abakpa, H. and Takon, J. (2015). Mathematics II frameworks, student edition, Enugu. Ovuories Publishers.

Jegede, O. J. (2002). Science, technology and mathematics education in Nigeria: A key note address of the 4th annual conference of the Nigeria Association for Science Education Research (NASER) held at University of Jos.

Kurume, P. (2004). Implementing mathematics reform; the challenge within. Educational Studies in mathematics, 4(2); 1-34.

Obikwere, O. (2008). The philosophy of mathematics education, Enugu: Abingdon publishers.

Okafor, I. (2014). The mathematical tale of two teachers: A longitudinal study relating mathematics instructional practices to level of intellectual development. Mathematics Education Research Journal, 18(1), 3-26.

Olarenwaju, M. (2010). Task design and analysis from an international perspective; Implications for studying mathematical proficiency for teaching. Educational Researcher, 2(6); 51-67.

Onwuka, J. (2016). Learning to teach hard mathematics: Do novice teachers and their instructors give up too easily? Journal for Research in Mathematics Education, 2(3); 194-222.

Perry, A. B. (2004). Decreasing mathematics anxiety in college students. College Student Journal, 38, 321-325.

Prescott, J. O. (2001). We love maths instructor, 110, 24-27, 72.

Rainic, D. (2001). Changing teachers, changing times: Teachers' work and culture in the postmodern age. London: Cassell.

Silver, H. (1997). Why numbers count: Quantitative literacy for tomorrow's learning, New York: College Entrance Publishers.

Usman, B. and Musa, C. (2015). Mathematics curriculum revision executive summary.

EFFECT OF DIVERGENT THINKING STRATEGY ON SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN ALGEBRAIC EQUATIONS IN AWGU EDUCATION ZONE OF ENUGU STATE

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Abstract
The study investigated the Effect of Divergent Thinking Strategy on Senior Secondary School Students' Achievement in Algebraic equations. The study was guided by two (2) research questions and three (3) research hypothesis. The design of this study was pretest-posttest non-equivalent group quasi-experimental design. The population for the study was one thousand, eight hundred and sixty-four (1864) Senior Secondary School One (SSS 1) students in the fifty-five (55) secondary schools, which comprised of thirty-nine (39) coeducational schools, nine (9) female schools and seven (7) male schools in Awgu Education Zone for 2022/2023 academic session. The sample size of the study was one hundred and eighty-six (186) Senior Secondary School One (SSS 1) students in the three (3) out of thirty-nine (39) coeducational secondary schools sampled in Awgu Education Zone. The instrument that was used for pretest and posttest was the Algebraic Equation Achievement Test (AEAT), which was validated, item analysis was done and founded to be reliable with KR 20 coefficient of 0.78. Mean ($\bar{x}$) and standard deviations (s) were used in answering the research questions while Analysis of Covariance (ANCOVA) was used in testing the research hypotheses at 0.05 Alpha levels. The researcher discovered that the students taught Algebraic Equations using Divergent Thinking Strategy achieved better than their counterparts taught Algebraic Equations using Expository method and the differences were statistically significant, the female students taught Algebraic Equations using Divergent Thinking Strategy achieved higher than their male counterparts and the differences were statistically significant and there were no significant interaction effect of method and gender on the achievement scores of SSS1 students in Algebraic Equation. The researcher recommended that States and Federal Governments should organize conferences and workshops for mathematics teachers and supervisors on the use of divergent thinking strategy in teaching algebraic equations.

Keywords*: divergent thinking strategy, achievement, algebraic equation, mathematics*

Introduction

Algebra is one of the broad areas of mathematics. Algebra is a branch of mathematics that deals with symbols and the rules for manipulating those symbols. Algebra is a branch of mathematics that deals with symbols and the rules for manipulating those symbols (Coolman, 2019). The symbols that represent quantities in elementary algebra without fixed values are known as variables. According to Aminu (2015), algebra is the bed rock of mathematics, which is an essential nutrient for thought, logic, reasoning and therefore, progress. Mashooque (2010) disclosed that algebra uses symbols, letters and signs for generalizing arithmetic which have different meanings and interpretations in different situations. The need for algebra increases because of technological advancement.

The knowledge gained in algebra brings solution in solving real life challenges. Skemp (2020) went

further to say that Algebra is currently playing a dominant role in Physics, Computer Science, Engineering, Economics and Chemistry. Ugwoke (2018) reported that the roles of Algebra to the material world are that Algebra develops individuals with skills in computation, manipulation, balancing and analyzing equations, logical reasoning, deductive thinking and problem solving with the aims of making the individuals to adapt and function effectively in the technologically dynamic world.

Algebra is wide in concept, forms, structure and applications. At the senior secondary schools, Algebra is divided into equations (simple, simultaneous and quadratic), set theory, inequality and variation with distinctive techniques for solving their problems. According to Demme (2018), Algebra aids a student to master statistics and calculus. In other words, Algebra helps one to master other branches of mathematics. Despite the importance of algebra, secondary schools students have not explored the resourcefulness of algebraic concepts, evident in their poor achievement in algebraic sections of mathematics examinations (Mashooque, 2010).

From the reports of Nduka (2016), Algebra and Geometry are the two branches of mathematics that the students have shown great dislike for at percentage rates of 63.27% and 71.17% respectively, and the students' achievement rates were 23.14 and 19.78 respectively. Recent research reports had showed that achievement in Mathematics has continued to be low and many scholars have continued to put the blame on the students' poor knowledge of Algebra (Nduka 2016). WAEC Chief Examiner's Report (2023) showed that candidates' weakness in algebraic expression and word problems among others that led to poor achievement of students towards the Mathematics.

Expository teaching method mostly used by mathematics teachers in Nigerian schools has been described by Mathematics scholars as an ineffective teaching method which has not given students enough opportunities to constructs their own learning and it is one of the causes of students' poor achievement in Algebra (Olutola, Ogunjimi, Daramola & Sheu, 2017; Al-Hassan, 2016; Udeinya & Okobiah, 2011). The use of Expository teaching method does not always enhance the understanding of Algebraic Equations. (Olutola, Ogunjimi, Daramola & Sheu, 2017). This calls for alternative teaching methods such as Divergent Thinking Strategy that can help to improve students' achievement in Algebraic Equations.

Student centered instructional methods are capable to improve students' intelligence and thinking creativity enhance students' achievement in Algebra. Teachers' teaching methods, skills and knowledge are the most important variables in the classroom that can enhance students' achievement in Algebra. Creative thinking according to Alsagosf (2012) is a mental process of analyzing and evaluating information to offer evidence and to form judgments about facts. Thus, Mathematics teachers have to teach in a way that creative thinking will be promoted. Divergent Thinking Strategy is a thought process or method used to generate creative ideas by exploring many possible solutions.

Divergent Thinking Strategy was discovered by an American Psychologist, Joy Paul Guilford in 1967 Guilford. It takes place in spontaneous, free flowing, and non – linear manner such that many ideas are generated in emergent cognitive manner. Many possible solutions are explored in a short amount of time and unexpected solutions drawn. Williams (2003) defined divergent thinking as the process of creating several unique solutions with intention to solve a problem. Thus, Divergent Thinking Strategy is the process of generating idea by exploring many possible solutions.

The students decide how to complete the assignments given by the teacher and what approach to take with them. Mathematics teachers use divergent thinking mostly in open-ended problems that creativity is a fundamental part (Sandless, 2013). Uzoechi (2014) classified divergent thinking into three skills such as fluency, flexibility and novelty while according to Guilford (1967), fluency, flexibility, originality, and elaboration are considered four divergent thinking that contribute to the more complex construct of creativity. DTS is classified as being student-centered and flexible, where the students are completely involved in their own learning (Tomar & Sharma, 2015).

Achievement is the result determined by the students' level of acquired knowledge in a learning activity. Hence, the researcher determined the Effect of Divergent Thinking Strategy on Senior Secondary School students' Achievement in Algebraic Equations after the students must have exposed to the knowledge of Algebra using Divergent Thinking Strategy. Students' achievement in Algebra, it refers to as the outcome of what the students have accomplished in learning Algebra, which is measured by test. According to Tenty and Awe (2021), it depicts students' performance on a standard of measurement such as performance test, skill test, and analytical thinking test among others.

Influence of gender is another factor that seems to affect the teaching and learning of Algebra on students' achievement in Algebra when taught Algebra. Gender means the condition of being male or female. Sadiq (2016) referred to sex as a physical distinction; gender is a social and cultural one. This implied that roles and expectations of males and females are defined by societies and cultures. Some scholarly studies have shown that there was no influence of gender on students' achievement in Algebra (Galadima & Yusha'u, 2017; Spence, 2014). Yet, some have showed that the female students achieved more than their male counterparts (Bosire, Mondoh & Barmao, 2018) while the rest of the scholars' findings indicated that the male students achieved more than their female counterparts (Ndukwe, 2018). Hence, the study determined the influence of gender on the effect of divergent thinking strategy on senior secondary school students' achievement in Algebraic Equation.

This study investigated the effect of divergent thinking strategy on senior secondary school students' achievement in algebraic equations in Awgu Education Zone of Enugu State. Specifically, the study aimed at determining the:

1. mean achievement scores and standard deviations of senior secondary school students that are taught algebraic equations using divergent thinking strategy (Experimental group) and those that are taught algebraic equations using the expository method (Expository group).
2. mean achievement scores and standard deviations of Senior Secondary School male and female students in the Experimental group.

The following research questions guided the study

1. What are mean achievement scores and standard deviations of Senior Secondary school students that are taught Algebraic Equations using Divergent Thinking Strategy (Experimental group) and those that are taught Algebraic Equation using the Expository method (Expository group)?
2. What are mean achievement scores and standard deviations of Senior Secondary school male and female students in the Experimental group?

The following null hypotheses were tested at 0.05 levels of significance.

1. There is no significant difference between the mean achievement scores of Senior Secondary school students that are taught Algebraic Equation using Divergent Thinking Strategy (Experimental group) and those that are taught Algebraic Equation using the Expository method (Expository group).
2. There is no significant difference between the mean achievement scores of Senior Secondary school male and female students in the Experimental group.
3. There is no significant interaction effect of methods (DTS and expository method) and gender on the achievement scores of students in algebraic equation.

Methods

The design for this study adopted pretest-posttest non-equivalent control group quasi-experimental design. This study was conducted in secondary schools in Awgu Education zone of Enugu State. Awgu Education zone is made up of three (3) Local Government Areas; Awgu L.G.A, Aninri L.G.A and Oji-River L.G.A. The population of the study was one thousand, 1864 Senior Secondary School One (SS 1) students in the 55 secondary schools, which comprised of 39 coeducational schools, nine (9) female schools and seven (7) male schools in Awgu Education Zone for 2022/2023 academic session. The

sample size of the study was 186 SS 1 students in the three (3) out of 39 coeducational secondary schools in Awgu Education zone. Purposive sampling technique was used to sample three (3) coeducational secondary schools. The instrument that was used for pretest, posttest and delayed post-test (retention test) is the Algebraic Equation Achievement Test (AEAT).

The items of Algebraic Equation Achievement Test (AEAT) were subjected to face validation by two experts in mathematics education and one expert in Measurement and Evaluation, all from the Department of Mathematics and Computer Science Education, ESUT. The reliability estimate for Algebraic Equation Achievement Test (AEAT) was determined using Kuder-Richardson Formula 20 (K-R 20) method. The treatment lasted for four weeks. The experimental procedure includes: 1. Pre-testing 2. Treatment 3. Post-testing. The following measures were adopted to minimize variability and control the extraneous variable that may had influenced the findings of the study. These include: (1) Teacher variable (2) Hawthorne effects (3) Instrumental variable (4) Inter groups variable (5) Effect of forgetfulness. Algebraic Equation Achievement Test (AEAT) was administered respectively as pretests on the first week of treatment by research assistants. Scores of the students on the pretests were recorded and kept for use after the experiment. The posttest data was generated after re-administration of Algebraic Equation Achievement Test (AEAT) to the students on the last week of treatment. For each of the groups, data for pretests and posttests were recorded separately. Data that was collected using Algebraic Equation Achievement Test (AEAT) was analyzed according to the research questions asked and the null hypotheses formulated. Mean and standard deviation were used to answer the research questions while analysis of covariance (ANCOVA) was used to test the null hypotheses at P<.05.

Results

The data collected from respondents are presented and analyzed. The presentation and analyses are according to the research questions and hypotheses.

1. What are mean achievement scores and standard deviations of Senior Secondary school students that are taught Algebraic Equation using Divergent Thinking Strategy (Experimental group) and those that are taught Algebraic Equation using the Expository method (Expository group)?

Table 1: Mean Achievement Scores and Standard Deviations of Students Taught Algebraic Equation Using Divergent Thinking Strategy and Those Taught Algebraic Equation Using the Expository Method

Group	Number (n)	Pre-test		Post-test		Gained Mean Score
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)	
Experimental	93	34.15	12.69	50.80	15.51	16.65
Expository	93	36.12	11.82	42.81	11.96	6.69

Table 1 showed the results of mean achievement scores and standard deviations of students taught Algebraic Equation using Divergent Thinking Strategy and those taught using the expository method in both pre-test and post-test. The results showed that the mean pre-test achievement score and standard deviation of students taught using Divergent Thinking Strategy were 34.15 and 12.96 respectively, while the post-test mean achievement score and standard deviation were 50.80 and 15.51 respectively. On the other hand, the pre-test mean achievement score and standard deviation of students taught using expository method were 36.12 and 11.82 respectively, while post-test mean achievement score and standard deviation were 42.81 and 11.96 respectively.

The result showed that the students taught Algebraic Equation using Divergent Thinking Strategy gained more with the gained mean score of 16.65 than the students taught Algebraic Equation using expository method the gained mean score of 6.69. Also, the table showed that the students taught Algebraic Equation using expository method had a lower standard deviation than their counterparts using Divergent Thinking Strategy. This implies that there were more extreme scores in the experimental group than in the expository group.

1. What are mean achievement scores and standard deviations of Senior Secondary School male and female students in the Experimental group?

Table 2: Mean Achievement Scores and Standard Deviations of Male and Female Students in the Experimental Group

Group	Gender	Number (n)	Pre-test		Post-test		Gained Mean Score
			Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)	
Experimental	Male	50	35.06	13.51	51.38	16.43	16.32
	Female	43	33.09	11.74	50.12	14.53	17.03

Table 2 showed the results of mean achievement scores and standard deviations of male and female students in the Experimental group. The results showed that the mean pre-test achievement score and standard deviation of male students were 35.06 and 13.51 respectively, while the post-test mean achievement score and standard deviation were 51.38 and 16.43 respectively. For the female students, the pretest mean achievement score and standard deviation were 33.09 and 11.74 respectively while the post-test mean achievement and standard deviation were 50.12 and 14.53 respectively.

The results showed that the male students had higher mean achievement scores at both pretesting and post-testing but the female students gained more than their male counterparts with the gained mean scores 16.32 for the male students and 17.03 for the female students. The result also showed that the male students had higher standard deviations both at the pretest and post-test. This means that the mean scores of the male students were not reliable and homogeneous. This implied that the male students had more extreme scores than their female counterparts.

Testing of Research Hypotheses

Table 3: Analysis of Covariance (ANCOVA) on the Difference in the Mean Achievement Scores of Students

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	30251.994[a]	4	7562.998	170.949	.000	
Intercept	2874.165	1	2874.165	64.966	.000	
PRETEST	26992.669	1	26992.669	610.126	.000	
GROUP	4569.303	1	4569.303	103.282	.000	S
GENDER	1.685	1	1.685	.038	.845	NS
GROUP * GENDER	11.268	1	11.268	.255	.614	NS
Error	8007.646	181	44.241			
Total	445663.000	186				
Corrected Total	38259.640	185				

a. R Squared = .791 (Adjusted R Squared = .786)

Table 3 showed the Analysis of Covariance (ANCOVA) on the mean achievement scores of students on hypotheses 1 to 3.

In the table 3, group (experimental and expository) as main effect, gave an f-value of 103.282 and was significant at 0.00. Since 0.00 was less than 0.05, this meant that at 0.05 significant level, the f-value was significant. Hence, Hypothesis 1 was rejected. The study therefore, concluded that there was significant difference between the mean achievement scores of Senior Secondary school students that were taught Algebraic Equation using Divergent Thinking Strategy (Experimental group) and those that were taught Algebraic Equation using the Expository method (Expository group). This implied that the Senior Secondary school students that were taught Algebraic Equation using Divergent Thinking Strategy significantly achieved higher than those taught Algebraic Equation using the Expository method.

In the Table 3, gender as main effect, gave an f-value of 0.038 and was not significant at 0.845. Since 0.845 was greater than 0.05, this means that at 0.05 significant level, the f-value was not significant. Hence, hypothesis 2 was accepted as stated. The study therefore, concluded that there was no significant difference between the mean achievement scores of Senior Secondary school male and female students in the Experimental group.

The result in Table 3 indicated that the main interaction effect gave an f-value of 0.255. This was not significant at 0.614. Since 0.614 was not less than 0.05, this meant that at 0.05 level, the f-value was not significant. This implied that there was no significant interaction effect of method and gender on the achievement scores of students in Algebraic Equation.

Discussion of Findings

The study discovered that students taught Algebraic Equation using Divergent Thinking Strategy significantly achieved higher than their counterparts taught using expository method. This implied that the mathematics teachers should avoid using the Expository teaching method in teaching Algebraic equations if they want to boost students' achievement in Algebraic equation to maximum level.

The results showed that there were no significant differences between the mean achievement scores of Senior Secondary school male and female students in the Experimental group. This finding is supported by the findings of Ugwoke (2018), Okeagu (2013) and Galadima & Yusha'u (2007) who reported in their individual studies that there was no influence of gender on students' achievement in Algebra. The study discovered that there was no significant interaction effect of method and gender on the achievement scores of students in Algebraic Equation. This corroborates Okoye (2019) who stated interaction effects of gender on students' academic achievement.

Conclusions

The study found out that students taught Algebraic Equation with Divergent Thinking Strategy had significant higher mean achievement scores than those students taught using expository method. Hence, the student achievement in Algebraic Equation depends on the mode of instruction and finally, there was no significant difference between the male and female students' achievement scores in Algebraic Equation.

Recommendations

From the findings of the study, the following recommendations were made;

1. Mathematics teachers should endeavor to use Divergent Thinking strategy in teaching Algebraic equations in such as a way that it allows the four cardinal thinking processes which are fluency, flexibility, originality, and elaboration.
2. States and Federal Governments should organize conferences and workshops for mathematics teachers and supervisors on the use of Divergent Thinking Strategy in teaching Algebraic equations.
3. Professional organizations and other stakeholders in Education industry should organize conferences and workshops on the use of Divergent Thinking Strategy in teaching Algebraic equations.

References

Al-Hassan, S.I. (2016). Impact of Inquiry-Demonstration Method on Remediating Newman Errors and Enhancing Performance in Algebra among Senior Secondary School Students, Kaduna state, Nigeria. *An Unpublished Masters of Science Degree of the Department of Science Education, Ahmamdu Bello University (ABU), Zaria.*

Alsagoff, Z. (2012). Thinking critically about teaching critical thinking. *Crossroads of learning*, 13, (3), 23 – 25.

Aminu, A.O. (2015). Teaching Algebra effectively with basic proficiency and software consideration. *Nigerian Journal of Computer Technology* 7 (18): 34 – 41.

Ann, J. (2013). Convergent and divergent methods of teaching spelling in relation to creativity. *Creativity*, 8 (6); 1-7.

Azurku, G.D. (2016). Meta- Analysis: Potentials and Promise. *BJM Clinical Research Ed* 315 (7119), 1371 - 1374.

Bar-Yam, M., Rhoades, K., Sweeney, L. B., & Bar-Yam, Y. (2012). *Changes in the teaching and learning process in a complex education system*. www.necsi.edu/research/management/education/teachandlearn.html

Bosire J., Mondoh H. & Barmao A. (2018). Effect of streaming by gender on student achievement in mathematics in secondary schools in Kenya. *South African Journal of Education EASA* 28(1); 595-607

Cooley, K.J., Martins T.P., Vidakovic F. and Loch G. (2017). The Influence of the type of Practice in Acquiring Process Skills in Students' Achievement in Algebra. *Journal of Research in Science Teaching* 34(3); 45 – 58.

Coolman, R. (2019). *What is Algebra?* www.livescience.com

Demme (July 18, 2018). *6 Reasons why we learn Algebra*? www.demelearning.com

Federal Republic of Nigeria (2004). *National Policy on Education (4th Edition*). Lagos: NERDC PRESS.

Galadima, I. & Yusha'u, M.A. (2017). An Investigation into Mathematics Performance Of Senior Secondary School Students in Sokoto State. *ABACUS*, 32(1); 24 – 33.

Guildford, J. P. (1959). Three faces of intellect. *American Psychologist*, 14, 469–479.

Guildford, J. P. (1967). *The nature of human intelligence*. New York, NY: McGraw-Hill.

Guilford, J. P. (1950). Creativity. *American Psychologist*, *5*. 444-454.

Guilford, J. P. (1959). Traits of creativity. In H. H. Anderson (Ed.), *Creativity and its cultivation* (pp. 142-161) (Reprinted in P. E. Vernon, Ed., 1970, *Creativity*, pp. 167-188, Penguin Books).

Guilford, J. P. (1967). *The nature of human intelligence*. New York: McGraw Hill.

Keller, E.F. (2011). *Gender Roles in Women Studies Encyclopedia*. New York: Peter Bederick Books.

Kurumeh, M.S. (2014). Effects of ethno-mathematics on students' achievement in Geometry and Menstruation. *ABACUS* 31(1): 67 – 79.

Macrae M.F., Kalejaiye A.O., Chima Z.I., Garba G.U., Ademosu M.O., Channon J.B.,

Mashooque, F.D. (2010). Teachers' Actual Difficulties in Teaching and Learning of Algebra. *Journal of Mathematics Educators* 90 (8); 457 – 550.

Meremikwu, A.N. (2012). Gender differences and Mathematics achievements among Secondary School Students. *Unpublished M. Ed. Thesis of the University of Calabar.*

National Council of Teachers of Mathematics (NCTM) (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM.

Nduka I. (2016). Effects of Computer Simulations and Problem-Solving Approaches on High School Students' Achievement and Interest in Algebra. *Journal of Educational Research*, 86(1), 7 – 19.

Ndukwe, C. J. (2018). Effect of Constructivist Teaching Strategy in Senior Secondary School Students' Achievement and Retention in Mathematics. *An Unpublished M.Sc. thesis of the Enugu State University of Science and Technology (ESUT), Enugu.*

Nwichi, E.J. (2011). The Retroactive Effect of Pleasant and Unpleasant Odours on learning of Algebra. *America Journal of Psychology*. 43(1); 73 – 78.

Okeagu, R.U. (2013). Effect of Problem-Solving Teaching Method on Students' Achievement in Mathematics. *Unpublished M.Sc. Dissertation, University of Nigeria Nsukka*

Olutola A.T., Ogunjimi M.O., Daramola D.S. & Sheu A.L. (2017). Effects of Convergent Learning and Divergent Learning Strategies on Students' Academic Performance in Biology in Ilorin, Nigeria. *African Journal of Interdisciplinary Studies* 10(1); 33 – 39.

Oshin A.D. (2015). Effect of Three types of Inserted Questions on Students' Achievement in Algebra. *Journal of Educational Psychology* 62(34); 387 – 400.

Rintelman, I. (2017). *An analysis of convergent and divergent instruction on the ability of eighth grade students to understand mechanisms*. http://www.uwstout.edu/lib/thesis/2020/2020rintelmanj.pdf

Ritchhart E.D., Church S.L. and Morisson A.G. (2011) Comparing the effects of convergent teaching methods on using articles by Iranain EFD learners. *International Journal of Educational Investigation,* 1 (1), 313 – 327.

Sadiq, S.D. (2016). Identification of students' weaknesses associated with achievement in Mathematics. *Delta Journal of Educational Development.* 2(2); 45 – 50.

Salau, M.O. (2011). Comparative effects of attending single sex and co-educational secondary schools on the female students" achievement in mathematics. In 0.0 Busarr (ed). Women in Science, Technology and mathematics Education in Nigeria. *52nd Annual Conference Proceeding* 2011. Pp. 299 – 303.

Sandless, A. (2013). Cognitive Thinking: Creativity, Brainstorming and Convergent and Divergent Thinking. *Journal of Cognitive Perspective in Psychology*, 34(2), 45.

Skemp J.O. (2020). Influence of sex difference of students on their achievement in secondary school mathematics. *Journal of Mathematics Association of Nigeria.* ABACUS 45(1); 102 – 112.

Sofolahan J. (2016). Historical Perspective on Problem-Solving in the Mathematics curriculum. In Charles R.I. and Silver E.A. (Eds). *The Teaching and Assessing of Mathematical Problem-Solving* 1(1); 1 – 22. USA: NCTM.

Spence, D.J. (2014). Engagement with mathematics courseware in traditional and online learning environments: relationship to motivation, achievement, gender and gender orientation. *Unpublished Ph.D Dissertation, Emory University*.

Tenty, O.J., & Awe, U.L. (2021). Pedagogy in secondary school mathematics. *http://www/maths edu.org/ journal. 4(1). 67-76.*Retrieved

Tomar, M. & Sharma, S. K. (2015). *Learning and teaching: Learning process.* India: Isha Book University of Nigeria, Nsukka.

Tukur C.M.M. (2017). Effect of Cooperative Learning on Students' Achievement and Retention in Secondary School in Benue State. *Unpublished M.Ed Thesis, Benue State University Makurdi*.

Udeinya G.C. & Okobiah B.I. (2011). The Differential Effect of Three Teaching Methods on Students' Achievement in Algebra. *European Journal of Science Education* 87 (3); 101 – 123.

Ugwoke, L.C. (2018). Effect of proper sequencing method on SSII students' achievement and interest in quadratic equation. *Unpublished M.ED. Thesis, University of Nigeria Nsukka.*

UNICEF (1991). In Okeagu, R.U. (2013). Effect of Problem-Solving Teaching Method on Students' Achievement in Mathematics. *Unpublished M.Sc. Dissertation, University of Nigeria Nsukka.*

Uzoechi, B.C (2014). Enhancing students' creativity through innovative science, technology and mathematics teaching. *Proceedings of the Science Teachers Association of Nigeria (STAN) 55th Annual conference*, pg 61 – 74.

WAEC Chief Examiner's Report (2023). *West African Annual Subject Report on Senior Secondary School students.* Yaba: WAEC

Wikipedia (2017). *The free encyclopedia.* www.en.wikipedia.org/eki/convergentthinking/divergentthinking

Williams, Y. (2003). Convergent thinking definitions, examples and quiz. *Educational portal*, 13 (3); 7 – 15.

Yeager, Z. (1991). The use of constructivist teaching model in environmental science at Beijing normal university. *China papers*, 78-83.

Zent, E. S. (2011). *Strategies of convergent thinking*. *http://faculty.washington.edulezent/imct.htm*

PERCEIVED IMPACT OF EXAMINATION OFFICERS ON ACADEMIC PERFORMANCE OF SENIOR SECONDARY STUDENTS

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Abstract
Proper evaluation and grading of senior secondary school students in Senior Secondary Certificate Examination (SSCE) have been compromised over the years. This has been blamed on compromised WAEC examination officers. The study determined the impact of WAEC examination officers on academic performance of senior secondary school students' in SSCE in Isi-Uzo Local Government of Enugu State, Nigeria. The study adopted survey research design. The study population was 225 students drawn from four (4) co-educational secondary schools in the study area. The sample size was 106 students. Instrument for data collection was structured questionnaire and direct observation of WAEC examination. Four (4) research questions were answered. The research questions were answered using mean at bench mark of 2.50 and standard deviation. ANOVA was used to test two hypotheses at 0.05 level of significance. Findings of the study revealed among others that WAEC examination officers impact negatively on the proper evaluation and grading of students performance in SSCE because they collaborate in examination malpractices alongside students and parents. Based on the findings, the study recommended; effective use of continuous assessment techniques in examination and grading of senior secondary school graduates in all subjects, less emphasis on paper qualifications, implementation of Examination Malpractice Act 33 of 1999, enhanced salary of examination officers, nationwide retraining and reassessment of examination officers on ethics of examination, revamping of moral values and sense of justice among all education agents.

Keywords: *Examination, Examination Officers, Academic performance, Senior Secondary Students, SSCE*

Introduction

Every field of human endeavor has a way of measuring its successes and failures. In education, examination is a measuring instrument in determining students' achievements at the end of a given educational program. Examination could be by week, month, and term or by semester. An examination (Ayanniyi & Anya, 2017) is a form of evaluation where the learner is tested in all areas covered in the process of teaching at the end of a term or semester for proper placement and certification. Examination has a time table and a time frame. Examination usually comes in the form of: i) Essay: which involves choice of items where lengthy written answers are expected. ii) Objective: this is designed to make students to answer a large number of items by using options. iii) Practical: this is employed in scientific and technical fields to test theory. iv) Oral: this is given to simply recognize phonetic symbols in a given word commonly used to test languages (Ayanniyi & Anya, 2017). All these examination forms are conducted by WAEC for SSCE. Examination, therefore, lies at the heart of any academic exercise. Its natural tendency is to establish a meritocracy, in which power, earnings and status depend, to a high degree, on education and passing of examinations (Ayanniyi & Anya, 2017). Examination provides information about an individual, student or group of students, a school (in terms of whether it is performing according to expectation), or about

educational system (in terms of whether or not the set objectives are being met), (Alhassan 2011). Examination lies in the centre of any educational enterprise as it serves three main purposes: i) Measuring competence or achievement in a given field of endeavour. ii) Helping to predict future success and also assisting in selection purposes. iii) As an activity, examination provides incentives to learning, (Onyibe , Uma & Ibina, 2015).

The success of an education system depends upon the effectiveness of its examination system as it is a fundamental component of teaching-learning process. Examinations are arranged to evaluate the academic achievement of students and to know whether they have achieved a standard of academic learning and knowledge (Suleman, Gul, Ambrin, & Kamran, 2015) based on subject and unit specific objectives. Nnam & Inah (2015) notes that examination is a yardstick against which students or candidates' competence and progress are formally measured and appraised in the education sector. According to Emaikwu (2012), examination as part of evaluation in education is aimed at determining a learner's level of skill acquisition or intellectual competence and understanding after a given training. George & Ukpong (2013) opines that examination is the most common tool around which the entire system of education revolves, it is the instrument used to decide who is permitted to move to the next academic level. Akaranga & Ongong (2013) observed that examination is not only a process of assessing the progress of students but, it also motivates and helps them to know their academic strengths and weaknesses apart from providing teachers with opportunities to try new methods of teaching. Examinations are considered the basis for promotion to higher classes, source of motivation for learners for better studies, basis for prediction about students' future education and job aptitudes. Examination serves as a source for the assessment of students' achievement level and assists the teachers to evaluate the effectiveness of their teaching and learning methods for future improvement. Examination is the most practical and useful way of determine the extent to which the students have achieved the instructional objectives in particular course of study as planned. Examinations that are valid, trustworthy and free of examinations malpractices will assess the academic achievement of students in an excellent and effective way (Duze, 2011). Those to ensure that examination achieves the above objectives are examination boards, bodies and its officers.

In Nigeria education system of 9,3,3,4, general examination to determine students' academic performance leading to their evaluation and grading are coordinated in Enugu state by Primary School Management Board (PSMB) and Post Primary School Management Board (PPSMB). Other examination boards include; West African Examination Council (WAEC), National Examination Council (NECO), Joint Admission Matriculation Board (JAMB) and Interim Joint Matriculation Board (IJMB). To achieve the aims of these boards and bodies, individuals are appointed to manage, coordinate, administer, evaluate and grade students based on their academic performance scores after examination. The individuals that do the aforesaid jobs are here referred to as examination officers. Generally, examination officers include teachers, invigilators, supervisors, associate academic deans, academic dean of studies and registrar. They have specified duties in the education sector. The roles of examination officers at all levels of education cannot be over emphasized. An Academic Handbook (2014) enumerated the functions of examination officers.

In secondary school certification examination (SSCE) WAEC and NECO examination officers receive, check and store securely all exam papers and completed scripts in line with regulations and ensure completed scripts are dispatched promptly and appropriately. They organize appropriate arrangements for the support of candidates with special examination requirements as directed by the Head of Learning Support; identify and manage examination timetable clashes. They manage the senior examination invigilators and invigilation team including organizing training and monitoring of the team and managing their hours. They manage the invigilators budget. They arrange and disseminate exam results and certificates to candidates and forward, in consultation with the principals and/or Deputy Head, any appeals/remark requests. They download process and distribute exam results to

pupils and staff. Under the direction of the Deputy Head, examination officers produce reports for internal use and a summary of statistics for external publication. They arrange internal school examinations working with the Dean of Studies. During the exam season, the role of arranging the internal school examinations is delegated to the school administration team and Dean of Studies. They also manage the collection of student approvals and managing fees relating to enquiries about results. They keep up to date with the current procedures, rules and regulations laid down by the different examining bodies. Examination officers use knowledge of these to produce and keep up to date exam related school policies. They deal with issues relating to appeals, remarking and other administrative issues such as students who miss examinations through illness and/or who require special consideration. Deal with all exam related enquiries from parents and students including former students. All these enable educationist assess students academic performance and students' educational process. This explains why, for example, public examinations conducted by examination bodies such as the West African Examination Council (WAEC) and National Examination Council (NECO), assume a tremendous importance. As such, teachers and students spend a great amount of time on those topics they expect to appear in a given examination. Students on the other hand utilize all means, right and wrong, available to them to ensure that they passed their examinations (Ayanniyi & Anya, 2017) especially SSCE. As such, some examination officers see SSCE period as a period of making illicit money.

According to Adams and Esther (2013), it is regrettable that in most countries of the world, the examination system is infected with examination misconducts or wrongdoings initiated by desperate students, sponsored by parents and guidance and accommodate by examination officers. When examination is not properly conducted, the expected feedback may not result. Hence, the result of such examination leads to wrong evaluation and grading of students which affect the teacher, the learner, the entire education industry, as well as the society (Ojonemi, Enejoh, Enejoh & Olatunmibi 2013). Whenever there is examination malpractice, the validity and resulting outcome is questionable.

Examination malpractice in Nigeria is as old as the country herself. Examination malpractice is commonly defined as a deliberate wrong doing contrary to official examination rules designed to place a candidate at an unfair advantage or disadvantage, (Akaranga & Ongong, 2013). Alutu & Aluede (2006) remarked that examination malpractice is any irregular behaviour exhibited by a candidate or anybody charged with the conduct of examination before, during or after the examination that contravenes the rules and regulations governing such examination. Onuka & Durowoju (2013) defined examination malpractice as any dishonest or unauthorized action or deed committed by a student on his own or in collaboration with others like fellow students, guardians, parents, teachers, head teacher, examination officials, supervisors, invigilators, security officers and anybody or group of people before, during or after examination in order to obtain undeserved marks or grades. This has distorted sincere evaluation and grading of students academic performance especially in SSCE. WAEC episode of examination leakage scandal in the 1970s, called the Owosho scandal is an example. The scandal was as a result of leakage of examination answer slips to students by an examination official prior to the conduct of the exam. This led to the cancellation of results in some examination centers and some students were asked to take the exam with their juniors the following year. Also in 1977, there was a much wider examination leakage and malpractice at examination centers which led to what was termed EXPO 77. By 1982, there were allegations that exams were sold and to combat these types of malpractices, examinations were cancelled at some centers affecting both innocent and guilty students (Wikipedia). It is clear that examination malpractice tends to confer undue advantage on the evaluation and grading of the perpetrators of the act and his or her collaborators.

Presently, examination malpractices seem to be considered as the right of the students. Teachers, students, parents and WAEC and NECO examination officers for SSCE are equally responsible for this destructive trend of examination malpractices. In fact,

examination malpractices constitute the most serious problem facing the nation's education system in general and secondary education in particular as they churn-out illiterate secondary school graduates. Based on the forgoing, there is need to examine perceived impact of examination officers on the academic performance of Senior Secondary School students in SSCE.

Students' academic performance in SSCE is the determined learning outcome after senior secondary school education. This is supported by issuance of graded and evaluated Senior Secondary Certificate (SSC) to all those who take part in the exams. This determined learning performance usually enables the students and teacher to be effectively ready for further teaching and learning as learning performance provides them feedback. Academic performance is the measured students' scores on achievement test (Pandey, 2017). It shows the extent at which the student has gained from the instructional objectives and calls for evaluation of the teaching and learning process. Senior Secondary Certificate (SSC) issued to senior secondary school students proves evidence of their academic performance in cognitive, psychomotor and affective domains of learning at that secondary level of education.

Secondary school education has two stages of junior and senior secondary. National Policy on Education (2014 Edition) enumerated broad and specific goals of Secondary education in Nigeria. To achieve the stated goals, secondary education has six years duration, given in two stages; a junior secondary school stage and a senior secondary school stage; each has three years duration. Government welcomes the participation of voluntary agencies, communities and private individuals in the establishment and management of secondary schools. Students' academic performance at this level of education are rewarded and documented in certification:

a. The junior school certificate (BECE) based on continuous assessment and examinations boards.
b. The senior school certificate (SSC) based on continuous assessments and a national examination.
c. Nigeria uses public examination bodies for conducting national examinations in order to ensure uniform standards at this level (WAEC and NECO).

The West African Examinations Council (WAEC) is an examination board established by law to determine the examinations required in the public interest in the English-speaking West African countries, to conduct the examinations and to award certificates comparable to those of equivalent examining authorities internationally. One of the examinations conducted by the council is International Examinations. The International exams are exams taken in the five countries with the WAEC ordinance. It consists of: WASSCE (West African Senior School Certificate Examination): WASSCE for Private Candidates (First Series) January–February, WASSCE for (School Candidates) March – May, WASSCE for Private Candidates (Main GCE) September–October. All these examinations are aimed at certifying actual academic performance of the examined student. Students of senior secondary school certified thus are given SSC (Senior Secondary Certificate).

Quality of Senior Secondary Certificate (SSC) evaluation and grading has been distorted. It is a source of worry for some brilliant students how they are outsmarted by those they are fully aware they are better off in SSCE. Some have accused examination officers of corrupt practices and compromise. Leakage of examination papers, award of marks and grades to underserved students, buying of marks both in cash and kind, and outright buying of good graded results are all blamed on examination officers. These have serious effects on the evaluation of students' actual educational performance and by extension on the individual growth, teachers' need of feedback, standard of education and nation building. All these are seen in unemployable certified graduates, low productivity of the employed ones, lack of creative workforce, creative writers, few creative entrepreneurs, scientists and managers to mention but a few. Some trace this national and educational catastrophe to fake and shaky foundation of thorough, valid and reliable evaluation of students' performance in primary and secondary school levels. As such, this study investigates perceived impact of examination officers on academic performance of senior secondary school in SSCE in Enugu education zone.

The main purpose of the study is to find out the perceived impact of examination officers on academic performance of senior secondary school in SSCE in Enugu education zone. The study specifically finds out:

1. The roles of examination officers in the conduct of SSCE in Secondary Schools in Enugu education zone
2. What influences examination officers to compromise their roles during senior secondary school certificate examination Enugu education zone
3. The impart of examination officers compromise on academic performance of senior secondary school in SSCE in Enugu education zone
4. Measures to contrail examination officers compromise on their roles during senior secondary school certificate examination in Enugu education zone

Four research questions guided the study

1. What are the mean and standard deviation scores on roles of examination officers in the conduct of SSCE in Secondary Schools in Enugu education zone?
2. What are the mean and standard deviation scores on what influences examination officers to compromise their roles during SSCE in Enugu education zone?
3. What are the mean and standard scores on impart of examination officers compromise on academic performance of senior secondary school in SSCE in Enugu education zone?
4. What are the mean and standard deviation scores on measures to curb examination officers' compromise on their roles during SSCE in Enugu education zone?

Two null hypotheses were tested in the study at 0.05 significant levels.

$H0_1$: There is no significant difference on the mean and standard deviation scores on the impact of examination officers roles on academic performance of senior secondary school students in SSCE in Enugu education zone.

HO_2: There is no significant difference on the mean and standard deviation scores on measures to curb examination officers' compromise on their roles during SSCE in Enugu education zone.

Methods

The study adopted survey research design. The research was conducted in four (4) secondary school in Isi-Uzo Local Government Area of Enugu State, precisely, Mburuanyi Development Centre. It is within Enugu education zone of Enugu State. The population of the study is 225 students from Community Secondary School, Neke,{50 WAEC Exam Students; 20 male and 30 female}, Community Secondary School Ikem,{60 WAEC Exam Students; 25 male and 35 female}, Community Secondary School Mbu{70 WAEC Students; 30 male and 40 female} and Isi-Uzo Technical College {45 WAEC Students; 20 male and 25 female}. These data are obtained from head count and record from the schools attendance register. Secondary data were collected questionnaire answered by past and present students of the study schools, parents of students in those schools and principals of the schools involved.

Purposive and conveniences sampling techniques were used to sample participants for the study. Purposive sampling was purposely used to get at a targeted authorized source believed to be reliable and rich in the information key to the study. These comprised four (4) school principals of the aforementioned schools, four (4) SSEC invigilators, four (4) teachers of senior secondary school precisely (SSS III) and Form Masters of the said classes. Hence, the researchers used ten (40) students from male students of the four (4) schools and ten (52) female students of the same four schools. Ten (10) parents and four (4) principals of the participant students and schools in SSS III also answered the questionnaire. Sample size is 106 participants.

Instruments used for data collection was structured questionnaire. The questionnaire has twenty (20) items. The items were closed ended rated as SA {Strongly Agree=4}, A {Agree=3}, DA {Disagree=2} and SDA {Strongly Disagree=1). The instrument was face and content validated by experts. The instrument yielded reliability index of 0.887 using Cronbach's alpha. The questionnaire items were 150 in number. 130 were returned, 20 not

returned. 80 were correctly marked. 30 were marked double or more while 20 were returned unanswered. Therefore, 50 out of the returned 130 were discarded. The results of 80 questionnaires were used for the study. The data collected from the subjects were analyzed using descriptive statistics such as mean and standard deviation, while ANOVA statistic was used to test the hypotheses at 0.05 level of significance. Any item with the mean response of 2.5 and above was considered accepted while an item with a mean below 2.5 is considered to be rejected.

Results

Research questions one: What is the mean and standard deviation scores of the roles of examination officers in the conduct of SSCE in Secondary Schools in Isi-Uzo Local Government Area?

Table 1: What is the mean and standard deviation scores on the roles of examination officers in the conduct SSCE in Secondary Schools.

Statement	SA	AG	DA	SDA	Mean	SD	Remark
Set questions, mark and record marks	63	14	1	2	3.73	0.61	Accepted
Evaluate students' through tests	42	33	4	1	3.45	0.65	Accepted
Award marks based on merit	54	22	4	0	3.62	0.58	Accepted
Grade students based on their merited scores	44	32	4	0	3.50	0.65	Accepted
Check examination misconduct	45	34	1	0	3.55	0.53	Accepted

The result in table 1 shows the means and standard deviation based on nature and roles examination officers in the conduct SSCE in secondary schools in Enugu Education Zone. The result shows that the respondents accepted items

1, 2, 3, 4, and 5 with mean scores of 3.73, 3.45, 3.62, 3.50, and 3.55 and standard deviation of 0.61, 0.65, 0.58, 0.65, and 0.53. Since all the items in table 1 obtained a mean score above the 2.5 mean score criteria, it means that examination officers are those who set examination questions, mark and record marks. Examination officers evaluate students' through tests, assignment and examination. Examination officers award marks based on merit, grade students based on their merited scores, and check examination misconduct. The result suggests that these should the ideal nature and roles examination officers during SSCE in secondary schools.

Research questions Two: What are the mean and standard deviation scores on what influences examination officers to compromise their roles during senior secondary school certificate examination in Enugu education zone?

Table 2: What are the mean and standard deviation scores on what influences examination officers to compromise their roles during senior secondary school certificate examination in Enugu education zone?

Statement	SA	AG	DA	SDA	Mean (X)	SD	Remark
Students	51	21	3	2	3.57	0.70	Accepted
School administrators	23	34	17	6	2.93	0.89	Accepted
Poor salary	18	27	18	17	2.58	1.06	Accepted
Bribery and Corruption	32	27	11	9	3.03	1.01	Accepted
Parents	26	28	14	12	2.85	1.04	Accepted

The result in table 2 shows the causes of disparity in the students' academic achievement in SSCE in secondary schools in Enugu Education Zone. The result shows that the respondents accepted items 6, 7, 8, 9, and 10 with mean scores of 3.57, 2.93, 2.58, 3.03, and 2.85 with standard deviation of 0.70, 0.89,

1.06, 1.01, and 1.04. Since all the items in table 2 obtained a mean score above the 2.5 mean score criteria, the result suggests that what influences examination officers to compromise their roles during SSCE in Enugu education zone are students, school administrators, poor salary, bribery and corruption and parents.

Research questions Three: What are the mean and standard scores on impart of examination officers compromise of their roles on academic performance of senior secondary school in SSCE in Enugu education zone?

Table 3: What are the mean and standard scores on impart of examination officers compromise of their roles on academic performance of senior secondary school in SSCE in Enugu education zone?

Statement	SA	AG	DA	SDA	Mean (X)	SD	Remark
Unmerited scores	54	20	4	2	3.58	0.71	Accepted
Improper grading	49	30	1	0	3.60	0.52	Accepted
Incorrect Evaluation	47	23	7	3	3.43	0.81	Accepted
Unreliable certificate	30	40	8	2	3.23	0.73	Accepted
Illiterate graduates	44	21	10	5	3.30	0.92	Accepted

The result in table 3 shows the impacts of examination officer's roles on academic achievement of students in SSCE in secondary schools in Isi-Uzo Local Government Area. The result shows that the respondents accepted items 11, 12, 13, 14, and 15 with mean scores of 3.58, 3.60, 3.43, 3.23 and 3.30 with standard deviation of 0.71, 0.52, 0.81, 0.73 and 3.30. Since all the items in table 3 obtained a mean score above the 2.5 mean score criteria, it means that the impart of examination officers compromise of their roles on academic performance during SSCE in Enugu education zone are seen in students unmerited scores, improper grading, incorrect evaluation, unreliable certificate and illiterate graduates.

Research questions Four: What are the mean and standard deviation scores on measures to curtail examination officers' compromise of their roles during senior secondary school certificate examination in Enugu education zone

Table 4: What are the mean and standard deviation scores on measures to contrail examination officers' compromise of their roles during SSCE in Enugu education zone?

Statement	SA	AG	DA	SDA	Mean (X)	SD	Remark
21years Imprisonment	31	25	18	6	3.01	0.96	Accepted
Good salary	50	25	5	0	3.56	0.61	Accepted
Ethical training	39	26	12	3	3.26	0.85	Accepted
Closure of schools	35	34	10	1	3.29	0.73	Accepted
Demotion of principals	44	24	8	4	3.35	0.86	Accepted

The result in table 4 shows the measures that should be taken to restore parity in students' academic achievement in SSCE result in secondary schools in Isi-Uzo Local Government Area. The result shows that the respondents accepted items 16, 17, 18, 19, and 20 with mean scores of 3.01, 3.56, 3.26, 3.29, and 3.35 with standard deviation of 0.96, 0.61, 0.85, 0.73, and 0.86. Since all the items in table 4 obtained a mean score above the 2.5 mean score criteria, it means that measures to contrail examination officers' compromise of their roles during SSCE in Enugu education zone are 21 years imprisonment of offenders, good salary, ethical training, closure of schools and demotion of principals.

HO_1: There is no significant difference on the mean and standard deviation scores on the impact of examination officers roles on academic performance of senior secondary school students in SSCE in Enugu education zone.

Table 5: ANOVA analysis on the mean and standard deviation scores of the impact of examination officers on academic performance of senior secondary students in SSCE in Enugu education zone

Source	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	8426.891	5	1685.378	5.340	.000
Within Groups	23356.309	74	315.626		
Total	31783.200	79			

Data in table 5showed that examination officers as a factor in the study has a significant impact on the mean scores on the impact of examination officers roles on academic performance of senior secondary school students in SSCE in Enugu education zone. This is because the calculated F-valve of 5.340 has a probability value of .000 and therefore significant at .05 level of significance. This implies that examination officers' impact significantly on academic performance in SSEC. Therefore, the null hypothesis that there is no significant impact of examination officers on the mean academic performance of senior secondary school in SSEC is rejected. Therefore, the researcher concludes that there is a significant impact of examination officers on the mean academic performance of senior secondary school in SSEC.

HO_2: There is no significant difference on the mean and standard deviation scores on measures to curb examination officers' compromise on their roles during SSCE in Enugu education zone.

Table 6: ANOVA analysis on the mean and standard deviation scores on measures to contrail examination officers' compromise on their roles during SSCE

Source	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1163.012	5	232.602	.721	.610
Within Groups	23882.975	74	322.743		
Total	25045.988	79			

Data in table 6 showed that measures to curb examination officers' compromise on their roles during SSCE as a factor in the study has a significant impact on academic performance of senior secondary school students in SSCE in Enugu education zone. This is because the calculated F-valve of 0.721 in respect of the treatment has a probability value of 0.610 and therefore not significant at .05 level of significance. This implies that there was no significant difference in the mean and standard deviation scores of the respondents on measures to curtail examination officers' compromise on their roles during senior secondary school certificate examination in Enugu education zone. Therefore, the null hypothesis that there is no significant difference on the mean and standard deviation scores on measures to curb examination officers' compromise on their roles during SSCE in Enugu education zone is accepted. Therefore, the researcher concludes that there is no significant difference on the mean and standard deviation scores on measures to curb examination officers' compromise on their roles during SSCE in Enugu education zone.

Discussions of the Findings

The findings of the study with respect to research question one showed that examination officers are those who set examination questions mark and record marks. Examination officers evaluate students' through tests, assignment and examination. Examination officers award marks based on merit, grade students based on their merited scores, and

check examination misconduct. The finding of the study agreed with the earlier findings of Ude (2010) who found out in a study that assignment and examination are means of evaluating students' academic performance in school.

The finding of the study with respect to research question two showed that what influences examination officers to compromise their roles during SSCE are students, school administrators, poor salary, bribery and corruption and parents. This finding agreed with the earlier findings of Udim, Umar & Essien (2018) who found that examination officers collude with students, school administrators, and parents to compromise students' academic performance during SSCE.

The finding of the study with respect to research question three showed that the impart of examination officers compromise of their roles on academic performance during SSCE in Enugu education zone are seen in students unmerited scores, improper grading, incorrect evaluation, unreliable certificate and illiterate graduates. The finding of the study agreed with the earlier findings of Eze (2013) who found out that examination officers compromise of their roles on academic performance denies totally the aim of education at all level and when the students educational performance are not properly assessed, the national goal of educating her citizens are adversely affected.

The finding of the study with respect to research question four showed that measures to contrail examination officers' compromise of their roles during SSCE in Enugu education zone are 21 years imprisonment of offenders, good salary, ethical training, closure of schools and demotion of principals. The findings of the study agreed with the earlier findings of Eze (2013) who found out that examination officers' compromise of their roles during SSCE will stop, if examination officers will develop sense of value and do their legitimate duties in the evaluation of students' academic performance, hard work is rewarded and laziness punished, examination malpractice of any form by anybody criminalized, and parents stop influencing the result of their children in schools by any means at all.

Conclusions

Based on the findings of the study, the following conclusions were drawn.

Examination officers are those who set examination questions mark and record marks. Examination officers evaluate students' through tests, assignment and examination. Examination officers award marks based on merit, grade students based on their merited scores, and check examination misconduct. That what influences examination officers to compromise their roles during SSCE are students, school administrators, poor salary, bribery and corruption and parents.

that the impart of examination officers compromise of their roles on academic performance during SSCE in Enugu education zone are seen in students unmerited scores, improper grading, incorrect evaluation, unreliable certificate and illiterate graduates. Those measures to contrail examination officers' compromise of their roles during SSCE in Enugu education zone are 21 years imprisonment of offenders, good salary, ethical training, closure of schools and demotion of principals. The study based on hypotheses that guided the study concludes that there is a significant impact of examination officers on the mean academic performance of senior secondary school in SSEC. Again, that there is no significant difference on the mean and standard deviation scores on measures to curb examination officers' compromise on their roles during SSCE in Enugu education zone.

Recommendations

Based on the findings of the study, the following recommendations are made.

The study also recommends that WAEC board especially examination officers should play their role effectively from question formation, examination to marking of examination scripts to ensure that every student has a certificate he/she can defend. The study recommends that measures to curtain examination officers' compromise of their duties during SSCE should be implemented immediate effect by the relevant authorities.

References

Adams, O. U. O. & Esther, O. D. (2013). Stakeholders' role in curbing examination malpractice in Nigeria. *International Journal*

of Economy, Management and Social Sciences, 2(6), 342-348

Akanni, O. O., & Odofin, B. (2015). Reducing examination malpractices in Nigerian schools through effective continuous assessment (C. A.) techniques as an alternative to one-shot examination in Osun State, Nigeria. *American Journal of Educational Research, 2*(1): 91–101

Akaranga, S. I., & Ongong, J. J. (2013). The phenomenon of examination malpractice: An example of Nairobi and Kenyatta Universities. *Journal of Education and Practice, 4*(18):87 – 96

Alhassan, A.B. (2011).*Concise Modern Dictionary of Educational Psychology*. Nigeria Tamaza Publishing Company.

Anih. S. (1987). *Fundamentals, Innovations and Issues in Education (Ed). A Manuel for Certificate, Diploma and Bachelor's Degree Studies In Education.* Institute of Ecumenical Education Press, Enugu.

Anzene, S. J. (2014). Trends in examination malpractice in nigerian educational system and its effects on the socio-economic development of Nigeria. *Asian Journal of Humanities and Social Sciences, 2(*3): 1 – 8

Ayanniyi, B. A. & Anya, C.A.(2017). Forms and consequences of examination malpractices' in Nigeria's schools and universities: what should the stakeholders do? *International Journal of Education, Training and Learning, 1* (1), 9-21

Barnard, H. W. & Lanwerys, J. A. (1967). *A Hand Book of Education Terms*. The Free Press.

Brief history of the Council. (2004). *The West African Examinations Council Diary.* Academy Press Plc.

Chudi, C. N. C (1987). In *Fundamentals, Innovations and Issues in Education. A Manuel for Certificate, Diploma and bachelor's Degree Studies In Education.* Institute of Ecumenical Education Press, Enugu.

Duze, C. O. (2011). Falling standard in Nigeria education: traceable to proper skill acquisition. *Educational research2* (1), 803-808,

Emaikwu, S. O. (2012). Assessing the impact of examination malpractices on the measurement of ability in Nigeria. *International Journal of Social Sciences & Education, 2*(4): 748 – 757

Federal Republic of Nigeria (2014). *National Policy on Education*. Lagos

George, I. N., & Ukpong, D. E. (2013). Contemporary social problems in Nigeria and its impact on national development: implication for guidance and counselling services. *Journal of Educational and Social Research, 3*(2): 167 – 173

Nnam, M. U., & Inah, A. F. (2015). Empirical investigation into the causes, forms and consequences of examination malpractice in nigerian institutions of higher learning. *International Journal of Novel Research in Humanity and Social Sciences, 2*(1), 52 – 62.

Ojonemi, P. S., Enejoh, W., Enejoh, A., & Olatunmibi, O. (2013). Examination malpractice: challenges to human resource development in Nigeria. *International Journal of Capacity Building in Education and Management, 2*(1), 91 – 101.

Onyibe, C. O., Uma U. U. & Ibina, E. (2015). Examination malpractice in nigeria: causes and effects on national development. Journal

Onuka, A. O. U., & Durowoju, E. O. (2013). Stakeholders' role in curbing examination malpractice in Nigeria. *International Journal of Economy, Management and Social Sciences, 2*(6), 342 – 348.

Pandey, B.D. (2017). A study of mathematical achievement of secondary school students. *International Journal of advanced research, 5(*12), 1951-1954.

Suleman, Q., Gul, R., Ambrin, S. & Kamran, F. (2015). Factors Contributing to Examination Malpractices at Secondary School Level in Kohat Division, Pakistan. *Journal of Education and Learning.9*(2) pp. 165-182.

Udim, D.K., Umar, A. & Essien, J. O. (2018). An in-depth evaluation on the issue of examination malpractice in Nigeria. *Research in Pedagogy, 8*(2), 204-213

UNESCO, (1961). *The Value of Education.* Paris.

Wikipedia. *Academic Handbook, (2014).* Examinations, administration of examinations.

WAEC. (2004). Retrieved April 12, 2006, from http://www.ghanawaec.org/about3.htm

FAMILY BACKGROUND FACTORS AS CORRELATES OF SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MATHEMATICS

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Abstract

The study investigated the correlation between the family background factors and the Senior Secondary School students' Achievement in Mathematics. The study considered four major family background factors which are students' Parental educational status, Parental occupation, Parental socioeconomic status and Family size. The design of this study was correlation survey research design. The population for the study was 107785 SSS III students in Enugu Education zone. The sample size of the study was 312 SSS III in the six (6) sampled public and private coeducational secondary schools. Simple Random Sampling Method was used to sample the 6 coeducational secondary schools. The instrument for data collection for this study was Students' Mathematics Achievement Test (SMAT). SMAT has two sections; Section A and B. Section A centered on determining the Family Background Factors while Section B contained 40 multiple choice Mathematics Questions. SMAT was validated by three experts; two in Mathematics and one in Measurement and Evaluation, all in the Department of Mathematics and Computer Education, Faculty of Education, Enugu State University of Science and Technology (ESUT), Enugu. SMAT underwent item analysis. At the end of the exercise, only 35 items of the SMAT were used to determine the reliability of the instrument and for data which gave the Kuder-Richardson (KR) 21 coefficient of 0.73 and Cronbach Alpha of 0.70 for Section A. Pearson Moment Correlation Coefficient with Mean and Standard Deviation was used to answer research questions 2 to 4 while Spearman Moment Correlation Coefficient with Mean and Standard Deviation was used to answer research question 1. Analysis of Covariance (ANCOVA) and Linear Regression were used to test all the four research hypotheses. Post-Hoc testing was done using Bonferroni for research hypotheses 2 to 4. The study disclosed that there was no significant correlation between the family background factors and the Senior Secondary School students' Achievement in Mathematics except the Students' Parental Socioeconomic status. The study disclosed that Students' Parental Socioeconomic status significantly increases the students' Achievement Scores in Mathematics by 5.779%. The study recommended among others that parents should continue to invest on their children/students' academics especially in Mathematics if they want their children/students to continue to improve on the knowledge of Mathematics. This is because the study showed that students from High Socioeconomic Status are superior to students from Low and Medium Socioeconomic Status because parents from High Socioeconomic Status spend more on their students' academics in Mathematics and any additional improvement of the Students' Parental Socioeconomic status/spending by 41.7% will increase their students' achievement in Mathematics by 5.78%.

Keywords: *Students' Achievement in Mathematics, Family Background Factors, Parental educational status, Parental occupation, Parental socioeconomic status, Family size*

Introduction

In the ancient times, people were compelled to organize things in a normal way and to count certain things such as cattle on the farm, ridges in the farm, trees on the field, number of people in the family among others. In addition to counting physical objects, people in those days also recognized how to count abstract quantities like time, days, seasons, and years. These led to the need for elementary arithmetic like addition, subtraction, multiplication, and division to enhance one's usefulness and effectiveness in the society, which became today's Mathematics. Mathematics is not only used as a computational aid, but as a tool of science and technology, enabling scientists to explore concepts with idealized models before utilizing them in the real world. Mathematics is perceived by society as the foundation for scientific and technological knowledge that is cherished by societies worldwide. Mathematics has been defined as a creation of the human mind, concerned primarily with the ideas, processes, and reasoning (Odili, 2016). Mathematics is further defined as the language of science, which describes the relationship between numbers and other measurable quantities. Bassey (2010) viewed Mathematics as a tool useful to all works of life. Charles-Ogan (2014) opined that Mathematics is a conglomeration of different but related topics and a system of communication between those concepts of shape, size, quantity and weight of phenomena.

In Nigeria, Mathematics is a compulsory subject from Pre-Primary school level to Senior Secondary School level. Mathematics is one of the subjects that occupy the centre stage in the pursuit of a science course in the university. There is no doubt that, secondary students go to school with the aim of acquiring dependable knowledge and passing excellently in Mathematics that will enable them to study their dream courses in the higher institutions (Ndukwu, 2017). West African Examination Council (WAEC) in 2021, 2022 and 2023 reported that the percentages of students that obtained credit and above in private WASSCE mathematics were 81.7%, 76.36% and 79.81%, respectively (WAEC, 2021, 2022, 2023). These statistics have shown that students' achievement in Mathematics have improved unlike what is obtained in the past where the percentages of students that obtained credit and above in May/June WASSCE mathematics in 2016, 2017 and 2018 were 52.97%, 32.80% and 49.98% respectively (WAEC, 2016, 2017, 2018). However, Sadiq (2021) have faulted the improvement in students' performance in mathematics in WASSCE. According to Sadiq (2021), the average performance of secondary school students in Mathematics stood at 43.7% which is below average. According to Sadiq, the improvement as reported by WAEC is because many families have resorted to engaging more in the educational corrupt system of Nigeria thereby reducing the trust in the public trust in the statistics report from WAEC. On the other hand, Adigun & Aborisade (2021) upheld the statistics of the students' performance in WASSCE mathematics. According to Adigun & Aborisade (2021), "educational statuses of the parents and pupils' academic performance have a close relationship. Parents having being to school realized the importance of being educated, and thereby support their children for better academic achievement. The higher educational level the parents obtained the higher the influence on their pupils' academic performance. The higher pupils' academic performance is been reflected on the current WASSCE statistics of students' performance in Mathematics".

Using Adigun & Aborisade's finding to judge the current performance of students in WASSCE from 2022 till date, one can ascertain that the high students' academic performance in WASSCE is because their parents are educated and so they support their children unlike what is obtainable in the past. Li and Qiu (2018) reported that educational level of parents affects their children's educational academics. This finding is in line with the finding of Adigun & Aborisade (2021) who also reported the same but his report gave a direction. The Adigun & Aborisade (2021)'s finding has not being contradicted by any known scholar. According to Ogbugo & Ololube (2016), there was a positive relationship between parents' educational background and the performance of their children at school. Ogbugo & Ololube (2016) stated further that students from good educational background tended to achieve more than students whose parents did not attain formal education. In the same vein, Eremie & Dimkpa (2020) reported that

parental nurture influence academic performance of secondary school students to great extent, that parental attention influences academic performance of secondary school students in Rivers State to a high extent and that parental care influence academic performance of secondary school students in Rivers State to a high extent. The findings of these researchers imply that family factors affect the students' academic performance positively or negatively. In addition, Eze (2021) reported that the socioeconomic status of parents affect their children academic performance positively. According to Eze (2021), a child from high socioeconomic status performs better than their counterparts from low level of socioeconomic status. This is because all these parental care, parental nurture, parental attention, educational level of parents and socioeconomic status of parents are all part of family Background Factors.

Family Background Factors are those factors (things) that determine a child's physical, mental, social and emotional development in the family. Similarly, Eze (2012) observed that family factors refer to those factors that are innate or which a particular family is known for which have an effect in the activities of their children. The basic Family Background Factors include parental education status, parents' occupation, parental socio-economic status and family size. Parental educational status refers to the academic attainment and other trainings acquired by parents. It is the ability or inability of the parents to acquire education (Isaac, 2012). Kenla (2012) asserted that parental educational status is classified according to academic qualification starting from doctorate level, master's level, degree holder, NCE, holder, WAEC holder, first school leaving certificate and illiterate. Mark (2012) classified parental educational status as literate and illiterate which is in support of (Isaac, 2012). According to Olivia (2013), literate parents are educated and may have high expectations and view education of their children to be very important. Roselyn (2013) asserted that literate parents may provide all the educative materials needed by children in school and may as well guide and supervise their children's book which will in turn influence their intellectual base. Nan (2013) explained that illiterate parents are associated with higher prevalence of indicators of an unhealthy lifestyle and may not have high expectation for their children, thus may or may not provide the need or necessary educational materials for their children. This implied that parental educational status determines the family expectations of their children and to a great extent the academic achievement of students in Mathematics.

Most cases, the educational status of parents determines the type of occupation that they do. This is because an educated parent will have higher occupation while uneducated parents will have lower occupation. Parental occupation refers to what parents do in life for their economic survival. According to Nan (2013), parental occupation is the daily engagement of parents to make ends meet. Nan (2013) further classified parental occupation thus business men and women, civil servants, farmers and politicians. Sam (2013) explained that students whose parents are civil servants like teachers or lecturers may be more interested in education; hence their parents tend to provide their learning needs and thus, they may perform well academically. This may be attributed to the fact that they want to assume the same or similar occupations like their parents' when they grow up. Some students whose parents are business men and women, politicians and farmers may have little or no interest in education and tend to be inactive, hence, their academic achievement may be affected (Brandy, 2013). The children might not be doing well in academics due to the fact that they are emulating their parents having the desire to make fast money and have more fun. These assertions imply that parental occupational status determines the children's academic achievement of students in Mathematics.

Parents' occupation improves the academic achievement of students and socio-economic status of their families as it enables the parents to provide basic needs of students, including nutritious foods, educational materials, and school/tuition fees. Socioeconomic status of parents encompasses the quality of life attributes as well as the opportunities and privileges afforded to people within society of the parents. Sean (2013) revealed that socioeconomic status of parents can be grouped in to three; low, middle and high-income parents. The classification of these incomes reveals determines how much the

parents can invest in his/her child's education, the type of school her child attends, the educational attainments of her child (Odenize, 2017). According to Abraham (2019), children of parents with high socio-economic status tend to academically perform better than the children whose parents are low high socio-economic status. This is because such children are economically empowered and their parents interacted everyday with the parents of other children, thereby being updated on the best education they can give their children. These findings from scholars give a positive indication that students whose parents are from High Socioeconomic status may perform best in the achievement scores in Mathematics when compared with those from low and middle socioeconomic status. Also, parental socioeconomic status determines the size of the family.

Family size can be described as the number of children in a giving family. Chima (2018) referred to it as the number of children that make up a family. Udensi (2013) asserted that a family may be small or large in size. According to Okafor (2012), a small family size contains small number of children or even one child, while a large family size is made up of many children. The author noted that the size of the family goes a long way in determining the type of care the child or children would receive and their academic interest and achievement. Okafor further explained that children from small family size receives more attention, thus their needs especially school needs are provided with ease and they tend to have high intelligent quotients (IQs) and interest hence, are successful academically. These assertions imply that Family size determines the children's academic achievement of students in Mathematics. Hence, there is need to determine the extents of these assertions on the students' achievement in Mathematics since that most of the studies ever cited are purely opinionated while the empirical ones weren't done in Mathematics.

The main aim of the study was to determine the correlation between the family background factors and the Senior Secondary School students' Achievement in Mathematics. Specifically, the study determined the;

1. correlation between the Parental educational status of the Senior Secondary School students and their Achievement in Mathematics;
2. correlation between the Parental occupation of the Senior Secondary School students and their Achievement in Mathematics;
3. correlation between the parental socioeconomic status of the Senior Secondary School students and their Achievement in Mathematics;
4. correlation between the Family size of the Senior Secondary School students and their Achievement in Mathematics

The following research questions guided the study

1. What is the correlation between the Parental educational status of the Senior Secondary School students and their Achievement in Mathematics?
2. What is the correlation between the Parental occupation of the Senior Secondary School students and their Achievement in Mathematics?
3. What is the correlation between the parental socioeconomic status of the students and the Senior Secondary School students' Achievement in Mathematics?
4. What is the correlation between the Family size of the students and the Senior Secondary School students' Achievement in Mathematics?

The following research hypotheses which were tested at 0.05 levels of significance guided the study.

1. There is no significant relationship between the Parental educational status of the Senior Secondary School students and their Academic Achievement in Mathematics.
2. There is no significant relationship between the Parental occupation of the Senior Secondary School students and their Academic Achievement in Mathematics.
3. There is no significant relationship between the Parental socioeconomic status of the Senior Secondary School students and their Academic Achievement in Mathematics.

4. There is no significant relationship between the family size of the Senior Secondary School students and their Academic Achievement in Mathematics.

Methods

The design of this study was correlation survey research design. According to Nworgu (2015), this research design seeks to establish relationship between two or more variables being investigated. According to Nworgu (2015), such relationships can enable the researcher to make a prediction which may or may not come true without necessarily establishing cause effect relationship. The researchers considered the design appropriate for the study since the researcher was interested in establishing the relationship between family background factors on the senior secondary school students' academic achievement in Mathematics. The population for the study was 107,785 SSS III students in Enugu Education zone as at 2022/2023 academic session (Examination Development Center, Enugu, 2023).

The sample size of the study was 312 SSS III students in the six (6) sampled public and private coeducational secondary schools in Enugu Education zone. Simple Random Method was used to sample two (2) most expensive private coeducational schools, two (2) average expensive private coeducational secondary schools and two (2) public coeducational secondary schools. The choice of sampling most expensive private schools is because students from High Socioeconomic status attend such schools, while moderate expensive private and public coeducational schools have students whose parents are from High, Middle and Low Socioeconomic status. In each of the sampled schools, simple random method was used to sample two (2) intact classes. The number of students in each of the twelve intact classes determined the Sample size of the study. Hence, the study sampled 75 students from High Socioeconomic Schools (that's 37 from the first and 38 from the second), 112 students from Middle Socioeconomic Schools (that's 56 from the first and 56 from the second) and 75 students from Least Socioeconomic Schools (that's the public schools, 64 from the first and 61 from the second).

The instrument for data collection for this study was Students' Mathematics Achievement Test (SMAT). SMAT has two sections; Section A and B. Section A centered on determining the Family Background Factors which are the Students' Parental educational status, Parental occupation, Parental socioeconomic status and family size. Hence, Section A has four parts; Part 1 centered on Students' Parental Educational Status (10 items), Part II centered on Students' Parental Occupational Status (10 items), Part III centered on Students' Parental Socioeconomic Status (10 items) and Part IV centered on Students' Parental Family size (5 items) while Section B contained 40 multiple choice Mathematics Questions on Matrices, Laws of Logarithm, Surd and Differentiation. SMAT was validated by three experts; two in Mathematics and one in Measurement and Evaluation, all in the Department of Mathematics and Computer Education, Faculty of Education, Enugu State University of Science and Technology (ESUT), Enugu. SMART underwent item analysis, which gave a test difficulty index of 0.59 which showed that the test was not too difficult or easy. 15 items were removed because they failed to meet the conditions of item difficulty index, discrimination index and item detractor index. At the end of the exercise, only 35 items of the SMAT were used to determine the reliability of the instrument and for data collection. For reliability of the instrument, the SMART was administered to Army Day Secondary School, where the Kuder-Richardson (KR) 21 coefficient was 0.73 and Cronbach Alpha of 0.70 for Section A. This showed that the instrument was highly reliable.

The Mathematics teachers of the sampled classes were trained by the researcher on these topics under five weeks using prepared lesson note prepared by the researcher and the teachers engaged in microteaching which was organized by the researcher. After the sixth week that the mathematics teachers became this

study's research assistants. They administered the SMART (pre- SMART) on the first day of the treatment, taught their classes on those selected topics using the lesson notes prepared by the researcher and then administered the SMART (post-SMART) on the last day of the treatment. Both pre-SMART and post-SMART were collected by their research assistants and handed them over to the researcher.

Pearson Moment Correlation Coefficient with Mean and Standard Deviation was used to answer research questions 2 to 4 while Spearman Moment Correlation Coefficient with Mean and Standard Deviation was used to answer research question 1. Pearson was used because the variables in research questions 2 to 4 are more than 2 while in research 1, Spearman was used because there are only two variables in the research question 1 which is Uneducated Parents and Educated Parents. In research 2, students' scores were grouped into four based on their responses in Part II of Section A of SMAT which are; Menial Job, Average Job, High Job and Executive Job. In research 3, students' scores were grouped into four based on their responses in Part III of Section A of SMAT which are; Low Socioeconomic Status, Middle Socioeconomic Status and High Socioeconomic Status and in research 4, students' scores were grouped into three based on their responses in Part IV of Section A of SMAT which are; Small Family Size, Moderate Family Size and Large/Big Family Size. In answering the research question 1 – 4, the reliability correlation coefficient was interpreted in line with Nwana (2011)'s assertions which is as follow

Correlation values from 0.80 – 1.00 =Very High positive Relationship;
Correlation values from 0.60 – 0.79 =High positive Relationship;
Correlation values from 0.40 – 0.59 =Average positive Relationship;
Correlation values from 0.20 – 0.39 =Low positive Relationship;
Correlation values from 0.00 – 0.19 =Very Low positive Relationship;
Correlation values from 0.00 – -0.19 =Very Low negative Relationship;
Correlation values from -0.20 – -0.39 =Low negative Relationship;
Correlation values from -0.40 – -0.59 =Average negative Relationship;
Correlation values from -0.60 – -0.79 =High negative Relationship;
Correlation values from -0.80 – -1.00 =Very High negative Relationship.

Analysis of Covariance (ANCOVA) and Linear Regression were used to test all the four research hypotheses because, in all the four research hypotheses, their variables do not have equal or equivalent number of respondents. The null hypothesis (H_0) was rejected when the significance of F (value of the test statistics) is less than 0.05. Otherwise do not reject at 0.05. Post-Hoc testing was done using Bonferroni for research hypotheses 2 to 4 once the study rejected the research hypothesis. In multiple comparisons post-hoc test with Bonferroni (modified approach) testing, the mean difference was said to be significantly superior if the mean difference value was positive and was less than or equal to 0.05.

Results

Question 1: What is the correlation between the Parental educational status of the Senior Secondary School students and their Achievement in Mathematics?

Table 1: Spearman Rho of the Correlation between the Parental educational status of the Senior Secondary School students and their Achievement in Mathematics

Parental Edu. Status	Number	Pretest		Posttest		Mean Difference	Spearman Rho
		Mean ($\bar{x}$)	Std Dev. (s)	Mean ($\bar{x}$)	Std Dev. (s)		
Uneducated	168	28.33	8.76	42.34	8.91	14.01	0.075
Educated	144	30.68	7.47	44.61	8.17	13.93	
Total	312	29.41	8.18	43.39	8.58		

Table 1 above displayed Spearman Rho of the Correlation between the Parental educational status of the Senior Secondary School students and their Achievement in Mathematics. Table 1 revealed that students whose parents are uneducated had a pretest mean score of 28.33 with the standard deviation of 8.76 while the posttest mean score was 42.34 with the standard deviation of 8.91 and a mean difference of 14.01 whereas the students whose parents are educated had a pretest mean score of 30.68 with the standard deviation of 7.47 while the posttest mean score was 44.61 with the standard deviation of 8.17 and a mean difference of 13.93. Also, the table showed that the Spearman correlation coefficient between the Parental educational status of the Senior Secondary School students and their Achievement in Mathematics was 0.075. The result showed that there was a very low/poor positive relationship between the Parental educational status of the Senior Secondary School students and their Achievement in Mathematics.

HO_1: There is no significant relationship between the Parental educational status of the Senior Secondary School students and their Academic Achievement in Mathematics.

Table 2: Analysis of the Covariance of the Relationship between the Parental Educational Status of the Senior Secondary School Students and their Academic Achievement in Mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Dec
Corrected Model	99016.302[a]	2	49508.151	1844.519	.000	
Intercept	17982.164	1	17982.164	669.959	.000	
SMAT_PRETEST	98616.112	1	98616.112	3674.128	.000	
EDUCATION	.109	1	.109	.004	.949	NS
Error	8293.771	309	26.841			
Total	694651.000	312				
Corrected Total	107310.074	311				

a. R Squared = .923 (Adjusted R Squared = .922)
b. Regression: R = 0.075; R Squared = .000 (Adjusted R Squared = -.003)

Table 2 above showed the Analysis of the Covariance of the Relationship between the Parental Educational Status of the Senior Secondary School Students and their Academic Achievement in Mathematics. From the result in Table 2, it was revealed that R^2 yielded 0.000, which implies that any variation in the Senior Secondary School Student' Achievement in Mathematics was not attributable to the joint effect of Students' Parental Educational Status. The ANCOVA for the relationship (predication) showed that F-ratio was .004 and was not significant at 0.949. Since .949 was greater than 0.05, the null hypothesis 1 was

rejected as stated. Hence, the study concluded that there was no significant relationship between the Parental educational status of the Senior Secondary School students and their Academic Achievement in Mathematics. This implied that the very low positive relationship between the predictor variable and the criterion variable was not significant. This means that the students' Parental Educational Level did not affect the students' achievement in Mathematics.

Question 2: What is the correlation between the Parental occupation of the Senior Secondary School students and their Achievement in Mathematics?

Table 3: Pearson Moment Correlation Coefficient of the Parental Occupation of the Senior Secondary School students and their Achievement in Mathematics

Parental occupation	Number	Pretest		Posttest		Mean Difference	Pearson Correlation, r
		Mean ($\bar{x}$)	Std Dev. (s)	Mean ($\bar{x}$)	Std Dev. (s)		
Menial Jobs	80	28.56	8.64	42.76	8.90	14.20	0.094
Average Job	72	31.86	9.03	45.74	9.30	13.88	
High Job	87	30.36	8.79	44.37	9.83	14.01	
Executive Job	73	26.81	5.92	43.39	5.72	16.58	
Total	312	29.41	8.18	43.39	8.58		

Table 3 above displayed Pearson Moment Correlation Coefficient of the Parental Occupation of the Senior Secondary School students and their Achievement in Mathematics. Table 3 revealed that students whose parents do menial jobs had a pretest mean score of 28.56 with the standard deviation of 8.64 while the posttest mean score was 42.76 with the standard deviation of 8.90 and a mean difference of 14.20, the students whose parents do average jobs had a pretest mean score of 31.86 with the standard deviation of 9.03 while the posttest mean score was 45.74 with the standard deviation of 9.30 and a mean difference of 13.88, the students whose parents do Great/High jobs had a pretest mean score of 30.36 with the standard deviation of 8.79 while the posttest mean score was 44.37 with the standard deviation of 9.83 and a mean difference of 14.01 and the students whose parents do Executive jobs had a pretest mean score of 26.81 with the standard deviation of 5.92 while the posttest mean score was 43.39 with the standard deviation of 5.72 and a mean difference of 16.58. Also, the table showed that the Pearson correlation coefficient between the Parental Occupation of the Senior Secondary School students and their Achievement in Mathematics was 0.094. The result showed that there was a very low/poor positive relationship between the Parental Occupation of the Senior Secondary School students and their Achievement in Mathematics.

HO_2: There is no significant relationship between the Parental Occupation of the Senior Secondary School students and their Academic Achievement in Mathematics.

Table 4: Analysis of the Covariance of the Relationship between the Parental Occupation of the Senior Secondary School Students and their Academic Achievement in Mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Dec
Corrected Model	99024.471[a]	4	24756.118	917.269	.000	
Intercept	18004.781	1	18004.781	667.117	.000	
SMAT_PRETEST	97940.772	1	97940.772	3628.923	.000	
OCCUPATION	8.277	3	2.759	.102	.959	NS
Error	8285.603	307	26.989			
Total	694651.000	312				
Corrected Total	107310.074	311				

a. R Squared = .923 (Adjusted R Squared = .922)
b. Regression: R = 0.094; R Squared = .009 (Adjusted R Squared = .005)

Table 4 above showed the Analysis of the Covariance of the Relationship between the Parental Occupation of the Senior Secondary School Students and their Academic Achievement in Mathematics. From the result in Table 4, it was revealed that R^2 yielded 0.009, which was 0.9% of the variation in the Senior Secondary School Student' Achievement in Mathematics was attributable to the joint effect of Students' Parental Occupation. The ANCOVA for the relationship (predication) showed that F-ratio was .102 and was not significant at 0.959. Since .959 was greater than 0.05, the null hypothesis 2 was rejected as stated. Hence, the study concluded that there was no significant relationship between the Parental Occupation of the Senior Secondary School students and their Academic Achievement in Mathematics. This implied that both the very low positive relationship between the predictor variable and the criterion variable, and 0.9% of the variation in the Senior Secondary School Student' Achievement in Mathematics which was attributable to the joint effect of Students' Parental Occupation were not significant. This means that the students' Parental Occupation did not affect the students' achievement in Mathematics.

Question 3: What is the correlation between the parental socioeconomic status of the Senior Secondary School students and their Achievement in Mathematics?

Table 5: Pearson Moment Correlation Coefficient of the Parental socioeconomic status of the Senior Secondary School students and their Achievement in Mathematics

SES	Number	Pretest		Posttest		Mean Difference	Pearson Correlation, r
		Mean ($\bar{x}$)	Std Dev. (s)	Mean ($\bar{x}$)	Std Dev. (s)		
Low SES	90	24.63	6.66	38.49	8.09	13.86	
Middle SES	112	26.41	5.85	40.24	6.13	13.83	0.275
High SES	110	36.38	9.59	50.60	9.23	14.22	
Total	312	29.41	8.18	43.39	8.58		

Table 5 above displayed Pearson Moment Correlation Coefficient of the Parental Socioeconomic status of the Senior Secondary School students and their Achievement in Mathematics. Table 5 revealed that students whose parents are Low Socioeconomic Status had a pretest mean score of 24.63 with the standard deviation of 6.66 while the posttest mean score was 38.49 with the standard deviation of 8.09 and a mean difference of 13.86, the students whose parents are Middle Socioeconomic Status had a

pretest mean score of 26.41 with the standard deviation of 5.85 while the posttest mean score was 40.24 with the standard deviation of 6.13 and a mean difference of 13.83 and the students whose parents are High Socioeconomic Status had a pretest mean score of 36.38 with the standard deviation of 9.59 while the posttest mean score was 50.60 with the standard deviation of 9.23 and a mean difference of 14.22. Also, the table showed that the Pearson correlation coefficient between the Parental Occupation of the Senior Secondary School students and their Achievement in Mathematics was 0.275. The result showed that there was low positive relationship between the Parental Occupation of the Senior Secondary School students and their Achievement in Mathematics.

HO_3: There is no significant relationship between the parental socioeconomic status of the Senior Secondary School students and their Academic Achievement in Mathematics.

Table 6: Analysis of the Covariance of the Relationship between the parental socioeconomic status of the Senior Secondary School Students and their Academic Achievement in Mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Dec
Corrected Model	99042.053[a]	3	33014.018	1229.837	.000	
Intercept	17545.640	1	17545.640	653.610	.000	
SMAT_PRETEST	90051.359	1	90051.359	3354.590	.000	
SOCIOECONOMIC	25.859	2	12.930	.482	.000	S
Error	8268.021	308	26.844			
Total	694651.000	312				
Corrected Total	107310.074	311				

a. R Squared = .923 (Adjusted R Squared = .922)
b. Regression: R = 0.275; R Squared = .076 (Adjusted R Squared = .073)

Table 6 above showed the Analysis of the Covariance of the Relationship between the parental socioeconomic status of the Senior Secondary School Students and their Academic Achievement in Mathematics. From the result in Table 6, it was revealed that R^2 yielded 0.076, which was 7.6% of the variation in the Senior Secondary School Student' Achievement in Mathematics was attributable to the joint effect of Students' parental socioeconomic status. The ANCOVA for the relationship (predication) showed that F-ratio was .482 and was significant at 0.000. Since .000 was less than 0.05, the null hypothesis 3 was rejected as stated. Hence, the study concluded that there was significant relationship between the parental socioeconomic status of the Senior Secondary School students and their Academic Achievement in Mathematics. This implied that both the low positive relationship between the predictor variable and the criterion variable, and 7.6% of the variation in the Senior Secondary School Student' Achievement in Mathematics which was attributable to the joint effect of Students' parental socioeconomic status were significant. This means that the students' parental socioeconomic status did affect the students' achievement in Mathematics. Thus, there is need to determine which of the students benefitted more than the other. Hence, table 7 would be used to check the group that is superior using the Bonferroni Technique.

Table 7: Multiple Comparisons Post-Hoc Test Using Bonferroni Technique with Dependent Variable of Students' Achievement in Mathematics

(I) SOCIOECONOMIC	(J) SOCIOECONOMIC	Mean Difference (I-J)	Std. Error	Sig.[b]	Dec
LOW	MIDDLE	-1.7522	2.52514	1.000	NS
	HIGH	-12.1111*	2.53535	.000	LS
MIDDLE	LOW	1.7522	2.52514	1.000	NS
	HIGH	-10.3589*	2.39448	.000	LS
HIGH	LOW	12.1111*	2.53535	.000	SU
	MIDDLE	10.3589*	2.39448	.000	SU

Based on observed means.
The error term is Mean Square(Error) = 318.186.
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Bonferroni.
Where SU =Superior; NS = Not Significant; LS = Less Superior

Table 7 showed the Multiple Comparisons Post-Hoc Test Using Bonferroni Technique with Dependent Variable of Students' Achievement in Mathematics. The table showed that the pair wise comparisons of achievement scores of students whose parents are High Socioeconomic Status are superior to students whose parents are Low and Medium Socioeconomic Status with the Mean Difference of 12.1111 and 10.3589 respectively and are significant at .0000. This means that students from High Socioeconomic status achieved more when taught Mathematics than their counterparts in Low and Medium Socioeconomic status. The table showed that there was no superiority between students whose parents are from Medium and Low Socioeconomic status.

Table 8: Test of Regression Weights for the Contribution of Students' Socioeconomic on students' Achievement in Mathematics

Model	Unstandardized Coefficients		Standardized Coefficients	t-ratio	Sig.	Decision
	B	Std. Error	Beta			
(Constant)	41.701	2.706		15.409	.000	S
SOCIOECONOMIC	5.779	1.159	.275	4.988	.000	S

a. Dependent Variable: SMAT_POSTTEST
b. Weighted Least Squares Regression - Weighted by SMAT_PRETEST
c.

Table 8 above showed the Test of Regression Weights for the Contribution of Students' Socioeconomic Status on Students' Achievement in Mathematics. From the result in Table 8, it was revealed that students' achievement in Senior Secondary School Mathematics which is constant had a t-statistic value of t=15.409 and was significant at 0.000. Other hand, On the other hand, Students' Parental Socioeconomic status has a t-statistic values of t=4.988 which is significant at 0.000 as regards to students' achievement in Mathematics. This implied that Students' Parental Socioeconomic status and their

Achievement Scores in Mathematics were statistically significant since that their significant values were less than 0.05. The result further showed that the Beta values obtained for Students' Students' Parental Socioeconomic status in Mathematics was 0.275. The unstandardized coefficient measured the extent to which the independent variable can predict the dependent variable. From the table, Students' Parental Socioeconomic status (independent variable) was predicted to increase the students' Achievement Scores in Mathematics (dependent variable) by 5.779% (Beta=5.779). This showed that for any additional unit of 41.701% (Beta=41.701) of the Students' Parental Socioeconomic status (that's any additional improvement of the Students' Parental Socioeconomic status), the Students' Achievement Scores in Mathematics is predicted to increase by 5.779% (Beta=5.779). Based on the obtained results, the null hypothesis is rejected and the alternative accepted which means that Students' Parental Socioeconomic status can significantly predict students' Achievement in Mathematics.

Question 4: What is the correlation between the Family size of the Senior Secondary School students and their Achievement in Mathematics?

Table 9: Pearson Moment Correlation Coefficient of the Family size of the Senior Secondary School students and their Achievement in Mathematics

Family Size	Number	Pretest		Posttest		Mean Difference	Pearson Correlation, r
		Mean ($\bar{x}$)	Std Dev. (s)	Mean ($\bar{x}$)	Std Dev. (s)		
Small FS	101	29.54	8.50	43.57	9.18	14.03	
Moderate FS	96	28.06	7.50	41.47	7.95	13.41	.030
Large FS	115	30.43	8.55	44.83	8.57	14.40	
Total	312	29.41	8.18	43.39	8.58		

Table 9 above displayed Pearson Moment Correlation Coefficient of the Family size of the Senior Secondary School students and their Achievement in Mathematics. Table 9 revealed that students from small Family size had a pretest mean score of 29.54 with the standard deviation of 8.50 while the posttest mean score was 43.57 with the standard deviation of 9.18 and a mean difference of 14.03, the students from moderate Family size had a pretest mean score of 28.06 with the standard deviation of 7.50 while the posttest mean score was 41.47 with the standard deviation of 7.95 and a mean difference of 13.41 and the students from Large Family size had a pretest mean score of 30.43 with the standard deviation of 8.55 while the posttest mean score was 44.83 with the standard deviation of 8.57 and a mean difference of 14.40. Also, the table showed that the Pearson correlation coefficient between the Family size of the Senior Secondary School students and their Achievement in Mathematics was 0.030. The result showed that there was a very low/poor positive relationship between the Senior Secondary School students' Family size and their Achievement in Mathematics.

HO_4: There is no significant relationship between the Family Size of the Senior Secondary School students and their Academic Achievement in Mathematics.

Table 10: Analysis of the Covariance of the Relationship between the Family size of the Senior Secondary School Students and their Academic Achievement in Mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Dec
Corrected Model	99073.222[a]	3	33024.407	1234.879	.000	
Intercept	18167.246	1	18167.246	679.327	.000	
SMAT_PRETEST	98478.269	1	98478.269	3682.391	.000	
FAMILY_SIZE	57.028	2	28.514	1.066	.346	NS
Error	8236.852	308	26.743			
Total	694651.000	312				
Corrected Total	107310.074	311				

a. R Squared = .923 (Adjusted R Squared = .922)
b. Regression: R = 0.030; R Squared = .000 (Adjusted R Squared = .003)

Table 10 above showed the Analysis of the Covariance of the Relationship between the Family size of the Senior Secondary School Students and their Academic Achievement in Mathematics. From the result in Table 10, it was revealed that R^2 yielded 0.000, which means that there is no variation in the Senior Secondary School Student' Achievement in Mathematics that is attributable to the joint effect of Students' Family size. The ANCOVA for the relationship (predication) showed that F-ratio was 1.066 and was not significant at 0.346. Since .346 was greater than 0.05, the null hypothesis 4 was rejected as stated. Hence, the study concluded that there was no significant relationship between the Family size of the Senior Secondary School students and their Academic Achievement in Mathematics. This implied that the very low positive relationship between the predictor variable and the criterion variable is not significant. This means that the students' Family size did not affect the students' achievement in Mathematics.

Discussions

The study revealed that the students' Parental Educational Level, Parental occupation and Family size did not significantly affect the students' achievement in Mathematics. For Parental Educational Level, the finding contradicts the findings of Ogbugo & Ololube (2016), there was a positive relationship between parents' educational background and the performance of their children at school but tallies with the findings of Busari (2014) who found out that qualification has no significant relationship with students' academic achievement in English literature in Imo state. The result implied that educated and not educated parents have no influence on their students' achievement in Mathematics. It is the level of investment that such parents made that makes influence on the students' achievement in Mathematics. The finding of this study as regards Parental Educational Status of students is not in consonance with the findings of Onah (2018) and Adelabu (2013) who found out that there is a relationship between educational status of parents and the students' achievement while for Family size, the finding of the study contradicts the findings of Ugwu (2010) who found out that family size and birth order has influence on the academic achievement of pre-degree students of tertiary institutions in Enugu state but tallies with the findings of Onah (2018) who reported that there was no significant relationship between family size and students' achievement in English Language. The study agreed with Adelabu (2013) who found out that socio-economic status demand from extended family were significantly related to the students educational aspirations in South west Nigeria. The study showed that it is the socioeconomic state of the parents that influence the students' achievement in mathematics. For the role of Socioeconomic Status, the study revealed that the Students' Parental Socioeconomic status significantly affected the students' achievement in Mathematics. Students' Parental Socioeconomic status significantly increases the students' Achievement Scores in Mathematics by 5.779%. This finding tallied with the assertions of Abraham (2019) who reported that students who had parents with high socio-economic status tend to academically perform better than the

children whose parents are low and middle high socio-economic statuses. This is because such children are economically empowered and their parents interacted everyday with the parents of other children, thereby being updated on the best education they can give their children. According to Odenize (2017), the type of Socioeconomic Status of the child's parents determines how much the parents can invest in his/her child's education, the type of school her child attends, the educational attainments of her child. Hence, Parents should strive to acquire more resources and invest such resources in their children's learning of Mathematics.

Conclusions

The study revealed that there was no significant correlation between the family background factors and the Senior Secondary School students' Achievement in Mathematics except the Students' Parental Socioeconomic status. The study disclosed that Students' Parental Socioeconomic status significantly predicted to increase the students' Achievement Scores in Mathematics by 5.779%. The study showed that students whose parents are High Socioeconomic Status are superior to students whose parents are Low and Medium Socioeconomic Status. This is because High Socioeconomic status parents invest on their children's academic especially in mathematics unlike their counterparts from Middle and Low Socioeconomic statuses. Hence, the study concluded that parents should continue to invest on their children/students' academics especially in Mathematics if they want their children/students to continue to improve on the knowledge of Mathematics because any additional improvement by 41.7% will increase their students' achievement in Mathematics by 5.78%.

Recommendations

Considering the findings in this study, the following recommendations are made:

1. Parents should continue to invest on their children/students' academics especially in Mathematics if they want their children/students to continue to improve on the knowledge of Mathematics.
2. Parents of secondary school students should put in more efforts in providing for their children's learning needs in other to improve their academic achievement in Mathematics.
3. Middle and Low Socioeconomic Parents should invest more on their Children's mathematics education.
4. Federal and State Government should invest on Mathematics Education by paying Mathematics teachers mathematics allowances that will prompt them to be more committed in teaching their students mathematics, providing all the necessary Mathematics learning materials to schools and make free education to help those from the low and middle income families have access to quality mathematics education.
5. Federal and State Ministries of Education with other government agencies and organizations like Mathematics Association of Nigeria (MAN), Science Teachers Association of Nigeria (STAN) etc should organize seminars, workshops and symposia for teachers and students aimed at discussing the effects (influence) of family background factors on students' achievement in mathematics especially on the role of Socioeconomic Factors to help students adopt alternative measures towards improving their learning of Mathematics.

References

Abraham, F. (2019). The impact of social capital on educational attainment: evidence from rural areas of Pakistan. *Research on Humanities and Social Sciences* 5(1); 95–102.

Adelabu, L.P. (2013). The roles of personality, vocational interest, academic achievement and socio-cultural factors in educational aspirations of secondary school adolescents in South Western Nigeria. *International Journal of Research in Education Development* 1(2); 171 – 191.

Adigun, O.T. & Aborisade, J.A. (2021). Influence of parents' educational background on the academic performance of pupils in mathematics in Ibarapa East Local Government Area of Oyo State. *International Journal of Research in Education and Sustainable Development* 1(5); 120 -131.

Bassey, L. (2010). *Nigeria: Education and Vision 2020.* From http://www.nigerianbestforum.com/generaltopic/?p=2010.

Brandy, F. (2013). The Role of Parents' Educational Status on their Children's Performance. *Journal of Educational Elites* 1 (2); 147 – 157.

Busari, A. A. (2014). The Correlation between students performance in social studies at JSS and achievement in Geography at senior secondary. *The Nigerian Teacher Today,* 1(2), 7 -11.

Charles-Ogan, G. (2014). Metacognitive strategy and senior secondary school Mathematics students' misconceptions in Rivers State, Nigeria. *abacus : Journal of the Mathematical Association of Nigeria,* 39(1), 234-246.

Chima, C. T. (2018). *Influence of parents occupation and children's development*. Lagos: Macmillan.

Emeka P.,Onorga. A. & Owolabi, A. B. (2012). Parental socio-economic background of pupils on academic attainment of pupil in primary school in Nigeria. *Nigerian Journal of Education* 2(2), 69-85.

Enyinna, N.O. & Ezekiel-Hart, J. (2021). Educational Level of Parents on Students' Academic Achievement in Secondary Schools in Abia State. *African Scholars Journal of Contemporary Education Research (JCER-8)* 21(8); 55 – 66.

Eremie, L.K. & Dimkpa, S (2020). Mother's influences on the high school student's academic achievement: A comparison of Asian immigrants, Asian Americans, and White Americans. *Psychology in the Schools*, 34(3), 267-277.

Eremie, M. & Dimkpa, A.C. (2020). Influence of Parental Guidance on Academic Performance of Secondary School Students in Rivers State. *International Journal of Innovative Psychology & Social Development* 8(1): 107-113. www.seahipaj.org

Eze, D.F. (2021). Influence of Parental Socioeconomic Status on Academic Performance of Secondary School Students in Ekiti State. *International Journal of Innovative Psychology & Social Development* 8(1): 57-63. www.seahipaj.org

Eze, S. I. & Ugwuanyi, C. C. (2013). Transformation of Mathematics education programme, a step towards the attainment of vision 2020. *abacus: Journal of Mathematics Association of Nigeria,* 27(1), 75-82.

Isaac, K. C. (2012). Family and religious influence on adolescents. *Journal of Growth Academics* 6 (3), 5-8.

Kenla, C.O. (2012). *Educational disport among families.* London: Income of family Press

Li, Z., & Qiu, Z. (2018). Educational and societal development. *The Journal of Chinese Sociology,* 10(3), 118-196. https://doi.org/10.1186/s40711-018-0083-8

Malik, N.A. & Salman, M.F. (2018). Teachers Perceptions of the Use of *BridgeIT* Mobile Application for teaching Mathematics at Basic Schools in Lagos State, Nigeria. *ABACUS* 43(1): 25 – 40.

Malik, N.A. (2017). Perceptions of teachers and pupils on use of *BridgeIT* mobile application for teaching mathematics in Lagos State, Nigeria. *An Unpublished doctoral dissertation of University of Ilorin, Ilorin, Nigeria*.

Mark, C. T. (2012). *Dynamics of family live*. Lagos: Ellison Press.

Nan, C. T. (2013). *Role expectation of families*. Englewood-Uiffs NJ: Prentice-Hall.

Ndukwu, E.C. (2017). Effect of immediate feedback on task persistence, self-efficacy and mathematics achievement of low achieving senior secondary school students. *An Unpublished Doctorate degree thesis of the Department of Science Education, University of Nigeria Nsukka*.

Nwana, K.O. (2011). *Research Methodology*. Port Harcourt: ABC printing Press.

Odenize, S.D. (2017). Interactive effects of family socioeconomic status, involvement and science achievement. *The Journal of Educational Research*, 96(6), 323-338.

Odili, G. A. (2016). *Mathematics in Nigeria secondary schools. A teaching perspective*. Enugu: Rex Charies and Patrick Ltd, in

association with Anachuna Educational Books.

Ogbugo F. & Olulube N. (2016). Home process variables that are related to educational environment. *Nigerian Journal of Education*, 2(2), 69-85.

Okafor, R. O. (2012). *Democracy in the family.* Enugu: Magnet Publishers.

Olivia, O. N. (2013). *Marriage, a history: How to conquer marriage*. New York: Viking/Penguin Books.

Onah, E.A. (2018). Family Factors as Correlates of Interest and Academic Achievement of Senior Secondary School Students in English Language in South-East Nigeria. *A Phd thesis of the Department of Educational Foundations, University of Nigeria Nsukka.*

Onyedikachim, E.N & Ezekiel-Hart, J. (2021). Educational Level of Parents on Students' Academic Achievement in Secondary Schools in Abia State. *African Scholars Journal of Contemporary Education Research (JCER-8)* 28(8); 55 – 66.

Roselyn, N. C. (2013). *Diversity in family life.* London: Ace Publication

Sam, D. H. (2013). *Achievement related motives and behaviours*. In J. T. Spence (ED), *Achievement and achievement motives* (7 – 74). San Francisco: W.H. Freeman.

Sean, F. R. (2013). The widening income achievement gap. *Educational Leadership*, 70(8): 10-16.

Udensi, M. N. (2013). *Children's emotion, family stability and academic achievement.* Ibadan: Longman.

Ugwu, P. O. (2010). *What is family?* Enugu: Magnet Press.

Ugwu, P. T. (2022). *Influence of family size and birth order on academic achievement of adolescents in tertiary institutions in South-East Nigeria.* Retrieved on 6/6/23 from http://www.familysizebirthorder.com/acamicachievementofadolescents

West African Examination Council (WAEC, 16, 2017, 2018, 2019, 2020, 2021, 2022). *West African Senior Secondary School Certificate Examination (WASSCE).* www.waec.org

INFLUENCE OF STUDENTS SELF EFFICACY ON STUDENTS ACADEMIC PERFORMANCE IN COMPUTER STUDIES IN AWGU EDUCATION ZONE, ENUGU STATE

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Abstract

Self efficacy could be at the root of these concerns because it has the capacity of attracting students' into performing very poor in examinations. Much as there are numerous factors associated with students' self efficacy, ascertaining influence of students self efficacy on students academic performance in Computer Studies in Awgu Education zone, Enugu State. is the problem that motivated the study. The purpose of the study was to ascertain self efficacy on academic performance of students in Awgu Zone, Enugu State. Three research questions were raised for the study while three hypotheses were tested. Survey research design was adopted for the study. All the 1,911 computer studies students were used for the study. The sample of this study was made up of 355 (200 Female and 155 female) students drawn through multi-stage sampling procedure. Self-Efficacy Questionnaire (SEQ) were used to collect data. The instruments for data collection were validated by three experts; two from the Department of Mathematics and Computer Education and one experts in the Measurement and Test Evaluation, all at Enugu State University of Science and Technology, Enugu. The reliabilities of SEQ were established using Cronbach Alpha statistics. Coefficients of 0.91 were obtained. Mean and t-test was used to answer the research questions and hypotheses. The findings of the study showed that self efficacy have a greater influence on academic performance of computer studies students and those female students have low academic efficacy in science subjects than the male counterparts. The implications of the study were brought to the fore and it was recommended among others that educational psychologists should evolve pedagogical interventions that will enable students develop time management skills that will address their self efficacy issues.

Keywords: *Self-Efficacy, Academic Performance, Gender*

Introduction

Education is described as the development of desirable qualities in people. This is why the basic principle of education in Nigeria is equipping every citizen with such knowledge, skills, attitudes and values as to enable one to derive maximum benefits from one's membership in a society, live a fulfilling life and contribute to the development and welfare of the society. In the spirit of promoting basic education and 'education for all' there was a plan to provide every child with nine year schooling up to the junior secondary school level (World Data on Education, 2020).

Science and technology studies is the study of how social, political and cultural values affect scientific research and technological innovation, and how these, in turn affect society, politics and culture. Science and technology is quite a broad category and it covers everything from studying the stars and the planets to studying molecules and viruses. Beginning with the Greeks and Hipparchus and Galileo and today, man continues to learn more and more about the world. In technology, you'll find many things that make life easy today. This includes medical advances like magnetic resonance imaging machines, portable computing devices and flat screen televisions.

Science which is a branch of study and part of education is as old as man. Since the inception of science, emphasis has been laid on the study and improvement of science because of its impact on the technology of nations. Its valuable role cannot be over emphasized in the societal world. According to Ezema (2018), science is an ever expanding dynamic subject involving the study of natural phenomenon and matter. It is a systematic enterprise that builds and organizes knowledge in the form of testable explanation and predictions about the universe. The introduction of science into Nigeria's post primary institution according to Ebeh (2016) started as early as 1878. It was taught as "general science" before with some basic ideas of Chemistry, Biology, Computer Studies and Computer Studies. The general sciences were suitable for least science oriented students who cannot pursue science beyond O'level stage. Later, there was introduction of core science subject which emerged from the general science such as Biology, Chemistry, Computer Studies and Computer Studies.

Computer Studies is the study of the theory, design, use and analysis of computer devices (Adigun, Onihunwa, Irunokhai, Sada & Adesina, 2015). This entails knowing the computer itself, its operation, what it can do, how it can do it and why it is doing it. These form the basis of Computer Studies curriculum in secondary schools. Therefore, computer studies, a recently introduced subject in the senior secondary school curriculum in Nigeria, introduces students to Information and Communication Technologies (ICT) which is of utmost importance and therefore needs to be given adequate attention particularly as it concerns its teaching/learning. This is necessary because of its unquantifiable significance towards introducing students to the world of computers and their applications on a wider scope.

Materials in learning Computer Studies is very important to cause of pleasure to the Computer Studies lessons so that students would be interested to learn and attention to all that have been studied. Attention that would encourage him to learn at home, at school and wherever it is located. Computer Studies is not a difficult subject but Computer Studies is a subject that is easy and fun. With strong interest in students to learn Computer Studies then it will be the driver to be active in learning Computer Studies so that lessons will run smoothly, influence ively and efficiently. Arrives to study objectives of Computer Studies is the first step in acquiring good performance. Intelligence and students' interest in learning and liveliness will have smoothed the process of teaching and learning in school in order to reach the learning objectives. The existence of student interest in learning Computer Studies will be seen when the learning process takes place, the good response from students that is active in learning, often ask, pay attention to any explanation from the teacher, not noisy in the classroom, and does not interfere with your friends who are diligent and also active in learning. Computer Studies teachers should try to make lessons more interesting and enjoyable so that students are motivated and enthusiasm in learning. Response students when they are interested to learn Computer Science, it can be seen when they study in the classroom with a variety of subject matter is interesting and not monotonous, so students do not fell bored and tired of learning Computer Studies (Sarason & Sarason, 2015).

Meanwhile, Computer Studies which is a branch of science is one of the core science subjects taught at the senior secondary school level of the Nigeria education system and is highly needed for technological breakthrough. It is a branch of science that deals with energy and matter and their interactions. It is sometimes referred to as the science of measurement and its knowledge has contributed greatly to the production of instruments and devices of tremendous benefits to the human race (Sani, 2019). The knowledge of Computer Studies is usually required to pursue courses like Astronomy, Geology, Medicine, Pharmacy, Engineering among others. Udoh (2019) established that learning of Computer Studies offers the students an opportunity to think critically, reason analytically and acquire the spirit of enquiry. This is why he asserted that: Computer Studies is crucial for influence ive living in the modern age of science and technology. Given its application in industry and many other professions, it is necessary that every student is given an opportunity to acquire some of its concepts, principles and skills.

These factors have equally added to decline in performance of students who enrolled for Computer Studies at the Senior Secondary Certificate Examination (SSCE). This is evident in the West African Examination Council (WAEC) results between 2020 and 2021. As a total of 165,604 candidates, representing 31.28% who sat for the 2016 WAEC in Nigeria, obtained credits and above in Computer Studies when compared to what was obtained in the same examination in 2015, 29.27%, 2018, 29.17%, 2017, 38.81%, 2019, 26.80% and 2018, 32.64%, it is presented as table in Appendix A. p. 53 that the performance not only fluctuates but also declines with years. The problem of low enrolment of students in Computer Studies class and poor performance of Computer Studies students in SSCE had been in part attributed to students' attitudes towards the subject and students' misconceptions that Computer Studies and most science subjects are difficult (Mekonnen, 2018). Affective factors such as anxiety, attitudes, interests, values, preferences, self-esteem, focus of control, motivation and self-efficacy influence students learning behavior and affect their final academic performance in their coursework.

Academic self-efficacy includes various learning and teaching processes. Jamali, Noroozi and Tahmasobi (2019) referred to academic self-efficacy as students' perceptions of their competence to do their class work. Academic self-efficacy refers to individuals' convictions that they can successfully perform given academic tasks at designated levels, which also includes the beliefs about the capabilities to achieve the tasks in certain academic fields. This belief is closely linked to self-concept which is a general self-descriptive belief that incorporates many forms of self-knowledge and self-evaluative feelings works together with personal motivation.

Therefore, it is important to determine the variables that influence students' performance in Computer Studies and this study now explored Self-efficacy and motivation as correlates of secondary school students' academic performance in Computer Studies. Also to explore the influence of gender on Computer Studies self-efficacy and motivation among the students.

According to Adedayo and Jegede (2017), the development in technology in Nigeria is poor and contributes immensely to the state of underdevelopment in Nigeria. There is need to redress and bring about a worthwhile growth in technology. Given that Computer Studies is one of the major subjects meant to provide the basic developments needed in technology, its influence ive learning should be put into consideration by adopting different strategies that will promote learning. Some of the research work carried out revealed that the performance of students in Computer Studies is very appalling and this calls for attention.

Majority of the students in the secondary schools in Nigeria perceived Computer Studies as a difficult subject. The impression cuts across gender. The cause of the negative perception of students towards Computer Studies was identified to include the fear of the mathematical skills involved, poor teacher-students relationship, students' un-readiness to study, preconceived bad information that Computer Studies is a difficult subject and poor method of teaching. This impression greatly affects students' readiness, interest, motivation and self-efficacy to the study of Computer Studies. If the situation is left unchecked, the performance of the students academically will be affected negatively and this becomes a problem.

Meanwhile, Majority of the students in the secondary schools in Nigeria perceived Computer Studies as a difficult subject. The impression cuts across gender. The cause of the negative perception of students towards Computer Studies was identified to include the fear of the mathematical skills involved, poor teacher-students relationship, students' un-readiness to study, preconceived bad information that Computer Studies is a difficult subject and poor method of teaching. This impression greatly affects students' readiness, interest, and self-efficacy to the study of Computer Studies.

The purpose of the study is to investigate influence of students self efficacy on students academic performance in Computer Studies in Awgu Education Zone, Enugu State. It is designed specifically to determine:

1. What is the influence of self-efficacy on students' academic performance in Computer Studies in Awgu Education Zone?
2. What is the influence of male students' self-efficacy on their academic performance in Computer Studies in Awgu Education Zone?
3. What is the influence of female students' self-efficacy on their academic performance in Computer Studies in Awgu Education Zone?

The following research questions guided the study;

1. What is the influence of self-efficacy on students' academic performance in Computer Studies in Awgu Education Zone?
2. What is the influence of male students' self-efficacy on their academic performance in Computer Studies in Awgu Education Zone?
3. What is the influence of female students' self-efficacy on their academic performance in Computer Studies in Awgu Education Zone?

The study tested the following null hypotheses at 0.05 level of significance.

1. There is no significant differences between self-efficacy on students' academic performance in Computer Studies.
2. There is no significant differences between male and female students' self-efficacy on their academic performance in Computer Studies

Methods

The descriptive survey design was used in this study. The correlation survey studies according to Nworgu (2015) a descriptive survey design is one which the entire population or a representative sample is studied by collecting and analyzing data for the group through the use of the questionnaire. The design was to be the most appropriate for the study because it permits the use of questionnaire to determine the opinions of the people in the study area.

The study was conducted in Awgu Education Zone in Enugu State. Enugu State has six Education Zones. The Zones are: Enugu, Agbani, Udi, Awgu, Obollo Afor and Nsukka. Awgu Education Zone consist of three Local Government Areas (LGA) namely AwguOji-River and Aninri L.G.A, Enugu State. The area is predominantly urban in nature with basic modern facilities such as good roads and electricity. Most people living in Awgu Education Zone are civil servants, lecturers, teachers, students and traders and a few are farmers. Thus, they value education. There are 54 public senior secondary schools in the zone. Awgu Education Zone is chosen because, it is made up of reasonable number of the school types (Boys schools, Girls schools and Co-Educational schools) which will enable the researcher draw a homogeneous sample for the study.

The population of the study was made up of the entire Senior Secondary two (SSII) Computer Studies Students totaling 1,911 students in the 54 government owned secondary schools within Awgu Education Zone. There are twenty six schools in Awgu, Seventeen (17) schools in Enugu Aninri and eleven (11) schools in Oji-River Local Government Area, Enugu State.

The sample comprises of 355 (20%) SSII Computer Studies students' who were drawn from 12 out of 54 government owned schools in Awgu Education Zone, using the multi-stage sampling technique. These schools include; three girls (only) schools, three boys (only) schools and six co-educational schools. In which four schools were sampled from each local government area of the Zone using simple random sampling (lucky dip) and purposive sampling. The only boys (only) school in Awgu and girls (only) school in Aninri were purposively sample.

The research purpose, scope, research questions, hypotheses and questionnaire items will be submitted to three experts, two from the department of mathematics and computer and one from Measurement and Evaluation, ESUT for face and content validation. These experts will examine the items in terms of contents; relevance and clarity as well ascertain if the items will be related to the purpose of the study. The clarity of language and coverage of relevant areas were also checked. The corrections given by the validators were influenced. The final draft will scrutinized by the supervisor before it was used for reliability test.

The reliability co-efficient of the questionnaires were established by administering the questionnaire to 25 students randomly in one of the secondary schools in Udi Education Zone in Enugu State outside the research area which has homogenous culture as the research area, Cronbach alpha was used to determine the reliability of the instruments. The reliability indices were found to be, 0.91 which shows that the instruments are reliable for the study.

The researcher with the aid of research assistants which were subject teachers in the sampled schools distributed the instruments to the respondents. She had meeting with the research assistants, where the objective of the study was discussed, the researcher ensured that all the research assistants understood the objective of the study by asking them questions. The responses at the end of administration were collected on the spot. The researcher revisited the school to collect any questionnaire that was not submitted on the spot. The data obtained were analyzed through mean statistics and t-test. Any item with a mean point above 2.50 is regarded a accepted whereas mean values less than 2.50 were regarded as not accepted.

Results

The results and discussion of findings. The results were presented in line with the research questions and corresponding hypotheses.

Research Question One

What is the influence of self-efficacy on students' academic performance in Computer Studies in Awgu Education Zone?

Table 1: Mean Response Scores on influence of self-efficacy on students' academic performance in Computer Studies.

S/N	ITEM	SA 4	A 3	D 2	SD 1	N	Efx	X	Decision
1.	Academic self efficacy breaks the barrier of low interest in Computer Studies	150	150	45	10	355	1240	3.4	Agree
2.	Students with low academic efficacy always perform poorly in Computer Studies	255	70	15	15	355	1275	3.52	Agree
3.	A lot of students that have negative belief in computer studies hardly solve problems in Basic issues in computer	180	90	75	10	355	1030	3.47	Agree
4.	Few students do avoid Computer Studies because they their performance in Computer Studies is very limited	160	130	62	3	355	997	2.80	Agree
5.	Some students have high belief in computer studies because of their career choice in science oriented courses	140	125	80	10	355	1105	3.11	Agree
	Grand Mean							**3.26**	Agree

Data in table 1 show a grand mean of 3.26 which is above the criterion mean of 2.50. This implies that self-efficacy on can improve or reduce students' academic performance in Computer Studies with grand mean of 3.26.

Research Questions 2: What is the influence of male students' self-efficacy on their academic performance in Computer Studies in Awgu Education Zone?

Table 2: Mean Response Scores on influence of male students' self-efficacy on their academic performance in Computer Studies

S/N	ITEM	SA 4	A 3	D 2	SD 1	N	Efx	X	Decision
6	Male students believes that computer is more practical	170	110	15	60	355	1100	3.0	Agree
7	Many male students believes that they are future engineers	150	130	10	65	355	1075	3.02	Agree
8	Male students do dedicate more time in science related subjects like computer studies	140	120	35	60	355	1050	2.95	Agree
9	Male students are more practical oriented	130	140	15	70	355	1040	2.92	Agree
	Grand Mean							**2.95**	Agreed

Data in table 2 show a grand mean of 2.95 which is above the criterion mean of 2.50. This implies that influence of male students' have higher self-efficacy on their academic performance in Computer Studies.

Research Questions 3: What is the influence of female students' self-efficacy on their academic performance in Computer Studies in Awgu Education Zone?

Table 3: Mean response Scores on female students' self-efficacy on their academic performance.

S/N	ITEM	SA 4	A 3	D 2	SD 1	N	Efx	X	Decision
10	Many female students believes that computer is for male students	140	125	80	10	355	1105	3.11	Agree

11	Many female students are not practical oriented	135	125	25	70	355	1035	2.95	Agree
12	Many female students enjoys more of reading and writing	105	155	30	65	355	955	3.18	Agree
13	It is believed by female students that computer engineering is highly dedicated to male students	110	160	65	20	355	1070	3.20	Agree
14	Few female students are believed to choose a career in computer related courses	140	120	35	60	355	1050	2.95	Agree
15	Almost all the female students have a negative and low efficacy concerning computer studies	130	140	15	70	355	1040	2.92	Agree
	Grand Mean							**3.01**	Agree

Data in table 3 show a grand mean of 3.01 which is above the criterion mean of 2.50. This implies that female students' self-efficacy have a negative influence on their academic performance.

Hypotheses

Ho_1 There is no significant differences between self-efficacy on students' academic performance in Computer Studies.

Ho_2There is no significant differences between male and female students' self-efficacy on their academic performance in Computer Studies

Table 4

There is no significant differences between self-efficacy on students' academic performance in Computer Studies.

Variable	N	X	SD	DF	Sig Level	t-cal	t-crit	Decision
Self efficacy/ performance	355	2.8878	0.434	354	0.05	0.3828	0.1980	No Sign

Based on the result on table 4, the calculated t –value at 354 degree of freedom and 0.05 level of significance is 0.3828. Since the calculated t –value is less than the critical table value of 1.98, the null hypothesis is therefore accepted. There is no significance differences between self efficacy and students academic performance.

Table 5

There is no significant differences between self-efficacy on students' academic performance in Computer Studies.

Variable	N	X	SD	DF	Sig Level	t-cal	t-crit	Decision
Male efficacy	155	2.8878	0.5188	353	0.05	2.0832	0.1980	Sign
Female efficacy	200	2.4312	0.5201					

Based on the result on table 5, the calculated t –value at 353 degree of freedom and 0.05 level of significance is 2.0832. Since the calculated t –value is higher than the critical table value of 1.98, the null hypothesis is therefore rejected. There is significance differences between male and female students self efficacy on their performance in computer studies. .

Conclusion

The study had shown that self efficacy have influence (positive or negative) influence on students academic performance in Computer Studies in Awgu Education Zone, and that male students are less efficacious than female students in some science subjects like computer studies.

Recommendations

Based on the findings of this study the following recommendations are put forward.

1. Teacher education programmes should include training teachers on ways of improving their students' performance motivation by adopting different teaching strategies and skills since motivation was of great influence on students' academic performance in Computer Studies.
2. Guidance and counselors in schools should guide female students properly on choice of career aspiration.
3. Ministries of education, both state and federal should organize workshops and seminars and sponsor teachers to attend in service courses on how to improve their teaching skills in order to enhance their students' performance motivation, thereby influence ively promoting students' academic performance.

References

Adedayo and Jegede (2017). A study of university students' motivation and its relationship with their academic performance. *International Journal of Business and Management*, 5(4), 80 – 88.

Adigun, C.O. Onihunwa, C.C, Irunokhai, P. Sada, N.K. & Adesina, O.E 2015). Self-efficacy and academic performance of the students of Gujrat University, Pakistan. *Academic Research International* 5(1), 283 – 288.

Ebeh, H.N. (2016). Academic self-efficacy: A reliable predictor of educational performance. *British Journal of Education*, 2(3), 57 – 64.

Ezema, J.U. (2018). *Integrated Science Method for Colleges and Universities*. Onitsha: Fogotek (Nig.) Limited.

Ezema, J.U., and Adizetu, A.A. (2018). Factors influencing the extent of use of library resources by Science Education undergraduates of University of Nigeria, Nsukka. *Journal of Department of Science Education University of Nigeria Nsukka*. 2(4),50 – 6.

Jamali, M., Noroozi, A., and Tahmasebi, R. (2019). Factors affecting academic self-efficacy and its association with academic achievement among students.*Iranian Journal of Medical Education*, 13(8), 629 – 641.

Mekonnen, S. (2018). Problems challenging the academic performance of Computer Studies

students in higher governmental institutions. *Journal Natural Science,* 6,32 – 49.

Nolting, P. (2007). *Winning at maths (5th ed.)*. Bradenton FL: Academic Success Press, Inc.

Nworgu, B.G. (2015). Research Designs. Educational Research: Basis issues and methodology. Ibadan, Nigeria: Wisdom publishers Ltd. 50-54.

Sani, A. (2019). Role of Computer Studies Education for Technological Development for Employment and Self-productivity in Nigeria. *Journal of Educational and Social Research*, 2 (10), 166 – 168.

Sarason, J.S. & Sarason, C.O. (2015). A gender study investigating Computer Studies self-efficacy.*FIU ElectronicTheses and Dissertations*. http://digitalcommons.fiu.edu/etd/519.

Udoh, A.U. (2019). Refocusing Computer Studies Education in Nigeria: Issues and Challenges in *Teacher Education Mediterranean Journal of Social Sciences*, 3(13).250 -261.

World Data on Education, 2020). Using self-efficacy theory as a guide for instructional practice. *Therapeutic Recreation Journal*, 1(4), 43 – 53.

EFFECT OF DRILL-AND-PRACTICE MODE OF COMPUTER AIDED INSTRUCTION ON JUNIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MATHEMATICS IN ENUGU EDUCATION ZONE

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Abstract

This study investigated the effects of drill-and-practice mode of Computer Aided Instruction on junior secondary school One students' achievement in geometry, in Enugu Education zone. Two research questions and a hypothesis guided the study. The design adopted by the researcher was a quasi-experimental research design called pre-test post-test none equivalent control group design. A sample of170 JS1 students from public secondary schools in Enugu Education zone of Enugu state made up of 83 male, 87 female. Purposive sampling technique was used to sample the schools that met the requirements for the study. Intact classes randomly selected after the purposive, were used for the experimental and the control groups. The treatment group was taught using the drill-and-practice mode of CAI, while the control group was taught using the chalk-talk method. The instrument for data collection was the geometry achievement test (GAT). It was face and content validated by experts. It had a reliability co-efficient of 0.98. The research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using ANCOVA. The result of the data analyses showed that, drill-and-practice mode of CAI is superior to the chalk-talk method in fostering students' achievement in geometry; there was no significant difference between the mean achievement scores of male and female students taught using the practice-and-drill mode of CAI.. It was recommended that Enugu State government should make use of drill and practice mode of CAI compulsory in teaching and learning of mathematics in their junior secondary schools.

Key words: *Mathematics, Geometry, Computer Aided Instruction, Achievement, JS1 students, Enugu Education zone*

Introduction

Mathematics has been playing significant roles in the development of nations. Dating from antiquity, mathematics has been doing the job of cultivating, sharpening, harnessing, refining and restructuring the intellectual faculty of all people in their different

levels and positions (Ozofor, 2015). Overview of the genesis and position of mathematics and mathematics education in Nigeria reveals that between 1930 and 1960, three books. Efficiency Arithmetic, A shilling Arithmetic, and Lacombe Arithmetic series were popularly adopted as Arithmetic class texts in primary schools in various parts of Nigeria (Badmus, 1977). These books contain topics, which could be described as arithmetic processes. The role of mathematics in national development can never be overemphasized. Indeed, Mathematics plays great roles in the general development of every nation. No wonder, in an attempt to enumerate its applications in different areas, Odumosu, Oluwayemi and Olatunde (2012) described mathematics as the carpenter's hammer, barber's clipper, hair dresser's comb, journalist's pen, broadcaster's microphone, doctor's stethoscope and lawyer's wig. It is the study of the measurement, relationships, and principles of quantities and sets, using numbers and symbols of which arithmetic, algebra, calculus and geometry are its branches (Obioma in Ozochinanuife, 2021).

Geometry is an indispensable branch of mathematics. It is the branch of mathematics that deals with the measurements and relationships of lines, angles, surfaces and solids (Hornby, 2022). Geometry is the mathematics of shapes; the branch of mathematics that is concerned with the properties and relationships of points, lines, angles, curves, surfaces, and solids (Encarta, 2009). It is also the branch of mathematics that deals with shapes and sizes. Geometry may be thought of as the science of space. It could be seen as:(a) plane geometry, geometric figures in two dimensions; (b) solid geometry, geometric figures in three dimensions; (c) space time geometry (in Einstein's theory of relativity)(Encarta (encyclopaedia), 2009). Coxeter (2003) defined geometry as the most elementary of the sciences that enable man, by purely intellectual process, to make predictions (based on observation) about physical world. The word geometry was coined from two Latin words-'geo' meaning earth and 'metry or metron' meaning measure or measurement. Sequel to that and the preceding explanations, geometry can be defined as the mathematics or branch of mathematics which, deals with measurement of plane, solid, and space figures including their properties.

Achievement: Achievement is a thing that somebody has done successfully, especially using their own effort and skill (Hornby, 2022).. It is the act or process of achieving something. An achievement is something done successfully, typically by effort, courage, or skill (Answers. ask, 2014). It is something accomplished, especially by superior ability, special effort, great courage, etc. (Dictionary.com, 2013). Achievement therefore, is something accomplished, got or done successfully through morally justified effort, ability, courage, and skill.

On achievement in mathematics with reference to geometry and CAI, Gambari, Ezenwa and Anyanwu (2014), compared the effects of two modes of CAI they called Animation with text (AT) and Animation with narration (AN). The report showed that the CAI package involving animation with narration (AN) generates more learning outcomes than animation with text (AT). Researchers are trying many innovative approaches because, the conventional teaching methods (i.e. chalk and talk or traditional methods) used in schools by teachers have not improved students' achievement in secondary school mathematics (Iyekekpolor in Okpube & Anugwo, 2016).

Academic achievement is the outcome of education; the extent to which a student, teacher or institution has achieved their educational goals (Wikipedia, 2017). It is commonly measured by examinations or continuous assessment but there is no general agreement on how it is best tested or which aspects are most important–procedural knowledge such as skills or declarative knowledge such as facts. Children's semi-structured home-learning environment transitions into a more structured learning environment, when children start first grade.

Examples of academic achievement: Academic achievements are achievements obtained in school by completing classes, maintaining good grades, and getting high scores on tests. Academic achievements do not include music or sports and are usually a representation of a student's exceptionally good work

in an academic term. Examples of academic achievement would be: a student winning a spelling bee, graduating first in their class, having the highest score on a test or quiz, and having the best grades in a class.

Academic achievement is a term used in schools when a student does well in academics (Wiki.answers, 2014). They achieve or do well in an area of school and do well in their studies. An example of academic achievement is Mathematics achievement. This is the score a student earns after performing mathematics task, which is after solving mathematics problems (Steinberger, in Ezenwelu, 2014).

In spite of the importance of mathematics in national development, students' academic achievement in mathematics at the secondary school level remains low. WAEC Chief Examiner's Report (2007, 2009, 2011 and 2013) showed that over 60% of the candidates performed poorly in mathematics by obtaining ordinary passes. The council observed that the poor achievement is caused by the students avoiding questions in geometry during the examination, showing a weak display of students' understanding of basic concepts and theories as they apply measurements and geometry (Anugwo and Dim, 2014). In spite of the (aforementioned) importance of mathematics in national development, students' academic achievement in mathematics at the secondary school level remains discouraging and disheartening. This is evidenced in their achievement in internal and external examinations. In the May/June 2011 West African Examination Council (WAEC) examination, only 38.93% of the candidates obtained credit and above in mathematics, while 838,314 candidates representing 55.34%, obtained credit and above in English Language (Uwadiae, 2011). This is in line with Agwagah in Ezenwelu (2014) assertions, that the achievement of students in mathematics in both internal and external examinations these days is very discouraging.

Olunloye in Abakpa and Igwue (2013) described the mass failure in mathematics as a national disaster and this limits learners' choice of careers. In Nigeria, remarkable poor achievement in mathematics was observed by the West African Examination Council's chief examiners over the years (WAEC, 2007 - 2011). Also, the reports from the West African Examination Council chief examiners indicated that the general achievement of the candidates in mathematics for the May/June, 2011, 2013 and 2015 examinations did not differ significantly from those of the previous years. Abysmal achievement of students in mathematics was observed in the past twenty- six years (Zalmon & Wonu, 2017). Some of the factors that affect students' achievement in mathematics occur naturally in students, through no effort of theirs while others are internalized by students through some external forces which include the way the society sees the subject (Ohanaka in Anugwo & Dim, 2014). Traditional mathematics teaching is still the norm in our nation's schools, and has continued to dominate the mathematics classroom (Agwagah, 2004). In traditional mathematics instruction, the teacher on daily basis shows the students several examples of how to solve a certain type of problem and then have them practice this method in the class and in homework.

Poor achievement in mathematics could be attributed to students' very poor achievement in geometry. This conception has for long been nurtured following the persistent very poor achievement of students in Geometry recorded in West African Examination Council (WAEC) chief examiner's reports (1996, 1997,1998,1999, 2000, 2002, and 2007). This was followed by the council's observation that the poor achievement is caused by the students avoiding questions in geometry during the examinations (WAEC, 2007, 2009, 2011, and 2013). Over the years, one can say that failures in WAEC SSCE (Senior Secondary Certificate Examinations) mathematics were due to, failures in geometry questions or students' weaknesses in geometry. Thus, evidence on poor achievement in mathematics is synonymous to evidence on poor achievement in geometry. Achievement in the area of geometry depicts achievement in mathematics, and poor achievement of students in geometry is imperative to the poor achievement of the students in mathematics (Harbor-Peters, and Ogbobe, in Anugwo and Dim, 2016).

Ani (in Anugwo and Dim, 2016) stated that another variable connected to achievement is interest. Sequel to the revealed problems in achievement in mathematics at the secondary school level, great mathematicians and stakeholders in education do not relent in their efforts, at improving the achievement of our students, to still the current situation(solve the current problems of achievement in mathematics). The latest emphasis is on the "learner" not on the "teacher" (Ezenwelu, 2014). Teachers improvise teaching aids for their teaching to be activity based. The Mathematical Association of Nigeria (MAN) and Mathematics Panel of the Science Teachers Association of Nigeria (STAN) organize workshops, paper presentations, seminars, quiz and Olympiad in their annual conferences to address the problem. They also write textbooks, and all these are moves to improve teaching and learning of mathematics. Agwagah (2004) advocated the employment of constructivism which is all about knowing and learning that emphasizes active role of learners in constructing their own knowledge thereby integrating, existing knowledge with new experiences.

In an attempt to make geometry easier to our students, the use of computer have been advocated by some professionals, such as Safo, Ezenwa, and Wushishi (2013), Gambari, Ezenwa and Anyanwu (2014).

Many professionals have advocated for and applied different methods and the use of instructional materials to improve the learning of geometry. Kurumeh (2007) tried the ethnomathematics approach, Abakpa and Igwue (2013) tried the mastery learning approach and Anugwo and Dim (2014) the SQ3R (Survey, Question, Read, Recite and Review)approach to mention but a few; yet students' academic achievement in mathematics at the secondary school level remains low. It still points to the problem of methods. If so, what next? Now, that the computers seem to be taking over everything, can they (the computers and their methods/modes) round up the problem and beef up significantly the students' achievement especially in geometry? Computer Assisted (Aided) Instruction (CAI) refers to situations in which a computer system is used in the process of instructing students (Odogwu, in Ozochinanuife, 2019). It is essentially learning with/through computer (but not about computers). In this case, the computer is used in a stimulated instructional situation. These stimulated instructional situations can be visual presentation and comments on learner's response and dealing with learner's additional comments. In mathematics, Computer Aided Instruction (CAI) programs demonstrate concepts, instruct, and remediate student errors. CAI applications are designed in several ways with different range of coverage. Computers are not substitute for good teaching, but they provide valuable instructional tool to help teachers and students learn (Saddiq, in Ozochinanuife, 2019 & 2021).

Computer Assisted Instruction is one of the multimedia instructions that has been empirically proved to enhance students' achievement, arouse their interest, and reduce the boring and abstract nature of mathematics (Adegoke et al in Gambari, Ezenwa, and Anyanwu, 2014). According to Wikiedu (2008), Devisiri and Kalaimathi (2016), CAI has numerous advantages; for instance: One-to-one interaction. This gives room to self-pacing and motivation of reticent students. In this situation, CAI is designed in such a way that by clicking the mouse buttons and pushing/punching some keys, the computer asks questions. In response, one answers the questions and in another click (such as 'check the answer') CAI gives the expected feedback as if one is discussing with another, one-on-one without external distraction. In this condition, one (or a student) proceeds at one's own pace, and with self-pacing a learner can move through a unit as slowly or as fast as he likes. He/she can repeat some tasks many times (drilling and practicing) until mastery is assured. In this case a reticent student who is afraid to make mistakes in a classroom situation is unconsciously motivated to learn effectively through learner autonomy. These agree considerably with Rowntree in Ozofor (2015). CAI applications are designed in several ways with different range of coverage (Saddiq, 2004). These methods or modes of CAI according to Saddiq (2004) in teaching and learning of Mathematics are as follow: problem solving, tutorials, drill and practice, simulation, and games. Mode means a particular way of doing something, or a particular type of something:

a mode of production/operation/communication; a mode of life/behaviour/dress. It is the way in which a piece of equipment is set to perform a particular task (Hornby, 2015).

Drill and practice is the method or mode of instruction where computer programs allow the students to interact directly with the computer on specific skills. Little is known about the use of computer-assisted instruction package in the Nigerian education system particularly in different mode settings (Gambari, Ezenwa, and Anyanwu, 2014). Drill and practice mode of CAI can be used by teachers as a follow-up after a lesson has been introduced to reinforce the teaching process. It provides opportunities for students to repeatedly practice the skills that have previously been presented and that further practice is necessary for mastery. These are in addition to the other advantages and characteristics of CAI highlighted earlier. Sequel to the above, Drill and Practice mode of CAI can clearly be seen as significant, though yet to be confirmed in Enugu state, and this is the reason the researcher is compelled to work on it to ascertain its efficacy compared to the observations and the results of other researchers who tried other modes (methods) especially in geometry.

In the light of the above persistent problem of geometry and mathematics teaching and learning, and the claims on CAI efficacy, the exploration of the above described innovative mode(of CAI) becomes imperative since CAI has numerous special features which can be infused into the teaching of Geometry. This study therefore sought to find out: if this drill and practice mode of CAI would make the students achieve significantly higher in geometry tests, and if this CAI drill and practice mode would favour the males and females equally.

Thus, the purpose of this study was to investigate the effect of Drill-and-practice mode of Computer Aided Instruction on academic achievement of junior secondary school One students in Geometry. Specifically, the study sought to find out the effects of:

1. drill-and-practice mode of CAI on the mean achievement of JS1 students in Geometry.
2. drill-and-practice mode of CAI on the mean achievement of male and female JS1 students in Geometry.

The study was guided by the following research questions.

1. What is the effect of drill-and-practice mode of CAI on the mean achievement of JSS students in Geometry?
2. What are the mean achievement scores of male and female students taught geometry using the practice-and-drill mode of CAI?

The following null hypotheses were tested at 0.05 level of significance.

Ho_1 There is no significant difference between the mean achievement scores of students taught geometry using the practice-and-drill mode of instruction and those taught using the chalk and talk method.

Ho_2 There is no significant difference between the mean achievement scores of male and female students taught using the practice-and-drill mode of instruction.

Methods

This study is a quasi-experimental study. It was conducted in Enugu Education zone of Enugu State. The area was chosen because no evidence of such study in that area or zone has been found at the start of this study. Enugu Education zone is made up of three local government areas, Enugu North, Enugu East and Isi-Uzo. Intact classes randomly sampled were used, after the purposive technique was used to select the schools that met the requirements for the study. Four schools were finally used. The population of the study comprised all the 5508 JS1 students of the public schools in the zone (PPSMB Enugu, 2023). The study sample was one hundred and seventy (170) JS1 students from public secondary schools in Enugu Education zone of Enugu state made up of 83 male, 87 female. The experimental group was 87, while the control group was 83. Intact classes were used. The classes were randomly assigned to the treatment and the control groups. The treatment group was taught

using the drill and practice mode of CAI, while the control group was taught using the chalk-talk method. The experimental group was made up of one male and one female school. Also the control group was made up of one male and one female school. The instrument for data collection was the GEOMETRY ACHIEVEMENT TEST (GAT). The GAT had a reliability co-efficient of 0.98 using Kuder-Richardson formula 20 (K-R20) and SPSS reliability analysis-scale (alpha). The research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using ANCOVA. The choice of JS1 is that the positive outcome of this study calls immediately for the application of the novel mode at the grass root level of the secondary school education. JS1 is the first of the upper basic education level in Nigeria. The earlier we introduce the novel mode the better. Let us catch them young.

The GAT was first administered to the subjects, experimental and control groups as pre-test and collected back before the start of the experiment proper. The treatment lasted for five weeks. Then the administration of the post-test to both groups followed. The scripts for the pre-test and post-test were collected, marked and the scores recorded accordingly.

The researcher adopted the following procedure to ensure that extraneous variables, which might introduce bias to the study, were controlled.

Teacher bias: It was clear that the researcher should not teach the groups, so the normal class subject teachers were used. The teachers on their own side differ in the way they present materials to the subjects. To control the variables, the researcher drew a clear instructional material for the study and prepared all the class teachers whose classes form the sample for the study. They were told exactly what to do. The researcher demonstrated, illustrated and explained as much as possible to see that the teachers comply with the specifications of the study. Furthermore, the researcher used the forum to discover or ascertain the problems of the individual teachers that might introduce bias to the study. Such problems like ill health (physical/mental impairment) were taken adequate care of beforehand. They conducted the experiment in their individual schools and classes. Experimental Mortality and Irregular participation: In the course of an experiment, some subjects might drop out or become irregular in attendance without cogent reasons. To control or minimize this phenomenon, the students were told from the beginning that roll calls (of subjects) in each group would be taken from time to time. This was carried out. Hawthorne-Placebo effect: This is the effect of subjects having the knowledge that, they are participating in an experiment. Definitely, they would be biased and this will affect the result of the experiment. To control this, the regular mathematics teachers of the different groups carried out the experiment. Test effect: To avoid this effect, the researcher rearranged the items of the post-test and changes the colour of the paper. Maturation effect: To control this, the researcher made the experiment to be as short as possible in duration, yet completing the necessary topics.

Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The decision rule was to reject the null hypothesis when the level of significance xceeds the given probability level.

Results

Research Question 1

What is the effect of drill and practice mode of CAI on the mean achievement of JSS students in Geometry?

Table 1: Mean Score and Standard Deviation of Students' Achievement for the two groups in Geometry

Groups	N	Adjusted Mean	Standard dev.
Drill and practice mode of CAI Approach	87	76.64	2.84
Chalk& talk	83	48.40	3.24

Table 1 shows the mean achievement scores of students taught Geometry with Drill and practice mode of CAI approach and those taught with Chalk and talk approach. Students taught with Drill and practice mode of CAI approach had mean score of 76.64 while students taught the same topics in Geometry with Chalk and talk approach had mean score of 48.40. The result showed that students taught with Drill and practice mode of CAI approach performed better in Geometry than those taught with Chalk and talk approach.

Research Question 2

What are the mean achievement scores of male and female JSS students taught Geometry using the drill and practice mode of CAI?

Table 2: Mean Score of males and females taught with Drill and practice mode of CAI approach

Students	N	Adjusted Mean	Standard deviation
Male	43	75.64	2.78
Female	44	77.64	2.90

In table 2 the male students taught Geometry with Drill and practice mode of CAI approach had mean score of 75.64 with standard deviation of 2.78 while the female students taught same topics in geometry with Drill and practice mode of CAI approach had mean score of 77.64 with standard deviation of 2.90. Thus, the female students taught Geometry with Drill and practice mode of Computer Aided Instruction approach performed slightly better than their male counterparts taught the same topic with Drill and practice mode of CAI approach.

Hypothesis

The null hypothesis was tested at 0.05 level of significance.

1. *There is no significant difference between the mean achievement scores of students taught Geometry using the Drill and practice mode of instruction and those taught using Chalk and talk method.*

Table3*: Analysis of Co Variance for Students' Overall Geometry Achievement scores by teaching strategies*

Source of variation	Sum of squares	DF	Mean square	F cal	f- probability
Covariates (Pretest)	475.147	1	475.147	80.373	.001
Main Effects	2196.137	2	1098.069	185.743	.000

Method	2194.965	1	2194.965	371.287	.000
Residual	975.442	165	5.912		
Total	3670.876	167	21.720		

For hypothesis 1, the ANCOVA table shows that the level of significance (0.05) is greater than the F-probability value (.001). The decision rule is to reject the null hypothesis when the level of significance exceeds the given probability level. Therefore, the null hypothesis was rejected. The researchers, therefore, conclude that there was a significant difference in the mean achievement scores of students taught Geometry using the Drill and practice mode of CAI approach and those taught Geometry using the Chalk and talk approach.

Discussions

In this study, the result of the analysis revealed that students taught geometry with Drill and practice mode of CAI performed better than those taught with the conventional (chalk-talk) approach. The study also showed that there was a significant difference in the mean achievement scores of students taught Geometry using the Drill and practice mode of CAI approach and those taught Geometry using the conventional approach. This result agreed with Yusuf and Afolabi (2010), Safo, Ezenwa and Wushishi(2013) that the experimental group taught with CAI performed better than the control group taught using the conventional expository method. Nevertheless, on the other hand, this finding did not agree with Tienken and Maher (2008) who found no significant positive influence on the students' achievement in mathematics using CAI (drill and practice) mode. This finding is also in contrast to the findings of Bayrakar (2008); Etukudo (2002) who did not find significant difference between the students exposed to CAI and those exposed to traditional method.

The result also showed that the female students taught geometry using drill and practice mode of CAI performed better than their male counterparts. According to the ANCOVA analysis there is no significant difference between the mean achievement scores of male and female students taught geometry using the Drill and practice mode of CAI approach. Null hypothesis was upheld. So, the mode fosters achievement equally in both male and female students. It greatly promotes the achievement of the boys and the girls equally, unlike the mathematical games which favoured the males, probably because as little children, the males love playing games a lot than the females (Okpube & Anugwo, 2016). This result supports Odogwu (2002), that there is no significant difference in the mean scores of the males and the females taught using CAI. Thus, the novel mode, which is student- centred, encouraged students in mathematics learning. This result equally supports Gambari, Ezenwa and Anyanwu (2014), Gambari and Adegbenro (2008), Osemmwinyen (2009), and Yusuf (2010) who found no significant difference between male and female students' achievement when taught geometry using the novel approach. This disagreed with Kurumeh (2006) who reported that female students achieved significantly higher than male students on effects of ethno-mathematics approach in geometry, and disagreed as well with Kolawole (2007) that male students achieved significantly better than the females in science education.

Conclusion

Sequel to the above, the researcher concludes that drill and practice mode of CAI is superior to the conventional (chalk-talk) method in fostering students' achievement in geometry. It is gender friendly, hence promotes learning evenly among the males and the females.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Enugu State and Federal Government should make the use of drill and practice mode of CAI compulsory for teachers teaching geometry and

mathematics in junior secondary schools in Nigeria.

2. Workshops should be organized by Enugu State Ministry of Education from time to time for teachers of mathematics on the use of CAI drill and practice packages in teaching geometry and mathematics in general.
3. The CAI packages should be developed by expert computer programmers and the teachers or ministries of education in line with the NERDC curriculum.
4. Students should be allowed by the school authorities to go to the computer laboratories from time to time for drilling and practicing, as practice leads to perfection. They should also be allowed and helped to procure some of the software for use at home and outside the computer laboratories.
5. Scientists and researchers should explore more of the CAI modes for increased success in the teaching and learning of geometry in this nation.

References

Abakpa, B.O. and Igwue, D.O. (2013). Effect of mastery learning approach on senior secondary school students' achievement and interest in geometry in Makurdi, Benue state, Nigeria. *Abacus: Journal of Mathematical Association of Nigeria (MAN),38*(1) 163-177.

Agwagah, U.N.V.(2004). Teaching number bases in junior secondary school mathematics. The use of the base board. Abacus: *The Journal of Mathematical Association of Nigeria*, *26*(1) 1-7.

Answers.ask. (2014). *What is academic achievement?* Retrieved from http://wiki.answers.com/Q/what is academic achievement... May 9, 2014

Anugwo, M. N. & Dim, C. (2014). Effects of survey, question, read, recite and review study (SQ3R) model on students' achievement in Geometry. *Journal of the Science Teachers Association of Nigeria (JSTAN)*, 49(1) 206-217

Badmus, G.A. (1977, August 1-3). An evaluation of the mathematics education component of Nigerian primary school curricula between 1930 and 1960. Paper presented at the *15th Annual Conference of the Mathematical Association of Nigeria,* Ahmadu Bello University, Zaria.

Bayraktar, C. (2008). Effects of computer simulation programs on university students' achievement in physics. *Turkish online journal of Distance Education*, 9(5) 53-62

Coxeter, H.S.M. (2003). *Introduction to Geometry*. Toronto: University of Toronto.

Devisiri, K. and Kalaimathi D. H. (2016). *Effect of CAI on the achievement of information technology.* U.S.A.: Lulu Publication ©.

Dictionary.com(2013). What is achievement? http://answers.ask.com/Education/ schools/what is a...23 Feb.

Edmiston, M. (2015). *Computer assisted instruction and mathematics.* Washington, DC 2007: The access centre, American Institute for Research (AIR). www.air.org/project/access-centre-improving-outcomes-all-student-k-8

Encarta (2009). *Geometry*. Microsoft® Encarta®2009[DVD], Redmond, WA: Microsoft Corporation, 2008.

Etukudo, U.E. (2002).The effect of computer assisted instruction on gender achievement of junior secondary school students in mathematics. *Journal of MAN*, *27* (1) 1- 8.

Ezenwelu. P.N.(2014). *Relationship between emotional intelligence and mathematics achievement of senior secondary students in Enugu state*. An unpublished MED thesis, University of Nigeria Nsukka, Nigeria.

Gambari, I. A., Ezenwa, V. I., and Anyanwu, R. C.(2014). Comparative effects of two modes of computer-assisted instruction package on solid geometry achievement. Federal University of Technology, Minna Nigeria: *Contemporary educational technology*, *5*(2)110-120. Retrieved from http://www.cedtech.net/articles/52/522.pdf 28/05/2017

Hornby, A.S (2022). *Oxford Advanced Learner's Dictionary.* Oxford: Oxford University Press.10th edition https//www.amazon.in > OXFORD….

Kurumeh, M. S. (2006).Effect of ethnomathematics approach on students' achievement in geometry and mensuration. *Journal of Mathematical Association of Nigeria, ABACUS, 31* (1) 35- 44.

Odumosu, M.O, Oluwayemi, M.O, & Olatunde, T.O (2012). Mathematics as a tool in technological acquisition and economical development in transforming Nigeria to attain vision 20, 20; A proceeding of Mathematical Association of Nigeria (MAN) Annual National Conference, 199-207.

Okpube, N.M. & Anugwo, M.N.(2016). Card games and algebraic tic-tacmatics on achievement of junior secondary school II students in algebraic expression. *International Journal of Evaluation and research in education.5(2), 93-100.*

Osemmwinyen, A. C. (2009). *Effects of e-learning on retention and achievement in secondary school mathematics in Abuja, Nigeria*(Unpublished doctoral dissertation). University of Nigeria, Nsukka.

Ozochinanuife, E.S.(2019). Effect of Visual BASIC computer aided instruction on academic achievement of junior secondary school students in mathematics in Agbani Education zone of Enugu State. *Journal of Research in Science and Vocational Education .1(1),*194-203 https//jrsve.gouni.edu.ng

Ozochinanuife, E.S.(2021). Effects of drill and practice mode of Computer Aided Instruction on junior secondary school students' achievement and interest in Geometry. An unpublished M.Sc.Ed. Dissertation, EBSU, Abakaliki

Ozofor, N. M.(2015). Effects of two modes of computer aided instruction on students achievement and interest in statistics and probability..International Journal of Education and Research. 3(1) ISSN 2201-6333

Safo, A.D., Ezenwa,V. I. and Wushishi, D. I. (2013). Effects of Computer Assisted Instructional package on junior secondary school students achievement and retention in geometry in Minna. *International Journal of Humanities and Social Science Invention,2* (5) 69-74. ISSN (Online): 2319-7722, ISSN (Print): 2319-7714: Retrieved from www.ijhssi.org

Tienken, C.H. and Maher, J.A. (2008). The influence of Computer Assisted Instruction on eight grade mathematics achievement. *National Middle School Association, RMLE Online 32*(*3*) ISSN 1940-4476.

Uwadiae, I. (2011, August 10). Address by the head of the national office WAEC. *The Nigerian Voice,*(Abuja): Retrieved from www.the nigerianvoice.com/nvnews/581

WAEC (2011). *Chief Examiner's Report*. Lagos: West African Examinations Council.

Wikipedia (2014, July 12). Mathematics Education in U.S.A. *Wall Street Journal*, *New York Times*, Chicago: Sun Times. http://en.wikipedia.org/wiki/mathematics_education_in_the_United_States10/02/2015

Wikipedia (2017). *Academic achievement.* Retrieved J une 1,2017;from https://en.wikipedia.org/wiki/Academic_achievemen

Yusuf, M.O. & Afolabi, A.O. (2010). Effects of Computer Assisted Instruction (CAI) on secondary school students' performance in biology. *Turkish Online Journal of Educational Technology, 9*(1) 62-69. Retrieved March 23, 2020 from https://www.learntechlib.org/p/55757/.

Yusuf, M.O. (2010). Effects of Computer Assisted Instruction (CAI) on secondary school students' achievement in Biology. *Journal of Educational Technology; 9(1) 62-69*

Zalmon, I. G. &Wonu, N.(2017). Comparative analysis of student mathematics achievement in West African Senior Secondary Certificate Examination in Nigeria. *European Journal of Research and Reflection in Educational Sciences. 5*(1) 25-30. ISSN 2056-5852 www.idpublications.org

AVAILABILITY AND UTILIZATION OF INSTRUCTIONAL RESOURCES IN TEACHING OF COMPUTER STUDIES IN SENIOR SECONDARY SCHOOLS IN AWGU EDUCATION ZONE, ENUGU STATE

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Abstract
The study investigated the extent of availability and utilization of instructional resources in teaching and learning of Computer science in Senior Secondary Schools in Awgu Education Zone, Enugu state. The research was guided by two research questions. The researcher employed survey method. The population of the study consists 1,911 and sample size of three hundred and eighty (380) respondents were sampled from secondary schools in Enugu Education Zone. A structured questionnaire was used as an instrument for data collection with four (4) likert scale and was validated by experts in the department. Test re-test method was used to ensure the reliability of the instrument. Cronbach Alpha was used to correlate the two scores obtained; the degree of the test obtained was 0.7. Mean analysis was used to provide answers to the research questions. The findings of the study showed that instructional resources are available and highly utilized for the teaching and learning of computer studies in Awgu Education Zone. From the findings, it was recommended that Teachers should make use of instructional resources in their teaching and that Government should provide funding for the provision of instructional resources in secondary schools.

Keywords: *availability, utilization, Computer Studies, Instructional resources*

Introduction

Materials are classified according to many different criteria including their physical and chemical characteristics as well as their intended applications whether it is thermal, optical, electrical, magnetic, or combined materials can be anything consisting of pure or impure substance, a singular composite or a complex mix, living or non-living matter, whether natural or man-made, either concrete or abstract ideas. Ibeneme (2020) defined teaching aids as those materials used for practical and demonstration in the class situation by pupils and teachers. Instructional materials are essential and significant tools needed for teaching and learning of school subjects to promote teachers‟ efficiency and improve students' performance. Orji (2020) asserts that teaching resources is "the guidance of learning activities" that "a teacher uses to motivate and arouse student's desire to learn" From the fore-going statement, it can be agreed that for effective learning to take place, a student need to be properly guided by the teacher by way of employing various method and means through which his teaching could be meaningful. Teaching is a transformational process that involves the transfer of knowledge and skills from a more experienced individual (teacher) to the leaner. Teaching fosters behavioral change in the leaner. Teaching is a set of events designed to initiate, activate and support learning (Koko, 2015). Teaching involves all activities that are geared towards the transfer of knowledge. Teaching Computer science to students in a clear and unbiased manner supports beginner students, master the essential principles of understanding the economizing problem, specific

economic issues, help the student to understand and apply Computer studies in a precise and empirical manner on economic issues and promote a lasting student interest in issues of Computer studies (Chakra, 2016). The teaching of Computer studies is indispensable in any country that is interested in providing training techniques and tools of economic analysis and researchers who can contribute to the development of society.

According to Federal Republic of Nigeria (FRN, 2017), Computer science is one of the elective subjects to be studied at the Senior Secondary School level as presented by the National Policy on Education, developed by the Comparative Education Study and Adaptation Centre and now reviewed by the Nigerian Educational Research and Development Council. Computer science according to Brookshear (2019) is a discipline that seeks to build a scientific foundation for such topics as computer design, computer programming, information processing algorithmic solutions problems, and the algorithmic process itself. Brookshear, (2019) continues to say computer science provides the underpinnings for today's computer applications as well as the foundations for tomorrow's computing infrastructure. Computer in education can be defined as the process of training and instructing children and young people on how to use and operate the computer to develop basic skills in computing and making contributions to the society. The computer science education curriculum content should be packaged in such a way that it will cover all the necessary area that supposedly affect the teaching and learning of computer science so that students' performance in the course of study would be enhanced. Teachers and learners alike must approach computer science with an open mind for them to engage in a meaningful interaction during the processes of teaching and learning of computer science.

Any established school curriculum calls for means of implementing it in order to reach the objectives at the various levels. Methods of teaching and learning are planned activities involves in the presentation of the curriculum. The discussion, tutorial, lecture, discovery or demonstrations are examples of bringing the students into contact with the subject matter. The effectiveness of this contact demands activities and instructional materials. This may be in the form of symbolic and pictorial presentation, real objects and specimens, experiment and demonstration. Meanwhile, teaching Computer science like every other subject requires the use of instructional resources to help gain the attention of the learner and to further explain concepts. Instructional resources make teaching and learning more understandable, meaningful and easy and its benefits to teaching and learning cannot be overemphasized. The absence of instructional resources hinders the efficiency in teaching. The use of instructional resources in Teaching Computer science remains the gateway to achieving set objectives as Ubulom and Ogwunte (2017) emphasized that instructional resources and facilities are very necessary for the utmost realization of the goals of education and requires being available and in good condition.

Availability refers to services/resources that can be obtained in the discharge of certain functions. Longman (2018) asserts that availability refers to resources ready to be used, able to be used or that can easily be found and used. Onyejiemezie (2018) noted that availability is a state of making provision for a satisfactory standard requirement in terms of teaching resource to enhance effective instructional activity in a particular subject. In other words, availability can be defined as human and material resources ready for use in teaching physical education. In recognition of the importance of availability of resources in teaching Olaitan, Igbo, Ekong, Nwachukwu and Onyemaechi (2019) noted that no meaningful learning or transfer of what has been learned will take place if such learning occurs in a situation devoid of relevant materials and activities as well as concrete experiences. The importance of availability of resources cannot be over-emphasized in teaching of Computer studies in schools. The availability of resources- instructional facilities, equipment and supplies as well as adequate personnel motivates the learners, increases the teacher's efficiency and promotes the productivity of the teacher. Facilities, supplies and equipment provision are important aspect of Computer studies when utilized effectively.

Utilization of instructional resources will make the learners employ most of their senses so as to make learning easier and a worthy experience. Baribor (2017) noted that the use of instructional resources is to aid the teacher in his teaching and the learner in his learning. He further stressed the importance of instructional resources in learning to include, extending the range of experience available to learners; providing the teacher with interest-compelling springboards into a wide variety of learning activities, assisting the teacher in overcoming physical difficulties of presenting subject matter, helping to stimulate student's interest, extend attention span and make for longer retention of what is learned; making it possible to cater for individual differences of learners, making teaching and learning easier and more effective as well as facilitating communication. This study is of the view that instructional resources for Teaching Computer science should be selected, supplied and be used effectively. The realization of this objective depends on the utilization principles. These principles include; the learner's characteristics, behavioural objectives and instructional constraints of Computer science as a subject.

Computer science as a subject is more of practical training than theoretical. Teachers therefore, should arrange conditions under which students learn more rapidly and effectively. The teacher should select relevant instructional resources to facilitate his teaching and learning. Some instructional resources include computers, made up of the keyboard, mouse, monitor, processor, interface, printers and disk drives, laboratory, projected pictures, textbooks and chalk board. The use of the above instructional resources in teaching and learning Computer science in secondary schools cannot successfully accomplish its objectives without the availability of these instructional resources in schools. There is also additional demand on teachers' time and competency. Past studies have bemoaned the non-availability and/or non-utilization of instructional resources for learning of Computer science as well as other subjects in Nigeria. The level of availability of instructional resources for teaching and learning is very low (Adedijio, 2018; Ogoma, 2019; Nwafor & Eze, 2017; and Arum, 2019). Eya and Neboh (2019) identified four major types of instructional resources the public schools need, which include: two-dimensional materials, three-dimensional materials, audio materials and audio-visual materials. Studies have shown that in most Nigerian schools, materials such as all audio or audio-visual materials like cassette recorder, tape-recorded materials, radio, projectors, film strips, slides, transparencies, television and video recorders are not available and where they are provided, they are inadequate (Eya, 2020). Whereas instructional resources such as textbooks and two-dimensional materials are readily available in schools for learning of computer studies, three-dimensional materials, audio materials, audio visual, computers and computer laboratories are not available in most Nigerian secondary schools (Adedijio, 2017; Nwafor and Eze, 2019). This is a situation that seriously hampers the effective teaching and learning of Computer science and acquisition of Information and Communications Technology (ICT) skills among secondary school students in Nigeria (Akanbi, 2018). Awgu local government have been in serious menace in infrastructural development in corroboration with poor monitoring and maintenance of instructional resources, just like every other part of the State were students performance are jeopardized by a lot of extraneous issues or challenges. Poor academic achievement in Computer science could be attributed to many factors among which teachers' strategy itself was considered as an important factor. This implies that the mastery of Computer studies concepts might not be fully achieved without the use of instructional materials. The teaching of Computer science without instructional resources may certainly result in poor academic achievement. Franzer (2018) stressed that a professionally qualified science teacher no matter how well trained, would unable to put his ideas into practice if the school setting lacks the equipment and materials necessary for him or her to translate his competence into reality. Bassey (2021) opined that Science is resource intensive, and in a period of economic recession, it may be very difficult to find some of the electronic gadgets and equipment for the teaching of Computer studies in schools adequately. A situation that is further compounded by the galloping inflation in the country and many at times, some of the imported sophisticated materials and equipment are found expensive and irrelevant;

hence the need to produce materials locally. Researchers such as Obioha (2016) and Ogunleye (2017) reported that there were inadequate resources for Teaching Computer science in secondary schools in Nigeria.

They further stated that the available ones are not usually in good conditions. There is the need therefore, for improvisation. Adebimpe (2017) and Daramola, (2018) however noted that improvisation demands adventure, creativity, curiosity and perseverance on the part of the teacher, such skills are only realizable through well-planned training programme on improvisation. Meanwhile, the study aimed at identifying the extent of availability and utilization of instructional resources in teaching and learning of Computer science in secondary schools in Awgu Education Zone.

Instructional resources make teaching and learning more understandable, meaningful and easy. But despite of the benefits of instructional resources to teaching and learning, the scarcity of the instructional resources has hindered, to some extent, the efficiency of teaching and learning of Computer studies. In view of these difficulties, most teachers of Computer science still resort to the theoretical method of teaching the subject. This undoubtedly, is contrary to the improvement of Computer science education, which is greatly needed at this period of our development with emphasis on practical oriented learning. The researcher has taught for a number of years in some secondary schools and had visited a number of secondary schools as a resource person. Through these experiences, the researcher observed that most teachers in secondary schools in the state did not fully make use of instructional resources in the teaching of Computer science to their students. This negligence of the effective use of the instructional facilities and materials in teaching and learning of Computer science common to both the trained and untrained teachers affected the academic performance of students in Computer science in secondary schools in Enugu State. In most cases, many schools do not have any provision for instructional resources in correspondent with the ugly situation of Nigeria educational system. Few schools that have instructional facilities are been managed by incompetent and obsolete teachers who find it difficult to organize instructional facilities to yield a positive teaching outcome.

Researchers opined that there has been General outcry about poor students‟ performance in the Senior Secondary School Examination especially in science oriented subjects like Physics, Chemistry and Computer Science. This study will examine the students' academic performance in Computer science as it relates to the extent of availability and utilization of instructional resources in teaching and learning Computer science in secondary schools in Awgu Education Zone.

The main purpose of the study was to find out the extent of availability and utilization of instructional resources in teaching and learning of Computer science in Senior Secondary Schools in Awgu Education Zone.

Specifically the study was designed to find out the extent:

1. availability of instructional resources for teaching and learning of Computer studies in senior secondary schools in Awgu Education Zone
2. utilization of Instructional resources for Computer studies in senior secondary schools in Awgu Education Zone

The following research questions guided the study.

1. What are the extent of availability of instructional resources for teaching and learning of Computer science in senior secondary schools in Awgu Education Zone?
2. What are the extent of utilization of Instructional resources for Computer studies in senior secondary schools in Awgu Education Zone?

The following hypothesis was developed to guide the study:

Ho_1

There is no significant different between availability of instructional resources and teaching and learning of Computer science in senior secondary schools

Ho_2
There is no different between utilization of instructional resources and teaching and learning of Computer science in senior secondary schools.

Methods
The procedure used by the researcher in collecting data for the study and were presented under the following subheadings; research design, area of study, population of the study, sample and sampling techniques , instrument for data collection , validation of the instrument, reliability of the instrument , method of data collection and method of data analysis.

The research design adopted for this study, was a survey design. This was used to elicit different opinion of people on issues under investigation. Survey design is a data collection method in which tools are used to gather information about an issue concerning the society (Nworgu, 2015). Survey design was used to elicit information from the respondent in order to examine the extent of availability and utilization of instructional resources in teaching and learning of Computer studies in Enugu East local Government Area.

The study will be conducted in Awgu Education Zone in Enugu State. Enugu State has six Education Zones. The Zones are: Enugu, Agbani, Udi, Awgu, Obollo Afor and Nsukka. Awgu Education Zone consist of three Local Government Areas (LGA) namely Awgu, Oji-River and Aninri L.G.A, Enugu State. The area is predominantly urban in nature with basic modern facilities such as good roads and electricity. Most people living in Awgu Education Zone are civil servants, lecturers, teachers, students and traders and a few are farmers. Thus, they value education. There are 54 public senior secondary schools in the zone. Awgu Education Zone is chosen because, it is made up of reasonable number of the school types (Boys schools, Girls schools and Co-Educational schools) which will enable the researcher draw a homogeneous sample for the study. The reason for this is to identify wither there is gender stereotype issues in the provision of instructional materials among schools in the area.

The population of the study was made up of the entire Senior Secondary two (SSII) Computer Studies Students totaling 1,911 students in the 54 public secondary schools within Awgu Education Zone. There are twenty six schools in Awgu, Seventeen (17) schools in Aninri and eleven (11) schools in Oji-River Local Government Area, Enugu State.
The sample will comprise of 380 (20%) SSII Computer Studies students' who were drawn from 12 out of 54 government owned schools in Awgu Education Zone, using the multi-stage sampling technique. These schools include; three girls (only) schools, three boys (only) schools and six co-educational schools. In which four schools were sampled from each local government area of the Zone using simple random sampling (lucky dip) and purposive sampling. The only boys (only) school in Awgu and girls (only) school in Aninri were purposively sample.

In each school, the students were purposively sampled to obtain the students whose cumulative annual results are in the school and then 32 SSII Computer Studies students was randomly sampled using balloting.

The instrument used for the collection of data was extent of availability and utilization of instructional materials in teaching and learning of computer studies questionnaire (EAUIMTLCSQ). The questionnaire has two sections (section A and B). Section has to do with data of the respondents; A contains information about the section B contained questionnaire that are divided into five clusters. Cluster A to C, respondents options are High Extent (HE), Extent (LE), Low Extent (LE), Very Low Extent (VLE), where cluster D and E respondents options are Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) The respondent were also required to tick good (√) where applicable to them.

The research purpose, scope, research questions, hypotheses and questionnaire items were submitted to three experts all in the department of mathematics and computer, ESUT for face and content validation. These experts examined the items in terms of content relevance and clarity as well ascertain if the items will be related to the purpose of the study. The clarity of language and coverage of relevant areas were also

checked. The corrections given by the validators were effected. The final draft was scrutinized by the supervisor before it was used for reliability test.

In testing the reliability of the instrument, the researchers employed a Pilot Study. This method can be described as a system where a respondent who had completed a questionnaire previously was asked to do so at a later date, two weeks. After this, the two responses are compared using correlation analysis. The correlation co-efficient obtained using the Cronbach Alpha method of estimating reliability was 0.64 this indicates that the instrument has a high level of reliability.

The researcher with the aid of research assistants which were subject teachers in the sampled schools distributed the instruments to the respondents. She had meeting with the research assistants, where the objective of the study was discussed, the researcher ensured that all the research assistants understood the objective of the study by asking them questions. The responses at the end of administration were collected on the spot. The researcher revisited the school to collect any questionnaire that was not submitted on the spot. 100% (380) of the questionnaire were filled and returned accurately after administration.

Research questions 1-5 were answered using mean. Hypotheses 1 to 5 were tested using t-test statistic at .05 level of significance. A mean score of 2.50 and above was classified as High Extent (HE) while mean score of less than 2.50 was classified as Low Extent (LE). For the purpose of analysis of data, responses of Very High Extent (VHE), High Extent (HE), Low Extent (LE) and Very Low Extent (VLE).
For the hypothesis, if the t-calculated was greater than t-critical, the null hypothesis was rejected. On the other hand, the hypothesis will not rejected when t-cal was less than t-crit.

RESULTS

The data collection for the study were presented and analyzed based on the research questions that guided the study.

Research Question 1

To what extent are instructional resources available for teaching and learning of Computer studies in senior secondary schools in Awgu Education Zone?

Table 1: Mean responses from the respondents on the extent of availability of instructional resources in teaching Computer science in secondary schools.

		N=380						
S/N	Item	**VHE**	**HE**	**VLE**	**LE**	ΣFX	X Mean	Remark
1	Radio materials are effectively utilized in teaching and learning of Computer studies	100	100	100	80	980	2.57	High Extent
2	Tape-recorder is not effectively utilized in teaching and learning of Computer studies	150	150	30	50	1010	2.65	High Extent
3	Earpiece materials is not used at all in the teaching and learning of Computer studies	300	70	5	5	1425	3.75	High Extent
4	Audio cassette player are used in low extent in teaching and learning of Computer studies	150	100	50	80	1080	2.84	High Extent
	Grand Mean						**2.89**	**High Extent**

Data in table 1 showed a grand mean of 2.89 which is above the criterion mean of 2.5. This implies and proved that the items 1-4 in table one above are the various extent to which instructional resources are available in learning of Computer science in secondary schools.

Research Question 2

What is the extent of utilization of instructional resources for enhance effecting Teaching Computer science in senior secondary schools in Awgu Education Zone?

Table 2: Mean responses from the respondents on the extent of utilization of visual materials in Teaching Computer science in secondary schools.

N 380

S/N	Item	**VHE**	**HE**	**VLE**	**LE**	ΣFX	X Mean	Remark
5	Some Computer studies teachers make use of over head projector during Computer studies Class	150	150	30	50	1010	2.65	High Extent
6	White or black board are mainly used by teachers to teach Computer studies.	160	150	40	20	1190	3.13	High Extent
7	The use of flip chart is the common method of Teaching Computer studies to students in Schools	220	80	50	30	1250	3.28	High Extent
8	Half of Computer studies teachers make use of paper handouts during Computer studies Lessons	180	100	58	42	1178	3.10	High Extent
	Grand Mean						**3.26**	**High Extent**

In table 2 above, a grand mean of 3.26 which is greater than the criterion mean of 2.5 was arrived at. It therefore showed "agree", identifying the extent of utilization of visual materials in Teaching Computer science in secondary schools.

Hypothesis

The following hypothesis was developed to guide the study:

Ho_1 There is no significant different between availability of instructional resources for teaching and learning of Computer science in senior secondary schools

Table 3: t-test on availability of instructional resources and teaching and learning of computer studies

Variable	N	X	SD	DF	Sig Level	t-cal	t-crit	Decision
Availability of instructional resources / teaching and learning	380	2.8878	0.434	379	0.05	0.3828	0.1980	No Sign

Based on the result on table 3, the calculated t –value at 379 degree of freedom and 0.05 level of significance is 0.3828. Since the calculated t –value is less than the critical table value of 1.98, the null hypothesis is therefore accepted. There are no significance differences between availability of instructional resources and teaching and learning of Computer science in senior secondary schools.

HO_2: There is no different between utilization of instructional resources for teaching and learning of Computer science in senior secondary schools

Table 4: t-test table on utilization of instructional resources in teaching and learning of computer studies

Variable	N	X	SD	DF	Sig Level	t-cal	t-crit	Decision
Utilization of resources/ teaching and learning of computer studies	380	2.8878	0.5188	379	0.05	2.0832	0.1980	Sign
	380	2.4312	0.5201					

Based on the result on table 4, the calculated t –value at 379 degree of freedom and 0.05 level of significance is 2.0832. Since the calculated t –value is higher than the critical table value of 1.98, the null hypothesis is therefore rejected. There is significance differences utilization of instructional resources for teaching and learning of Computer science in senior secondary schools.

Summary of Findings

1 respondents agreed that instructional resources are highly provided for the teaching and learning of computer with grand mean of 2.89

2 Result of the study revealed that instructional resources are highly utilized for the teaching and learning of computer in Awgu Education Zone with grand mean of 3.26

The hypothesis tested stated that There are no significance differences between availability of instructional resources and teaching and learning of Computer science in senior secondary schools, while there is significant different in its utilization. This is to say that the materials are available, but not adequately utilize.

Discussion of Findings

Result in table 1 showed that instructional resource available for teaching and learning of Computer science. This finding was not surprising because the National Policy on Education (FRN: 2017) recommends the need to emphasize the subject at all levels of education in Nigeria. It also recommends that the subject be made relevant, practical and comprehensive at that level of education through the provision of adequate resources. However this finding was not in line with Onyeachu (2016) who revealed that secondary schools in Nsukka education zone had inadequate instructional facilities in their schools.

Table 2 showed that instructional resources are highly utilized in learning Computer studies in secondary schools in Awgu Education Zone. The findings showed that Computer studies teachers make use of over head projector during Computer studies class. This is in line with the work of Bassey (2021) who opined that teaching resources facilitate proper understanding by the students and discourage the act of cramming; it also makes the classroom or learning environment lively and active. In teaching of physical education, teaching resources are referred to as physical education resources.

Conclusions

At the end of this study which attempted to evaluate the extent of use of instructional resources in teaching and learning of Computer studies in Secondary school in Awgu Education Zone, the following conclusions were made:

1. Instructional resources such as radio, materials were used in teaching and learning of Computer studies in secondary schools.
2. Instructional resources such as head projector slide were used in Teaching Computer science in secondary schools.

Recommendations

After a critical evaluation, the following recommendations were made:

1. Teachers should make use of instructional resources in their teaching
2. Government should provide funding for the provision of instructional resources in secondary schools.
3. Curriculum developer should make the development of the curriculum in favour of instructional resources.
4. Further research should be made on topic related to instructional resources.

References

Adebimpe, M.N., (2017) and Daramola, R.I., (2018). Instructional resources as correlates of students' academic performance in Computer studies in senior secondary schools in Osun State. *International Journal of Information and Education Technology*. 6 (4), 9-11.

Adedijio, U.O. 2018; Ogoma, A.E. (2019); Nwafor, M.T. & Eze, W.U. (2017); and Arum, O.B. (2019). Eya, N. O. and Neboh, J.C. (2019)

Akanbi, J.J. (2018). *Psychology of Learning theories into classroom Practices,*

Baribor, N.N. (2017). Importance of aids and resources in classroom teaching. In Oyeneyin, A.M. (ed). *Perspectives of classroom teaching.* Abuja: Martmonic Investment Limited.

Bassey, O. (2021). Assessment of the implementation of Computer Studies curriculum in senior secondary schools in Kano State. (M.ED. Thesis) Zaria: Ahmadu Bello University.

Brookshear, K.O. (2019). Learner-centered teacher-student relationship are effective. A metal analysis. *Review of Educational Research 77 (1) 113-143.*

Chakra, A.J. (2016). Identification and effective utilization of appropriate instructional materials as a means of enhancing the classroom performance of primary school teachers. *Obudu Journal of education studies*. OBUJE (1) 95-99

Eya, C.J. (2020). *Principles of school from management*. Owerri, Cape Publishers.

Franzer, J.C., (2018). The effect of class size on students academic achievement in secondary school mathematics. *International Journal of Research in Science Education* 1 (1).

FRN (2017). *Quality teaching through effective use of instructional materials,* Ibadan, ketex press ltd.

Ibeneme, C.M. (2020). *Self regulation of learning and performance. Issues and educational applications,* Hillscale.

Koko, V.R. (2015). New for effective classroom teaching/learning (The instructional material dimension) Being paper presented at need based workshop UBE Professional support project for primary school teachers Kaduna State, held at resource model primary school Kawo Kaduna on 20th November, 2015.

Obioha, C.A. (2016) and Ogunleye, J.K. (2017). *The importance of computer in the teaching and learning of Physical and health education, Journal* of Basic technology education, 3, (4) 61-69.

Obu, C.A. (2015). Effect of instructional resources on the performance of senior secondary school Computer studies students in Enugu metropolis, Nigeria *Peccop Journal of Research and Practice in African Education* 1 (1) 88-101

Okoro, A.R. (2018). *Television for instruction*, NTA Quarterly 1-7-2000.

Olagungu, J.K. (2020). Conditions for classroom technology innovations. Teachers College Records 104(2) 482-515

Olagunjo J.C. (2020). *A simplified approach Computer studies for schools and colleges*. London: Macmillan Publishers Ltd.

Olaitan, C.G. Igbo, O.O, Ekong, S.A., Nwachukwu, W.O. and Onyemaechi, B.E (2019). *Students' attitudes towards ICT in Nigeria tertiary institutions, educ focus* 1(1): 73-79.

Onyeachu, P. (2016). *Improvisation in the teaching of Computer studies.* A paper presented during the Annual conference of the Nigerian Association of Educational media and Technology held at FCE (T) Asaba.

Onyejiemezie, A.A., (2018). Teachers' perception of the role of media in classroom teaching in secondary school*: Journal of Educational Technology*. January, 8 (2) 99-106

Orji, S.A. (2020). Definition of Computer science. Retrieved February 11, 2013 from http://en.wikipedia.org/wiki/Computer science.

Shagoney, M.O. and Miller, S.A. (2018). *Educational research*: planning, conduction and evaluating quantitative and qualitative research. New Jersey: Pearson prentice hall. Technology and Mathematics. *Journal of Science Education. 38-42*

Ubulom, U.A. and Ogwunte, N.N. (2017). Impact of instructional scaffolding on students' achievement in chemistry in Secondary school in Ebonyi State of Nigeria. *International Journal of Education, Learning and Development* (IJELD) www.eajournals.org (3(7) 74-83

EFFECT OF LINEAR PROGRAMMED STRUCTIONAL STRATEGYON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN GEOMETRY IN ENUGU STATE

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Abstract
This study examined the effect of Linear Programmed Learning Strategy on secondary school students' achievement in Geometry. The study was guided by two (2) research questions and two (2) research hypotheses. The design of this study was quasi-experimental research design. The sample for the study comprised of 235 SSII students drawn from four co-educational secondary schools in Enugu Education zone. Geometry Achievement Test (GAT) was administered to the schools chosen. Mean ($\bar{x}$) and standard deviations(s) were used in answering the research questions while Analysis of Covariance (ANCOVA) was used intesting the research hypotheses at 0.05 alpha level of significance. From the findings of the study, it was discovered that students who were taught Geometry using Linear Programmed Learning Strategy significantly achieved higher than their counterparts taught with expository strategy in Geometry. The results of the study also revealed that there was no significant interaction between gender and instructional strategy on students' in geometry. Based on findings the researcher made recommendations and conclusion for the study that the serving mathematics teachers in Senior Secondary Schools should adopt the use of linear Programmed Learning Strategy in teaching Geometry.

Keywords: *Mathematics, Linear Programmed, Instruction, Geometry, Programmed Theory, Achievement, gender.*

Introduction

Education is widely acknowledged instruments that helps modify or change the behaviour of its recipients to become better citizens and contribute meaningfully to overall development of the Nation. This laudable objective of education as stipulated by the FRN, (2013) may be the reason why mathematics was introduced into the nation's secondary school curriculum as a compulsory subject and criteria for admission into all the courses in the universities and other higher institutions was that mathematics must be a credit passes. According to Akanmu, (2017), Mathematics is the study of concepts that teaches the relationship of sets, properties, measurement, transformation, combination, generalization, physical objects, symbols, space, shapes and use of numbers in calculating, computing and solving problems.

Geometry is an important topic in the secondary school mathematics curriculum that is taught at the early stage of a child and it deals with the properties of points, estimation, construction and measurement of lines, surfaces, distance, angles, relationship and solids (Ozofor, 2015). Mastering geometric concepts and understanding its relationship is vital to the study of other branches of mathematics because geometry develops students spatial ability, knowledge of geometrical theorem, logical reasoning, problem solving skills, scientific interest, computational skills, manipulative skill, develop skill of visualization, critical thinking and perform calculation accurately (Iji, Abakpa, & Age, 2018).

Despite the importance attached to Geometry, it is clearly observed that students lacks concentration at the mention of the topic at senior secondary school level (Aroh, 2018). According to the WASSCE

Mathematics Chief Examiner 2020), Geometry has been continuously reported as one of the themes where students are still dread and persistently having low achievement when compared to other themes. It was reported that candidates couldnot recall or apply cyclic theorems, general principles, proof and concepts of Geometric theorem correctly which in turn makes students to avoid, skipped and poorly attempted geometry questions during external examination (WASSCE Mathematics Chief Examiner, 2020).

This was in line with Iji, Ogbole & Uka, (2014)'s assertion that Secondary school students tend to fear and hate geometry topics especially the circle theorems to the extent that they avoid geometry questions in both internal and external examinations. The reports show that students are very weak in geometry and also exhibited poor knowledge of circle theorems and geometrical construction which leads the students' poor achievement in mathematics. Achievement in mathematics is basically concern with the students' performance in either teacher-made test or standardized achievement test given by examination bodies. Students' poor performance in mathematics has been more prominent in some aspects of mathematics curriculum content than in others. Such content areas have also been shown to be very difficult to tackle by students for example geometry.

However, it can be observed that the deplorable state of mathematics achievement is attributed to a number of factors such as lack of instructional resources and instructional techniques Aroh (2018), lack of understanding of basic mathematical principles , poor teaching and learning environment and lack of modern equipment, poor mathematical ability of the students, students' poor attitude toward Mathematics, inadequate teaching/ materials, lack of motivation of both teachers and students and ineffective instructional strategies(Adegoke, (2013). Iji and Age (2019) also supported the above assertion that the causes of students' poor achievement in Geometry is mainly shortage of qualified mathematics teacher, paucity of relevant mathematics textbook, students population explosion, students' poor attitude to study, lack of mathematics laboratory, ineffective method of instruction, rote memorization, and poor teaching strategies.

The report of the Chief Examiners, West African Examination Council (WAEC, 2022) lamented that there was no significant improvement in the performance of candidates in Mathematicsand some aspect of the syllabus like geometry were poorly handled by the candidates . In another related observation by the Chief Examiner (WAEC, 2023) that the problems affecting geometry achievement can be related to teachers' methods of presenting the contents abysmally made students to misunderstood the topic at senior secondary school level. In the light of the poor achievement of students in Mathematics over the years and with the suspicion on ineffective instructional strategies , calls have been made by both federal and state governments, for immediate solution to improve the students' achievement in Mathematics.

This will facilitate the much needed technological breakthrough of Nigeria as well as qualitative education of the citizenry. The researcher revealed that the issue of how best to help the learners acquire knowledge, skills and values has been a problem to educationists over the years. Several researchers, (Unodiaku 2018, Alio, Anibueze and Ayogu, 2017, Onoh, 2016, Adeoke 2015), have advocated for several strategies for improving the poor academic achievement of the students in the senior school examinations. The major strategies suggested in those researches include th e use of Mathematics games, team teaching, problem solving strategies, motivational teaching strategies, peer instruction and assessment strategies, use of advance organizers, etc.

There is an incessant poor achievement among the senior secondary school student in mathematics in general and geometry in particular, and this is worrisome to mathematics researchers. This is why this study focused on determining the effect of linear programmed instructional strategy in senior secondary school two (SS2) students' achievement in Geometry since there is a limited research in this topic.

Gender is also identified as a sub-variable responsible for poor achievement among senior secondary students in geometry. Iji and Age (2018) state that

gender issues have been linked with performance of students in academic tasks in several studies but without any definite conclusion. Some studies revealed that male students performed better than females in mathematics (Chaudhry, (2015) and Ije , (2019) Celik, (2018) found no gender differences in the performance of male and female students in mathematics. Contrary to the above results,

Udegbe (2005) in Anaeche (2019) found that female students perform better than male students in geometry. Against these contradictions and conflicting results, it becomes pertinent to find out if there will be gender disparity in students' achievement, in geometry when linear programmed instructional strategy is used in teaching and learning of geometry.

However, Similar findings were also reported by Boden, (2020) found that teachers' geometry learning activities were uncreative and boring due to merely using blackboard to explain definitions, concepts, and specific theorems. Also Aroh, (2018) have found that mathematics classrooms and its individualistic nature affect the students individually and actually discourage their learning of Geometry because many mathematics teachers are still using the expository method to teach Geometry in most secondary schools in Nigeria. This butress with (Ezemaenyi, (2010)'s in Aroh, 2018) assertion that expository mathematics teaching is still the norm in Nigeria's schools and has continued to dominate the mathematics classroom.

Expository method used by mathematics teachers was unproductive and its deficiency affected the student's mathematical thinking skills, intellectual ability and problem solving proficiency.

Moreso, Mathematics educators such as (Ezeamaenyi and Nneji,(2010) in Aroh, 2018,) Ude, I O, Edeoga B. and Okpueme N. (2018) and Onoh ,(2016) asserted that teaching and learning enterprises should be structured to accommodate new instructional strategy that improves students centered learning and make them good problem solvers.
However, there are many strategies that teachers can embrace to promote autonomy, competency and relatedness in mathematics classroom. One of such strategy is linear Programmed instructional strategy. The Linear programmed instructional strategy is a type of programmed instruction based on operant conditioning theory of learning that is based on stimulus -response (S-R) connections. Linear Programmed instructional strategy is a student-centered strategy of learning in which the learners are presented with many small learning frames or pieces of information in a logical sequence to provide immediate knowledge and feedback after a test of comprehension (Pigcon, 2014). Boden (2020) asserted that linear Programmed instructional strategy is the process of arranging the materials to be learned into a series of sequential steps; usually it moves the student from a familiar background into a complex and new set of concepts, principles, theorems and understandings. Linear programming instructional strategy is a programmed instruction in which subject matter is broken down into a sequence of small steps or frames that followed logically upon one another, with each of the steps representing only a very small part of the concept or skill being taught.
Hence, Linear programmed instructional strategy is the systematic application of reinforcement theory to the analysis and construction of complex behavior to mastery in Geometry through demonstration, prompted and released approach. Also, Linear Programmed instructional strategy controls the individual variations of the learners and gives equal weighted to learning situation, desirable behavior and mastery of content. Researchers like Carbo & David (2015) developed a linear program of 20 frames for mathematics for Universal Basic Education 3 class and found that the strategy of using programmed instructional material (PLM) worked better than the traditional mode of teaching.

Chaudhary (2015) prepared programmed learning material in Geography for senior secondary school one students and found that after pursuing Programmed instructional Method, students gained significantly as far as knowledge of the subject is concerned. Desai (2016) developed programmed material on Heat in Physics for Senior Secondary School one students and found that students took

active interest in reading and learning through programmed material. The researcher also found that the programmed learning technique was superior to the expository method. The assertions of these researchers give a positive indication that when students are taught Geometry using Linear Programmed instructional strategy, the students' achievement in Geometry will tremendously improve.

Hence, there is need to ascertain the audacity of this assertion in Geometry in order to determine if the students' achievement will be improved as revealed by scholars in other subjects. It is against this background that this study looked into the effect of linear programmed instructional strategy on senior secondary school students' achievement in geometry. Due to limited study on the efficacy of the use of Linear of Programmed instructional strategy for the improvement of students' academic achievement, in Geometry in Enugu Education Zone of Enugu State. In essence, the study sought to answer the questions of whether the use of Linear of Programmed instructional strategy will have any effect on the achievement of the students and if there is any gender effect on students' geometry achievement in Enugu Education Zone of Enugu State.

The purpose of this study is to investigate the effect Linear of Programmed instructional strategy on secondary school students' achievement in Geometry Enugu Education of Enugu State. Specifically, the study sought to find out the:

1. Mean achievement scores of senior secondary two (SS2) students in Geometry when taught with Linear Programmed Instructional Strategy (LPIS) and those taught with expository method.
2. Mean achievement scores of male and female SS2 students when taught Geometry with LPIS and those taught with expository method.

The study was guided by the following questions.

1. What are the mean achievement scores of students taught Geometry using Programmed Instructional Strategy (treatment group) and those taught using expository method (control group) as measured by Geometric Achievement Test (GAT)?
2. What are the mean achievement scores of students in treatment and control groups due to gender as measured by (GAT)?

HO1: There is no significant difference between the mean achievement scores of SSS II students taught Geometry using Linear Programmed Learning Strategy and those taught with expository strategy in Geometry Achievement Test (GAT).

HO2: There is no significant difference between the mean achievement scores of male and female students taught Geometry using linear Programmed Learning Strategy and those taught with expository strategy in Geometry Achievement Test (GAT).

Methods

This study adopted the quasi-experimental design. Specifically this study employed Pre-test Post-test non-equivalent control group design. The study was conducted in secondary schools in Enugu Education Zone of Enugu State, Nigeria. Enugu Education zone has a total of 33 secondary schools. The reason for choosing the zone was because of poor achievement of students in mathematics in the area which could be attributed to low achievement in the subject and also for the uniform structure of the public schools in the area. The population of the study comprised all senior secondary two (SSII) students in the 33 secondary schools located within the area. The study sample comprised 235 SSII students from intact classes of the sampled schools from the study. Two co-educational secondary schools were drawn for this study. (GAT) was used for data collection and was subjected to construct validation.

The instrument was subjected to test of reliability using Kudder-Richardson formula method (K-R 20) with 0.78 reliability. Research questions were answered using mean and standard deviation while the hypotheses were tested at an alpha level of 0.05 using the Analysis of Co- Variance (ANCOVA).

Results

Research Question 1: What are the mean achievement scores of students taught Geometry using linear Programmed Learning Strategy (experimental group) and those taught using expository method (control group) as measured by Geometric Achievement Test (GAT)?

Table 1: Mean Achievement Scores and Standard Deviations of students taught Geometry in both pretest and posttest

Groups	Number	Pretest		Post-test		d
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)	Mean
Experimental	118	40.69	9.81	52.85	10.12	12.16
Control	117	40.92	10.16	46.53	10.26	5.16
Total	**235**					

MINIMUM SCORE = 0; MAXIMUM SCORE = 100

Table 1 displayed the result of Mean Achievement Scores and Standard Deviations of students taught Geometry in both pretest and posttest. From the results in Table 1, it showed that learning took place. This is because the groups achieved higher posttest mean scores than their pretest mean scores. The students in the Experimental Group had a pretest mean score of 40.69 with the standard deviation of 9.81 and a posttest mean score of 52.85 with the standard deviation of 10.12 while their counterparts in Control Group had a pretest mean score of 40.92 with the standard deviation of 10.16 and a posttest mean score of 46.53 with the standard deviation of 10.26. The table showed that the students in the Experimental Group gained higher than their counterparts with the gained mean of 12.16 while the control group had gained mean of 5.16.

Research Question 2: What are the mean achievement scores of students in experimental and control groups due to gender as measured by Geometric Achievement Test (GAT)?

Table 2: Mean Achievement Scores and Standard Deviations of Male and Female Students in Experimental and Control Groups

Gender	Number	Males			Female		
		Number	Mean ($\bar{x}$)	Standard Deviation (s)	Number	Mean ($\bar{x}$)	Standard Deviation (s)
Experimental	118	62	54.37	9.91	56	51.16	10.17
Control	117	61	46.41	10.71	56	46.66	9.83
Total	**235**	**123**	**49.41**	**10.31**	**112**	**47.91**	**10.00**

MINIMUM SCORE = 0; MAXIMUM SCORE = 100;

Table 2 showed the mean achievement scores and standard deviations of male and female students in experimental and Control groups. The results of data analyses in table 5 above showed that male students had higher mean achievement score and standard deviation than their female counterparts. The male students had a mean achievement score of 49.41 with the standard deviation of 10.31 while their female counterparts had a mean achievement score of 47.91 and a standard deviation of 10.00. The table 2 showed that the female students' mean score is homogeneous than their male counterparts because they had smaller standard deviation than their male counterparts.

Table 3: **Analysis of Covariance (ANCOVA) of the Mean Achievement Scores of the Experimental and Control Groups**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	24578.120[a]	4	6144.530	2032.188	.000	
Intercept	1241.933	1	1241.933	410.746	.000	
PRETEST	23177.900	1	23177.900	7665.655	.000	
GROUP	1204.058	1	1204.058	398.220	.000	S
GENDER	9.211	1	9.211	3.046	.082	NS
GROUP * GENDER	3.922	1	3.922	1.297	.256	NS
Error	695.429	230	3.024			
Total	629288.000	235				
Corrected Total	25273.549	234				

Table 3 showed the Analysis of Covariance (ANCOVA) of the Mean Achievement Scores of the Experimental and Control Groups.

Hypothesis 1

HO1: There is no significant difference between the mean achievement scores of SSS II students taught Geometry using Programmed Learning Strategy and those taught with expository strategy in Geometry Achievement Test (GAT).

From the result of ANCOVA in Table 2, it was observed that Group (treatment and Control) gave an F-value of 398.220 and was significant at 0.000. Since 0.000 was less than 0.05, the null hypothesis 1 was rejected as stated. Hence, the study concluded that there was significant difference between the mean achievement scores of SSS II students taught Geometry using Linear Programmed Learning Strategy and those taught with expository strategy in Geometry Achievement Test (GAT). This implied

that the higher achievement score of the students in the Experimental group than their counterparts in Control group was significant. This means that SSS II students taught Geometry using Programmed Learning Strategy significantly achieved higher than their counterparts taught with expository strategy in Geometry.

Hypothesis 2
HO2: There is no significant difference between the mean achievement scores of male and female students taught Geometry using linear Programmed Learning Strategy and those taught with expository strategy in Geometry Achievement Test (GAT).
From the result of ANCOVA in Table it was observed that Gender (Male and Female) gave an F-value of 3.046 and was not significant at 0.082. Since 0.082 was greater than 0.05, the null hypothesis 2 was accepted as stated. Hence, the study concluded that there no significant difference between the achievement mean scores of male and female students taught Geometry using linear Programmed Learning Strategy and those taught with expository strategy in Geometry Achievement Test (GAT). This implied that the higher achievement mean score which the male students had over the female students is not significant.

Discussions
The analyzed data brings a lot of insight into the effect of linear programmed instructional strategy in boosting of students achievement in geometry. From the result gathered, it was observed that school related factors militate against the implementation of linear programmed instructional strategy in schools. The findings revealed that scarcity of programmed books in the society has not made the implementation of linear programmed instructional strategy in schools possible. This could be traced to the facts that curriculum experts have not really paid much attention to the efficacy of linear programmed instructional strategy in learning. Much emphasis have been only on the development of texts in the expository teaching approach, thus leaving the potential of linear programmed instructional strategy in teaching process untapped. The results revealed that where programmed books are scarcely available, professional mathematics educators to help implement its usage are not readily available. Thus, lack of trained mathematics in schools to guide students in the usage of linear programmed books has also been a factor hindering the adoption of such strategy in school. This also depicts the view of Iji (2019) as a problem associated with the implementation of individualized learning in Nigeria.

The findings also revealed that costs of procuring programmed books and running programmed textbooks are exorbitant. This has remained a great factor hindering the implementation of linear programmed instructional strategy in schools. This could be due to high financing cost involved in the development of programmed books by individual, publishers and the non-involvement of governmental agencies in financing the development of programmed books. It also revealed that

Conclusion
Based on the findings of this study, it can be concluded that the use of linear programmed instructional strategy in geometry instruction increases the achievement of senior secondary school students in geometry. This instructional approach (LPIS) favours male students more than the females but there is no significant difference between the mean achievement scores of male and female students. This implies that the use of linear programmed instructional strategyschools can bridge the gap between male and female students' performance in Geometry achievement tests.

Recommendation
Based on the findings of the study, the following recommendations were made:

- The curriculum planners should emphasize, in the curriculum document, the use of linear programmed instructional strategy in secondary school geometry instruction. This will help to reduce maths phobia among the students.

- Conferences, seminars and workshops should be organized by the post primary school management board for the Mathematics teachers on how to use linear programmed instructional strategy s in classroom instruction.

- The use of linear programmed instructional strategy should be encouraged by the authorities of Colleges of education during teacher training programmes. This will help the would be teachers to master its use before graduation.

References

Adegoke, B. A. (2013). Modeling the Relationship between Mathematical Reasoning Ability and Mathematics Attainment. European *Journal of Educational studies..4.17.*

Anderson, T. & Fretin, L. (2004). Programmed Instruction, http://lrs.ed.uiuc.edu/students/fretzin/epl1qo grammed.htm.

Akanmu, I. A. (2017). Integration of geogebra software into teaching and learning of mathematics in Nigeria senior secondary schools. *Abacus*: *The Journal of the Mathematical Association of Nigeria,* 42(1), 1-11. 67.

Alio B.C. and Anibueze C.O. (2017). Effect of mathematics scrabble game on junior secondary school students' achievement in mathematical computational skill. *Mathematics Association of Nigeria Abacus,* 42 (1): 345 – 354.

Anaeche, K. C. (2019), Effect of expository advance cognitive organizer on senior secondary school students' achievement in mathematics in Enugu East l. g. a. Enugu state, Nigeria. anaechekevin@gouni.edu.ng, chykendo@gmail.com.

Aroh, O.F. (2018). Effect of Problem based learning Strategy on senior secondary school students' achievement and interest in geometry. *Unpublished M.Sc. Thesis of Department of Science Education, Enugu State University of Science and Technology, Enugu State, Nigeria*.

Boden, A. (2020). Linear programmed instruction in secondary education: Paper presented at the Yahen College of education annual lecture.

Carbo, R. &Davids, K. (2015). Feedback types in programmed instruction: A systematic review. *The Psychological Record,* 57(1), 219-232.

Chaudhary, M. (2015). Preparation and evaluation of programmed learning material in geography for the secondary level. *Fourty survey of research in education* 3(3); 5 – 67.

Desai, U. R. (2016). Programmed learning vs traditional approach in the teaching of geometry in standard ix. inm.b. bs (ed.). a survey of research in education baroda: centre of advanced study in education.

FRN, (20I3). National policy on education. yaba, national educational resource development centre press. annua.

Iji C. O and Age, T.J. (2019). Effect of 5Cs on senior secondary school students' Achievement in Geometry in Makurdi Metropolis, Benue State, Nigeria *International Journal of Research and Review* 2454-2237.

Iji C. O. (2019). Effect of 5Cs on senior secondary school students' achievement in geometry in Makurdi Metropolis, Benue State, Nigeria. *International Journal of Research & Review* 6(12); 68 – 82.

Iji, C .O.,Ogbole, P.O. &Uka, N. K. (2014). Effects of improvised instructional materials on students achievement in Geometry at the upper Basic education level in Makurdimetropolis, Benue State, Nigeria. *America Journal of Educational Research* 2 (7); 538-542.

Nneji, S.O. (2012). Improving secondary school students' achievement and interest in trigonometry through A constructivism-based teaching strategy. *Journal of science and computer education (JOSCED).* 2(1); 55-79

Nneji, S.O. & Ezeamaenyi, M. N (2014). Application of Polya George's problem solving techniques in teaching of secondary school students in Ebonyi State. *Journal of science and computer education (JOSCED). 2(2), 169- 188.*

Onoh, D.O, (2016), Effect of advance organizer on senior secondary school students' achievement in mathematics in Enugu state, Nigeria. *International journal of education and research* 2(1), 82-90.

Ozofor, N. M. (2015). Effect of two modes of computer aided instruction on students' achievement and interest in statistics and probability. *International journal of education and research* 3(1), 89-102.

Pigcon, F. (2014). Programmed instruction for biology. *Journal of Bioscience* 16(8);21-24.

Ude, I O, Edeoga B. and Okpueme N. (2018). Effect of programmed learning strategy on students interest in mathematics. *International Research Journal of Mathematics, Engineering and IT* 28(1); 259 -264.

Unodiaku, S. S. (2018). Teaching geometrical and mensuration proofs with origami- based instrumental model approach among senior secondary school students in Enugu State. ABACUS *Journal of Mathematical Association ofNigeria 43 (1), 14 -24*

West African Examination Council (WAEC) mathematics chief examiners' report (2022-2023). *Resume of Mathematics*. Accra: WAEC.

EFFECTS OF PROJECT-BASED INSTRUCTION ON THE ACADEMIC ACHIEVEMENT AND RETENTION OF STUDENTS IN CABLE JOINTING IN ELECTRICAL INSTALLATION AND MAINTENANCE WORKS IN TECHNICAL COLLEGES IN ABIA STATE

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Abstract
This study was conducted to determine the effect of project-based instruction (PBI) on the academic achievement and retention of students in cable jointing in electrical installation and maintenance works trade in technical colleges in Abia State. The study adopted a quasi- experimental research design using pre-test and post-test. The population for the study consisted all 1,297 National Technical Certificate (NTC) II (701 male and 596 female) students of electrical installation and maintenance works trade from the 24 technical colleges in Abia State with a sample size of 224 (147 male and 77 female) NTC II electrical installation and maintenance works trade students obtained using multi-stage sampling technique. Two research questions and two null hypotheses guided the study. The instrument for data collection was an Electrical Installation and Maintenance Works Achievement and Retention Test (EIMWAT) with multiple choice questions consisting of 50 items with options lettered A-D. The instrument was validated by three experts while the reliability of the instrument was determined using Kuder Richardson formula (K-R 20) technique because the instrument was multiple-choice type and is dichotomously scored, giving reliability indices of 0.74. The data collected were analyzed using mean scores. The pretest-posttest mean difference for each of the two groups were computed. Thereafter, the mean values of the students were computed to determine the effect of treatment and the effect of gender (male and female) on achievement and retention of the students in the subject. The hypotheses formulated for the study were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). Findings from the study indicated among others that the students taught cable jointing using project-based instruction achieve higher than their counterpart taught using lecture method. Also, a significant difference was found in the mean achievement scores of students taught cable jointing using project-based instruction and those taught using lecture method. It was thereafter recommended that PBL should be fully adopted by technical college teachers for enhanced achievement and retention of students in Abia State, and government and appropriate authorities should encourage teachers' capacity development by sponsoring seminars and workshops for present-time capacity development in Abia State.

Keywords: *Project-Based Instruction; Academic Achievement; Retention; Cable Jointing; Electrical Installation and Maintenance Works.*

Introduction
Education is defined as an organized system of learning which equips the recipient with the needed capacities for all-round relevance in an environment. Through education, knowledge and skills are acquired which in turn enable a country to develop socially and economically (Ololube, 2014). However, the system of education as offered in Nigeria runs through three stages. These stages are primary, secondary and tertiary. The focus of this work is on the secondary stage. Technical colleges belong to secondary stage.

Technical colleges can be defined as core-skill embodied institutions of learning where students are enriched with saleable practical competencies for self and societal relevance. Abdul, Ibrahim and Abdulkarim (2020) defined technical colleges as institutions mainly established for the training of students to acquire practical skills, knowledge and attitudes essential for employment in a given occupation. Thus, the place of technical education in enhancing the capacity of recipients for relevance upon graduation cannot be underrated in present time. According to Okolie, Elisha, Osuji and Igwe (2019), technical colleges are educational institutions established with the aim of training students to acquire appropriate vocational skills, knowledge,

attitudes, habits of thoughts and qualities of character. These trainings enable them develop their intellectual, social, physical, emotional and economic capabilities, become self-reliant and contribute to economic growth and development of their nations. By this definition, it is note-worthy that technical education is an agent of development that transforms the dark-inner character of a man into lime-light with manual dexterities.

However, Federal Republic of Nigeria (FRN, 2013) in its national policy on education summarized the goal of technical education at technical college level among others to be education that; provides technical knowledge and vocational skills necessary for agriculture, industrial, commerce and economic development; trains manpower in applied sciences, technology and commerce particularly at sub-professional grades, and gives training and impacts necessary skills leading to the production of craftsmen, technicians and skilled personnel who will be enterprising and self-reliant. In technical colleges, various trades are offered.

Technical education programmes as offered in Nigeria technical colleges according to National Board for Technical Education [NBTE], 2012) syllabus include: window and door installation, roofing, radio, television and electronics work, auto-wiring, wiring and equipment installation, coil and armature winding and repair, auto-mechanic, wheel alignment and tyre balancing, auto-body repair, auto-shop and service station management, auto-air conditioning, engine cleaning and lubrication, brick laying and concreting, building construction, block moulding and bricks making, painting, air conditioning and refrigeration servicing and repair, welding and fabrication, mechanical operation, woodwork, computer science, foundry and forging technology. These areas of specialization equips an individual with life-long career competencies for either self-employment or paid employment.

In view of the identified trades offered at technical colleges, electrical trade generally offers in addition to general education, both theory and practical knowledge on the principles of operation, installation and maintenance of general electrical products. NBTE (2012), gave details of electrical and electronics engineering-trade subjects taught in Nigerian technical colleges as follows: domestic and industrial installation and repairs, cable jointing, battery charging and repairs, winding of electrical machines, electrical circuit, electrical electronic drawing and calculations, radio communications and services, television services and repairs and electronic devices and circuits. These trade areas are for giving recipients focus on a specific trade for capacity development in the said areas of specialization.

Electrical Installation and Maintenance Works Trade (EIMWT) is an area of specialization where recipients are trained to be substantially proficient in the needed skills for the utilization of trending electrical goods. Through EIMWT, the students are made to be skillful in the assemblage and maintenance of the said electrical goods. Ogwa (2015) affirmed that in electrical installation and maintenance works, trainings are provided in technical field to meet the demands of electrical industry and the needs of the individuals by allowing the students to identify their career objectives. Thus, EIMWT is offered for both National Technical Certificate (NTC) level and Advance National Technical Certificate (ANTC) levels in Technical Colleges. Onoh and Onyebuenyi, (2017) stated that electrical installation and maintenance works curriculum is designed to prepare the students to acquire entry level knowledge and manipulative skills for employment in the electrical industry in Nigeria, noting that students who undergo training in Electrical Installation Trade are expected to acquire skills for excellence in installation of electrical machines and equipment, maintain machines and equipment, winding of electrical machines, testing and inspection of electrical installations, repair of electrical machines and, cable jointing and termination for relevance upon graduation.

Cable jointing can be defined as the technology of elongating a cable in its length. It involves the addition of more cable(s) to a specific quantity (length) of a cable that is perceived to be short or not enough for a particular purpose. Nwokike (2014) defined cable jointing as an aspect of electrical installation and maintenance works trade that provides

the trainee with knowledge and skills to enable him undertake proficiently, various methods of cable jointing, terminations, installation of underground cables, installation of overhead wires and cable. Cable jointing deals with connection between two or more separate lengths of cables with the conductors in one length, connected individually to conductors in other lengths and with the protecting sheaths so connected as to extend protection over the joints. Nwokike identified joints to include splice, britannia, married, sleeve and compression types. Thus, lack of awareness/knowledge of different types of joints could hamper the attainment of the goals of electrical installation and maintenance works trade. Daramola and Emmanuel (2010) pointed out that unsatisfactory situation resulting from lack of knowledge could lead to breakdown in the economic, industrial, technological and educational growths of a nation since the main goal of technical education is to achieve self-reliance. Hence, the level of knowledge of students could be a product of many factors.

In view of the above, Nwagbo (2011) identified a number of factors obstructing students' understanding and achievement in the sciences including practical subjects. Among these factors was the use of inappropriate, non-effective teaching methodology. Sharma and Kumar (2018) opined that the continued use of the chalk-and-talk traditional teaching methods to teach in schools may not provide students with valuable skills and may also lead to students not retaining knowledge. Hence, Nwosu (2014) submitted that most science teachers do not possess the prerequisite knowledge needed for activity-based learning and as a result, the most prevalent method of teaching has been the 'talk and chalk' (lecture) method. Ajaja (2013) found that the method adopted for the teaching and learning of science is one of the factors contributing to this low achievement of students in science subjects and hence expressed the need for a search for alternative instructional method that could stimulate students' retention and enhance their achievement. Umar (2011) indicated that the persistent use of conventional teaching method like drills, dictation and explanation makes students passive rather than active learners, and hence it does not promote insightful learning and long–term retention of some abstract concepts and topics in electrical installation and maintenance works.

Enumerating the benefits of various innovative teaching strategies, Oyelekan, Igbokwe and Olorundare (2017) stated that the use of various innovative teaching strategies including project-based instruction is borne out of the fact that there are different topics to be taught and skills intended to be developed. In this case, many innovative methods are being developed by educators with a view to involving learners more in the teaching learning process. The authors stressed that this is considered very important and there is the need to get these methods into the classrooms. For this to be done successfully there is need for teachers not only to be aware of these methods, but also to learn how to use these methods appropriately in the classroom. A teacher who is not aware of a variety of these methods can neither attempt to use them in the first place nor use them appropriately. These methods may include but not limited to project-based instructional method.

Project-based Instruction (PBI), also known as project-based learning (PBL) is defined as a learner-centered instructional method that is based on problem identification and solving upon the guidance of a teacher. According to Hârtescu (2014), PBL organizes learning around projects and involves the students in authentic situations where they can explore and apply the subject matter to problems that are complex and relevant to the professional practice for which they are preparing. PBL according to Sari and Angreni (2018) is a learning model that directly involves students through research activities to complete a specific learning project by developing solving skills in working on a project to produce something.

In view of the fore-going, Mulyasa (2013) noted that project-based learning aims to focus students on a complex problem, where it is necessary to investigate, hence students will understand the lesson through investigation. Hence, project based learning is said to have two sections. The two sections involved in project-based learning according to Abidin (2016) are; the pre-project and post-project sections. The pre-project; where the practitioner (lecturer) provides a

project description, determines the project milestones, prepares media and various learning resources, as well as prepares conditions for the project learning. At the final stage (post-project), the practitioner also provides an assessment and reinforcement of the product or project that has been produced by students. Hence, Fraenkel and Wallen (2019) stated that the project-based learning method includes several activities, namely project preparation, project design, project launch, and project publication. Through PBL, academic achievement and retention of electrical installation and maintenance works students would be improved.

Academic achievement may be seen in the context of this study as the measure of the product of effective teaching activity. This can further mean the measure of the extent or degree of the knowledge and skill acquired by the students specifically in electrical installation and maintenance works. Academic achievement also denotes the knowledge attained and skill developed in the school subject, usually designated by test scores (Karthigeyan and Nirmala, 2012). Eze, Onwusuru and Ginigeme (2021) defined academic achievement as the extent to which students are able to accomplish the specific goals of a subject which is signified by the outcome of their performances, specifically in technical colleges. Ogundele, Olanipekun and Aina (2014) lamented that there has been consistent decline in the performance of students in public examinations conducted by the NBTE/NABTEB, West African Examination Council (WAEC) and the National Examination Council (NECO) in sciences across the country over the years. Thus, ascertaining academic achievement could be said be necessary in determining the students level of retention.

Retention can be defined as the capacity to keep and the ability to remember something kept over a long-term. Retention according to Ngwoke and Eze (2010) is the process by which a child stores information in his memory for use at a later period. Obidile (2017) viewed retention as an important factor in the sustenance of achievement. In this context, retention is very important in that it concerns itself with the ability of students of electrical installation and maintenance works to keep or store and remember ideas or concepts over time. Therefore, retention is the ability to remember the stored ideas in the (long-term) future. Thus, retention abilities of students could be gender-wise.

Gender can be seen as that attribute which differentiates man from a woman. According to Adigun, Irunokhai, Sada and Adesina (2015), gender can be seen as the variation of substantial, natural, psychological and performance features relating to and distinguishing between the feminine and masculine population. Igbo, Onu and Obiyo (2015) asserted that gender is mainly used conventionally to describe how the society gives certain roles to boys and girls. In a gender related study, Oludipe (2012) discovered that male students have better performance than their co-female students in sciences. Gender effect is therefore inclusive and this justifies the inclusion of gender as a variable in this study. Hence, gender is considered significant in this study as there may appear to be differences between the performances of male and female students. Thus, the place of gender can be considered significant in the retention of students in electrical installation and maintenance works which could impart negatively or positively on live of the students and the society at large. Hence, technical education generally is established for the preparation of recipients for relevance upon graduation and thus, it becomes worrisome that this core-objective is grossly undermined today in Abia State as students' performance has been seen to be poor.

The objectives of electrical and installation works trade have not been fully actualized in technical colleges in Abia State as studies had shown that students over time had been failing in their various examinations. Osmol (2012) in a study, observed that students who graduate in electrical and electronics trade do not possess the prerequisite skill to practice this technical course after graduation. Whereas, it is expected that individuals who pass through technical education with inherent skills become relevant to themselves and the society at large by being actively engaged in a particular vocation with the set of skill acquirable through technical education. But in Abia State, the reverse has been the case.

In view of the poor performances of students in electrical trades, Mbagwu (2009) recorded a poor performance of students' in electrical and electronics subjects in technical colleges both in theory and in practice including cable jointing as an area in electrical installation and maintenance works trade. One could believe that the problem of retention among students of technical colleges in Nigeria could be affected by the absence of full implementation of project-based instruction in the teaching and learning of cable jointing in electrical installation and maintenance works in technical colleges in Abia State. Onyebuenyi, Mba and Odeluga (2017) pointed out that the traditional method of teaching employed by most technical college teachers in Abia State which does not grant recipients time and autonomy to study, practice, explore and utilize learning resources at their pace has contributed to the ill training of technical college students in that it has made teaching and learning teacher-centered and as well increased the rate of dependency among students. It is against this background that the study seeks to determine the effect of PBI on the academic achievement and retention of students in cable jointing in technical colleges in Abia State.

However, the state of teaching and learning of cable jointing in technical colleges in Abia State has been poor. In place of recording high academic achievement, low performance and poor retention is witnessed amongst the students, such that many students are resorting to studying basic arts and related subjects as no record of enhanced productivity could be traced. The students' inability to do well in exams especially external ones could be as a result of use of poor teaching methods that are not meant for practically-oriented subject like cable jointing. Thus, this has resulted to delays/un-attainment of the set-educational goals which have contributed to the slow pace of socio-economic development in Abia State. These poorly-trained graduates from technical colleges are found roaming the streets of Abia State, with a greater population involving in socio-economic vices like thuggery, smoking, robbery, kidnapping and others. Hence, there is need to ascertain the efficacy of an innovative teaching method known as project-based instruction (PBI), which based on its modalities appear to have great potentials in holding students interest on the desired skills and knowledge. On this note, the study sought to determine the effect of project-based instruction on the academic achievement and retention of students in cable jointing in electrical installation and maintenance works trade in Technical Colleges in Abia State.

The general purpose of this study is to determine the effect of project-based instruction (PBI) on the academic achievement and retention of students in cable jointing in electrical installation and maintenance works trade in Technical Colleges in Abia State. Specifically, the study sought to determine the mean:

1. Mean achievement scores of students taught cable jointing using project-based instruction and those taught using lecture method.
2. Mean retention scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method.

The following research questions guided the study:

1. What is the mean achievement scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method?
2. What is the mean retention scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method?

Hypotheses

The following null hypotheses formulated and tested at 0.05 level of significance guided the study:

1. There is no significant effect in the mean achievement scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method.
2. There is no significant difference in the mean retention scores of male and female student's taught cable jointing using project-based instruction and those taught using lecture method.

Method

The study adopted a quasi- experimental research design using pre-test and post-test. The population for the study consisted all 1,297 National Technical Certificate (NTC) II (701 male and 596 female) students of electrical installation and maintenance works trade from the 24 technical colleges in Abia State with a sample size of 224 (147 male and 77 female) NTC II electrical installation and maintenance works trade students obtained using multi-stage sampling technique. Two research questions and two corresponding null hypotheses guided the study. The instrument for data collection was an Electrical Installation and Maintenance Works Achievement and Retention Test (EIMWAT) designed on cable jointing with multiple choice questions consisting of 50 items with options lettered A-D with 2 marks allocation of 0 and 100% minimum and maximum scores. The instrument was validated by three experts while the reliability of the instrument was determined using Kuder Richardson formula (K-R 20) technique because the instrument was multiple-choice type and is dichotomously scored, giving reliability indices of 0.74. The data collected were analyzed using mean scores. The pretest-posttest mean difference for each of the two groups were computed. Thereafter, the mean values of the students were computed to determine the effect of treatment and the effect of gender (male and female) on achievement of the students in the subject. The hypotheses formulated for the study were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA).

Results

The results are presented in Table 1 to 3 in line with the research questions and null hypotheses that guided the study below.

Research Question One

What is the mean achievement scores of students taught cable jointing using project-based instruction and those taught using lecture method?

Table 1: Mean Achievement and Standard Deviation Scores of Male and Female Students Taught Cable Jointing Using Project-Based Instruction and those Taught Using Lecture Method

Group	Gender	Statistics	Pretest	Posttest	Mean Difference
Experimental	**Male**	**N**	83	83	
		Mean	43.92	66.27	**22.35**
		SD	7.79	9.20	
	Female	**N**	46	46	
		Mean	43.46	67.41	**23.96**
		SD	7.72	8.44	
Control	**Male**	**N**	64	64	
		Mean	41.56	51.06	**9.50**
		SD	8.04	7.52	
	Female	**N**	31	31	
		Mean	44.10	52.65	**8.55**
		SD	6.97	8.80	

Data in **Table 1** shows that before treatment, the pretest mean achievement and standard deviation scores of male students in experimental group were 43.92 and 7.79 respectively, whereas their female counterpart had mean score of 43.46 with corresponding standard deviation score of 7.72. Also, the male students in control group had mean and standard deviation scores of 41.56 and 8.04

respectively, whereas their female counterparts had mean score of 44.10 with corresponding standard deviation score of 6.97. After treatment, in experimental group (project-based instruction), the male students obtained mean achievement score of 66.27 and standard deviation score of 9.20, whereas their female counterparts had mean achievement score of 67.41 and standard deviation score of 8.44. In control group (lecture method), male students had mean score of 51.06 and standard deviation score of 7.52, whereas their female counterparts had mean score of 52.65 with corresponding standard deviation score of 8.80. Hence, the mean difference between male (22.35) and female (23.96) in the experimental group is 1.61. Hence, the difference is not tangible; therefore both male and female students taught cable jointing with project-based instruction achieved equally.

Hypothesis One

There is no significant difference in the mean achievement scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method.

Table 2: Analysis of Covariance of the Mean Achievement Scores of Male and Female Students Taught Cable Jointing Using Project-Based Instruction and those Taught Using Lecture Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	12558.221[a]	3	4186.074	57.436	0.000	
Intercept	689993.068	1	689993.068	9467.188	0.000	
GROUP	10998.202	1	10998.202	150.903	0.000	**S**
GENDER	91.299	1	91.299	1.253	0.264	**NS**
GROUP * GENDER	2.314	1	2.314	0.032	0.859	**NS**
Error	16034.168	220	72.883			
Total	842329.000	224				
Corrected Total	28592.388	223				

Table 2 shows that the F-value on mean achievement score of male and female students taught cable jointing using project-based instruction and those taught using lecture method is 1.253 which is not significant at 0.264 level of significant, which is greater than 0.05 level of significant set for the study. Therefore, the null hypothesis is not rejected; this means that there is no significant difference in the mean achievement scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method.

Research Question Two

What is the mean retention scores of male and female student's taught cable jointing using project-based instruction and those taught using lecture method?

Table 3: Mean Retention and Standard Deviation Scores of Male and Female Students Taught Cable Jointing Using Project-Based Instruction and those Taught Using Lecture Method

Group	Gender	Statistics	Posttest	Retention	Mean Difference
Experimental	**Male**	**N**	83	83	
		Mean	66.27	60.73	**-5.53**
		SD	9.20	8.58	
	Female	**N**	46	46	
		Mean	67.41	58.07	**-9.35**
		SD	8.44	10.75	
Control	**Male**	**N**	64	64	
		Mean	51.06	42.14	**-8.92**
		SD	7.52	7.75	
	Female	**N**	31	31	
		Mean	52.65	43.16	**-9.48**
		SD	8.80	7.20	

Table 3 shows that the male students in experimental group had posttest mean score of 66.27 with corresponding standard deviation score of 9.20, whereas their female counterpart had posttest mean score of 67.41 with standard deviation score of 8.44. Also, the male students in control group had posttest mean score of 51.06 with corresponding standard deviation score of 7.52, whereas their female counterpart had posttest mean score of 52.65 with standard deviation score of 8.80. similarly, after retention test, in experimental group (project-based instruction), male students had mean retention and standard deviation scores of 60.73 and 8.58 respectively; while their female counterparts had mean retention and standard deviation score of 58.07 and 10.75 respectively. In control group (lecture method), after retention test, male students had mean retention and standard deviation scores of 42.14 and 7.75 respectively; while their female counterparts had mean retention and standard deviation score of 43.16 and 7.20 respectively. However, in the experimental group the mean difference of male students is -5.53, while that of female students is -9.35. The difference in their mean differences is -3.82. This implies that male students retain better than their female counterpart.

Hypothesis Two

There is no significant difference in the mean retention scores of male and female student's taught cable jointing using project-based instruction and those taught using lecture method.

Table 4: Analysis of Covariance of the Mean Retention Scores of Male and Female Students Taught Cable Jointing Using Project-Based Instruction and those Taught Using Lecture Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	16624.345[a]	3	5541.448	73.525	0.000	
Intercept	510070.506	1	510070.506	6767.757	0.000	
GROUP	13739.768	1	13739.768	182.303	0.000	S
GENDER	33.297	1	33.297	0.442	0.507	NS
GROUP * GENDER	166.755	1	166.755	2.213	0.138	NS
Error	16580.901	220	75.368			
Total	649241.000	224				
Corrected Total	33205.246	223				

Table 4 shows that the F-value on mean retention score of male and female students taught cable jointing using project-based instruction and those taught using lecture method is 0.442 which is not significant at 0.507 level of significant, which is greater than 0.05 level of significant set for the study. Therefore, the null hypothesis is not rejected; this means that there is no significant difference in the mean retention scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method.

Discussion of Findings

Regarding the findings of the study as regards to mean achievement scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method, the study showed that both male and female students taught cable jointing with project-based instruction achieved equally. In this case, achievement of both male and female students taught cable jointing using project-based instruction and those taught using lecture method did not attribute directly to gender in that both performed equally. Hence, PBL adopted in teaching both female and female students can enhance their academic achievement. The hypothesis of no significant difference in the mean achievement scores of students taught cable jointing using project-based instruction and those taught using lecture method, showed that there is a significant difference in the mean achievement scores of students taught cable jointing using project-based instruction and those taught using lecture method.

This finding agreed with Eze (2013) whose study revealed that gender has no significant effect on the students' academic achievement. This also tallied with Ezenwafor, Okoye and Obi (2020) who noted in a study that the project-based method improved male and female students' psychomotor skill development while both methods equally promoted male and female students' interest in electrical installation and maintenance work. Cheng and Yang (2019) indicated that project-based learning has a medium to large positive effect on students' (male and female) academic achievement compared with traditional instruction.

On the mean retention scores of male and female student's taught cable jointing using project-based instruction and those taught using lecture method, the study revealed that male students taught cable jointing with project-based instruction retained better than their female counterparts taught same topic using lecture method. It could be said herein that project-based instruction is an instructional method that gives students irrespective of their gender the autonomy to implement what they have learnt at their convenience. Thus, project based is seen to be significant in equipping students with necessary skills in practical-oriented subject like cable jointing in electrical installation and maintenance works trade. Hence, there is no significant difference in the mean retention

scores of male and female students taught cable jointing using project-based instruction and those taught using lecture method. By implication, gender appears insignificant in this context.

This finding is in concordance with Hârtescu (2014) who noted that PBI organizes learning around projects and involves the students in authentic situations where they can explore and apply the subject matter to problems that are complex and relevant to the professional practice for which they are preparing. Bassey, Joshua and Asim (2010) stated that teachers should employed teaching methods including PBI that will allow the students to remember what they have been taught in a longer-term.

Conclusion

The result from this study has provided an empirical basis on the effect project-based instruction (PBI) on the academic achievement and retention of students in cable jointing in electrical installation and maintenance works trade in technical colleges in Abia State. The study indicated that PBI is alternative that is capable of meeting the contemporary teaching and learning needs of both the teacher and student especially in practical oriented subject like cable jointing of electrical installation and maintenance works trade. Hence, PBL is found to be capable of improving the achievement and retention of students in a practical-oriented subject like n cable jointing. The findings from the study have revealed that the use of PBI is more beneficial in practical context than the conventional method. In view of these findings, it is therefore concluded that PBL has significant effect on the retention of students in cable jointing in electrical installation and maintenance works trade in technical colleges in Abia State**.**

Recommendations

In view of the afore-stated educational implication of the result of this study, the following recommendations were made:

1. PBI should be fully adopted by Technical College teachers as practical-based method for enhanced retention of students in Abia State.
2. More cable jointing practical exercises should be adopted by teachers for better achievement and retention of Technical College students in Abia State.
3. Government and appropriate authorities should encourage teachers' capacity development by sponsoring seminars and workshops for present-time capacity development towards ensuring higher achievement of male and female students in Abia State.
4. Educational stakeholder and appropriate authorities should encourage teachers by providing adequate funds for the project-based practical materials. This would enhance academic performance of students.

References

Abdul A., Ibrahim M. D & Abdulkarim I (2020). Electrical installation and maintenance skills required by graduates of science and technical colleges for self-employment in Yobe State. *Journal of Science Technology and Education,* 8(2). 101-107

Abidin, Y. (2016). Desain sistem pembelajaran dalam konteks kurikulum (Design of learning systems in the context of the curriculum). Refika Aditama.

Adigun, J., Onihunwa, J., Irunohkai, E., Sada, Y. & Adesina, O. (2015). Effect of gender on students' academic performance in computer studies in secondary schools in New Bussa, Borgu Local Government of Niger state. *Journal of Education and Practice,* 6(33), 1-7.

Ajaja, O. P. (2013). Which method best suits biology teaching? Lecturing, concept mapping, cooperative learning or learning cycle? *Electronic Journal of Science Education,* 17(1), 1-37.

Bassey S. W., Joshua M. T. & Asim A. E. (2010). Gender differences and mathematics achievement of rural senior secondary students in Cross River State, Nigeria. Proceedings of International Conference to Review Research in Science, Technology and Mathematics Education. *Munba, India,* 2(3), 12-18.

Daramola, I. S. & Emmanuel, D. G. (2010). Knowledge and skills possessed by technical college graduate of building trade in Taraba State. *Journal of League of Researchers in Nigeria.* 4(1) 8-16.

Eze, T. I., Onwusuru, M. I & Ginigeme, O. O (2021). Gender-relative effect of project-based learning method on academic achievement and retention of technical college students in basic electricity. *Journal of Vocational Education Studies,* 4(1), 1-10

Federal Republic of Nigeria (FRN, 2013), *National Policy on Education.* Lagos: NERDC Press.

Fraenkel J. R. & Wallen, N. E. (2009). *How to Design and Evaluate Research in Education,* (7th ed.). New York: McGraw-Hill Companies.

Hârtescu, I (2014). "Providing technology support for project-based learning," In Proc. the International Scientific Conference e-Learning and Software for Education, vol. 3, pp. 223-229.

Karthigeyan, K. & Nirmala, K. (2012). Academic achievement in English: An analysis through gender lens. *MIER Journal of Educational Studies, Trends & Practices,* 2(2), 144-157.

Mbagwu, V. (2009). *Teachers' perception of influence of social network site on secondary school students' disruptive behaviour in Nsukka Local Government Area.* Unpublished Thesis, Odumegwu Ojukwu's University, Awka.

Mulyasa. H (2013). Pengembangan dan Implementasi kurikulum 2013 (2013 curriculum development and implementation). Remaja Rosadakarya

National Board for Technical Education (NBTE, 2012). *Curriculum for Technical colleges (Revised).* Kaduna: NBTE Press

Ngwoke, D. U. & Eze, U. (2010). *School leaving theories and application.* Enugu: Immaculate Publication Limited.

Nwagbo, C. R. (2011). The relative efficacy of guided inquiry and expository methods on achievement in biology students of different levels of Scientific Literacy. *Journal of Science Teachers Association of Nigeria, 36 (1&2),* 43 –51.

Nwokike, C. J (2014). Skills required by graduates of technical colleges for self-employment in electrical installation and maintenance works in Enugu State. *Unpublished dissertation*, presented to the Department of Vocational Teacher Education, University of Nigeria, Nsukka

Nwosu, A. A. (2014). Teachers' awareness of creativity related behaviors in science classroom. *Journal of the Science Teachers Association of Nigeria 39(1&2), 22-26.*

Obidile, I. J. (2017). *Effects of problem-based teaching method on students' academic performance and retention in accounting in technical Colleges in Anambra State. Unpublished Dissertation.* Nnamdi Azikiwe University, Awka.

Ogundele, G. A, Olanipekun, S. S & Aina, J. K (2014). Causes of poor performance in West Afican School Certificate Examination (WASCE) in Nigeria. *Scholars Journal of Arts, Humanities and Social Sciences,* 2(5B), 670-676.

Ogwa, C. E (2015). Teachers and students perception of instructional supervision on capacity building in electrical installation trade. *Journal of Education and Practice.* 6(29); 182-187

Okolie U. C, Elom, E. N, Osuji C. C & Igwe P. A (2019). Improvement needs of Nigerian technical college teachers in teaching vocational and technical subjects. *International Journal of Training Research,* 17(1), 21-34.

Ololube, N. P. (2014). Blended learning methods in introduction to teaching and sociology of education courses at a university of education. *In N. P. Ololube (Ed). Advancing technology and educational development through blended learning in emerging economies,* (108-127). Hershey, PA: Information Science Reference.

Oludipe, D. I (2012). Gender difference in Nigerian junior secondary students' academic achievement in basic science. *Journal of Educational and Social Research,* 2(1), 93-99

Onoh, B. C. E. C & Onyebuenyi P. N (2017). Electrical installation and maintenance skill

needs of technical college graduates for job creation and self-reliance in Enugu State. *Journal of Science and Computer Education (JOSCED),* 3(3), 223-232.

Onyebuenyi, P. N., Mbah, C. O & Odeluga, P. E (2017). Enhancing practical skill acquisition among technical college students through information and communication technologies (ICTS) for self-reliance in Abia State. *Odumegwu Ojukwu Journal of Vocational Education and Research,* 2(1); 252-264.

Osmol, H. (2012). Factors influencing the learning process. In Amadi P.G (Ed). *Principles and method of teaching and learning.*

Oyelekan, S. O, Igbokwe, F. E & Olorundare, S. A (2017). Science teachers' utilizations of innovative strategies for teaching senior school science in Ilorin, Nigeria. *Malaysian Online Journal of Educational Sciences,* 5(2), 49-65.

Sari, R. T., & Angreni, S. (2018). Penerapan model pembelajaran project based learning (PjBL) upaya peningkatan kreativitas mahasiswa (The application of the project based learning (PBL) learning model is an effort to increase student creativity). *Jurnal Varidika,* 30(1), 79-83.

Sharma. A. & Kumar. N (2018). Importance of talk and chalk method of teaching: Dental students‟ view in preclinical years. *International Journal of Healthcare Education & Medical Informatics* 5(3): 11-15.

Umar, A. A. (2011). Effects of biology practical activities on students' process skill acquisition in Minna, Niger State, Nigeria. *Journal of Science, Technology, Mathematics and Education,* 7(2), 118–126.

CONSTRUCTION AND PRELIMINARY VALIDATION OF ANATOMY AND PHYSIOLOGY ACHIEVEMENT TEST FOR NURSING STUDENTS IN EBONYI STATE

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Abstract
A good knowledge of Anatomy and Physiology is indispensable to ensure safe and efficient nursing practice. The study constructed and validated Anatomy and Physiology achievement test for nursing students in Ebonyi State. Three research questions were formulated and two null hypotheses were verified at 0.05 probability level. The study adopted instrumentation design on sample of 324 nursing students. Data were analysed using SPSS. Results show that 95% of the test items fall within acceptable range of item difficulty index and also good discriminators. 97% of test items have positive distracters. 71 pure factorially test items were extracted under 6 factors loading using rotated component normalization method. There is significant difference in the students' mean achievement scores in the year of study. Conclusion, Anatomy and Physiology achievement test has a good psychometric qualities and should be used in all schools of basic Nursing for students' evaluation.

Key words: *Anatomy, Physiology, Achievement, Test, Students.*

Introduction

Over the years the knowledge of the human body has been of a great concern to the health professionals especially those that work tirelessly in the promotion of health. Anatomy is the study of the structure of the body and the physical relationships between its constituent parts while Physiology is the study of how the body structure works, and the way in which their integrated activities maintain the life and health of the individual (Waugh & Grant, 2014:4). Anatomy and Physiology is one of the approved courses studied in Schools of Nursing as it is expected to help in meeting the needs of nursing education and clinical practice. Anatomy and Physiology is studied as one course in general nursing education unlike in generic nursing where it is split into two different courses. However, the study of Anatomy and Physiology in nursing has become an objective discipline based on direct observations as well as scientific principles. Hull, Wilson, Hopp and Jaagon (2016) stated that Anatomy and Physiology courses provide a foundation of knowledge that is critical for health professions' students, but obtaining adequate mastery for this information prove to be a challenge to many students.

The knowledge of Anatomy and Physiology equips nurses to understand and provide the patient's health needs. However, instructors of Anatomy and Physiology course often observe poor performance in this course. Anatomy and Physiology constitute 40% to 45% of both paper 1 and 2 in Professional Examination for General Nursing. Chiwuba (2023) observed students' poor performance in this course in Professional Examination for General Nursing conducted by Nursing and Midwifery Council of Nigeria for the past decade. Gaining better understanding of the causes of poor performance in

Anatomy and Physiology course is necessary to propose adequate solutions. Researchers in nursing education have identified poor quality test instruments as one of the causes of students' poor performance. Anigbo (2014) observed that quality of test instrument is a predetermined factor for measuring a sample of characteristics or behaviours. However, researchers in nursing education have noted little attention paid by the examiners on the critical issue of the quality of the test used in measuring the level of achievement of students in both internal and external examinations. And this can be remedied by a well-constructed test.

A well-constructed test involves the presentation of a standard set of questions to a person or a group of persons to be answered. Arising from the answers supplied, a measure is obtained. Achievement test plays a very pivotal role in education at all stages of learning in different educational institutions. A well-made assessment tool that tests objectives relevant to the course is an important characteristic of an examination (Namdeo and Sahoo, 2016). Nursing and Midwifery Council has developed strategies for ensuring that only candidates who have proven to be competent are licensed to practice nursing and midwifery. Therefore, Nursing and Midwifery council of Nigeria periodically calls for test items for the professional examination for general nursing. In response, schools of general nursing submit test items for the examination and subsequent item banking.

A test is said to be good when it has good psychometric qualities in terms of item difficulty, discrimination and distracter index. This study determined the psychometric qualities of Anatomy and Physiology test items. Furthermore, the study intended to test factorial pure items. Factorial design is necessary when interaction may be present to avoid misleading conclusions (Ekpenyong, Omekara & Usoro, 2018). This study covers the knowledge gap on the paucity of documented studies on the construction and validation of Anatomy and Physiology achievement test in Schools of Nursing.

The main purpose of the study was to construct and preliminary validated Anatomy and Physiology Achievement Test (APAT) for Schools of General Nursing. Specifically, the study sought to:

1. determine the item difficulty, discrimination and distracter indices of the APAT
2. find out factorially pure items of APAT
3. determine the students' achievement in APAT with regards to gender and year of study.

The following questions guided the study:

1. What are the psychometric measures in terms of item difficulty, item discrimination and distracter indices of the APAT?

2. What are the factorially pure items in APAT?

3. What are the students' mean achievement scores in APAT with regards to gender and year of study?

The following null hypotheses were verified at 0.05 probability level

1. There is no significant difference between the mean achievement scores of male and female nursing students in Anatomy and Physiology course using APAT.
2. There is no significant difference between the mean achievement scores of nursing students in Anatomy and Physiology with regards to year of study using APAT.

Methods

The research adopted instrumentation research design. Instrumentation research is the type that aim at developing and certifying an efficacy of an instrument for the measurement of a given behaviour or construct. Ebuoh, 2024 purported that an instrumentation research is the type of research which is purely geared towards the development and validation of measurement instrument in education. The study was conducted in Ebonyi State: Schools of

Nursing Alex Ekwueme Federal University Teaching Hospital Abakaliki and Mater Misericordiae Hospital Afikpo. The sample of the study consisted of 341 nursing students of the 2021/2022 academic session in all the schools of general nursing in Ebonyi State. The intact classes were the second and third year students from the both schools.

The instrument used for the study was Anatomy and Physiology Achievement Test (APAT) developed by the researcher which consist of 100 test items. Development of the test blue print was based on the content of five selected units of Anatomy and Physiology in the general nursing curriculum. The APAT was trial tested on 34 students of School of Nursing University of Nigeria Teaching Hospital Enugu (SONUNTH). The reliability was established at 0.78 using Kudder-Richardson formula K-R20. The instrument was further refined by carrying out item analysis as follows**:**

i. difficulty index (p) was computed using

$$P = \frac{U+L}{N}$$

ii. item discrimination index (D) was computed using the formula

$$D = \frac{U-L}{N}$$

iii. Distractor index (DI) is wrong alternative answers in a test items which was computed using the formula.

$$DI = \frac{L-U}{N}$$

Where
L= Number of students in the lower group who chose the options
U= Number of students in the upper group who chose the options
N= Number of students in the upper or lower groups.

The bench mark for the difficulty index was between 0.25 and 0.75 in line with the general accepted range. Also, the set bench mark for discrimination index was 0.20 (borderline) and to avoid the rejection of the too many items, as this reduces the content validity of test All positive distracters were retained and negative and zero distracters were either restructured or discarded. From the trial study, at about I hour was considered as adequate for final test administration for APAT. The test items that survived item analysis were selected and they were 88 items. Additional 18 items were restructured from the difficulty items and new constructed items and was pretested to the same students. Thereafter, 100 test items were selected. The statistics tool used for the research hypotheses were t-test and ANOVA.

Results

Table 1: Showing Item Analysis of Unit A (Muscloskeletal System)

Item	Difficulty Index (P)	Discrimination index (DI)	Distracter Index	Distracter Index (DS)				Decision
				A	B	C	D	
1	0.38	0.17	-0.02	-0.01	√	-0.02	-0.01	Discarded
2	0.69	0.34	0.15	√	0.09	0.01	0.05	Selected
3	0.51	0.44	0.25	0.15	-0.01	√	0.11	Selected
4	0.52	0.41	0.22	0.14	0.04	√	0.03	Selected
5	0.53	0.24	0.04	0.04	√	0.03	-0.01	Selected
6	0.58	0.40	0.20	0.16	0.02	0.00	√	Selected
7	0.63	0.39	0.19	0.09	√	0.09	0.03	Selected
8	0.31	0.25	0.05	0.13	-0.08	√	-0.05	Selected
9	0.41	0.32	0.13	√	0.03	0.10	-0.02	Selected
10	0.35	0.40	0.20	0.04	0.08	0.03	√	Selected
11	0.59	0.52	0.32	0.04	√	0.30	-0.04	Selected
12	0.40	0.33	0.14	0.12	-0.03	√	0.04	Selected
13	0.33	0.31	0.12	-0.02	0.02	√	0.11	Selected
14	0.58	0.39	0.19	0.00	0.15	0.02	√	Selected
15	0.35	0.12	-0.08	0.06	-0.12	√	0.02	Discarded
16	0.48	0.52	0.32	0.20	0.09	√	0.00	Selected
17	0.45	0.28	0.09	0.22	√	-0.05	-0.08	Selected
18	0.38	0.35	0.16	√	0.03	0.05	0.04	Selected
19	0.27	0.25	0.05	-0.06	0.08	√	0.03	Selected
20	0.47	0.30	0.11	0.13	√	0.03	-0.06	Selected

From the above table, following the validation rule 18 items were selected while 2 items (1 and 15) were discarded.

Table 2: Showing Item Analysis of Unit B (Blood and Cardiovascular System)

Item	Difficulty Index (P)	Discrimination index (DI)	Distracter Index	Distracter Index (DS)				Decision
				A	B	C	D	
21	0.60	0.19	0.00	√	0.06	-0.05	-0.01	Selected
22	0.62	0.34	0.15	0.05	√	0.03	0.05	Selected
23	0.58	0.35	0.16	√	0.08	0.04	0.06	Selected
24	0.56	0.39	0.19	√	0.04	0.06	0.09	Selected
25	0.37	0.22	0.02	0.24	√	0.05	-0.25	Selected
26	0.20	0.24	0.04	0.01	0.17	-0.13	√	Discarded
27	0.33	0.31	0.12	0.10	√	0.01	-0.01	Selected
28	0.44	0.28	0.09	-0.01	0.06	0.04	√	Selected
29	0.62	0.51	0.31	0.12	√	0.13	0.05	Selected
30	0.30	0.18	-0.01	-0.02	√	0.02	-0.02	Discarded
31	0.70	0.40	0.20	√	0.04	0.06	0.08	Selected
32	0.28	0.30	0.11	0.06	-0.02	0.05	√	Selected
33	0.38	0.24	0.04	√	0.01	0.06	-0.04	Selected
34	0.38	0.41	0.22	0.00	0.14	0.06	√	Selected
35	0.38	0.24	0.04	-0.01	√	0.04	0.00	Selected
36	0.40	0.31	0.12	√	-0.08	0.03	0.15	Selected
37	0.51	0.48	0.29	0.11	0.10	0.06	√	Selected
38	0.44	0.30	0.11	0.13	√	-0.14	0.10	Selected
39	0.61	0.47	0.28	0.16	0.14	√	-0.02	Selected
40	0.43	0.33	0.14	√	0.05	0.03	0.03	Selected
41	0.43	0.17	-0.02	√	0.08	0.06	-0.17	Discarded
42	0.39	0.25	0.05	0.01	√	-0.06	0.11	Selected
43	0.37	0.40	0.20	0.04	0.06	√	0.09	Selected
44	0.50	0.32	0.13	-0.03	0.08	0.10	√	Selected

Table 2 shows that 21 items met the validation rule and were selected while 3 items (26, 30 and 41) were discarded.

Table 3: Showing Item Analysis of Unit C (Digestive System)

Item	Difficulty Index (P)	Discrimination index (DI)	Distracter Index	Distracter Index (DS)				Decision
				A	B	C	D	

45	0.51	0.37	0.17	√	-0.08	0.13	0.12	Selected
46	0.50	0.51	0.31	0.15	0.02	0.13	√	Selected
47	0.42	0.33	0.14	0.03	0.01	√	0.09	Selected
48	0.53	0.45	0.26	0.11	0.10	√	0.05	Selected
49	0.54	0.34	0.15	√	0.11	0.01	0.02	Selected
50	0.30	0.32	0.13	-0.02	0.10	0.05	√	Selected
51	0.22	0.27	0.08	0.05	0.04	-0.03	√	Discarded
52	0.43	0.35	0.16	√	0.15	-0.01	0.03	Selected
53	0.57	0.42	0.23	0.17	0.12	√	-0.08	Selected
54	0.33	0.29	0.10	0.14	√	-0.10	0.05	Selected
55	0.32	0.41	0.22	0.15	0.12	-0.09	√	Selected
56	0.54	0.46	0.27	0.12	√	0.09	0.05	Selected
57	0.40	0.41	0.22	0.11	0.09	0.01	√	Selected
58	0.23	0.01	-0.18		-0.28	0.04	0.02	Discarded
59	0.46	0.47	0.28	0.12	0.18	0.00	√	Selected
60	0.54	0.34	0.15	0.09	0.03	√	0.03	Selected
61	0.48	0.46	0.27	0.06	0.15	√	0.04	Selected
62	0.38	0.31	0.12	√	-0.03	0.12	0.03	Selected

Table 3 above illustrates that 16 items met the validation rule and were selected while 2 items (51and 58) were discarded.

Table 4: Showing Item Analysis of Unit D (Reproductive System)

Item	Difficulty Index (P)	Discrimination index (DI)	Distracter Index	Distracter Index (DS)				Decision
				A	B	C	D	
63	0.26	0.27	0.08	-0.01	0.09	√	-0.01	Selected
64	0.58	0.45	0.26	0.06	√	0.15	0.03	Selected
65	0.49	0.40	0.20	0.14	0.16	√	-0.13	Selected
66	0.36	0.25	0.05	-0.04	√	0.02	0.08	Selected
67	0.33	0.29	0.10	√	0.03	0.04	0.03	Selected
68	0.23	0.15	-0.04	-0.02	-0.05	√	0.04	Discarded
69	0.26	0.26	0.06	-0.12	-0.04	0.23	√	Selected
70	0.31	0.37	0.17	0.09	0.08	0.01	√	Selected
71	0.69	0.57	0.38	0.15	0.15	√	0.06	Selected

72	0.56	0.47	0.28	√	0.24	0.00	0.02	Selected
73	0.61	0.47	0.28	0.05	0.17	√	0.05	Selected
74	0.42	0.44	0.25	0.04	0.14	0.03	√	Selected
75	0.53	0.33	0.14	√	0.08	0.03	0.03	Selected
76	0.67	0.47	0.28	0.11	√	0.09	0.09	Selected
77	0.25	0.24	0.04	-0.06	0.19	√	-0.10	Selected
78	0.47	0.49	0.30	0.27	0.04	0.00	√	Selected
79	0.38	0.29	0.10	0.02	0.08	√	-0.01	Selected
80	0.54	0.40	0.20	√	0.09	0.10	0.00	Selected

Table 4 above illustrates that 17 items met the validation rule and were selected while only an item (item 68) was discarded.

Table 5: Showing Item Analysis of Unit D (Nervous System)

Item	Difficulty Index (P)	Discrimination index (DI)	Distracter Index	Distracter Index (DS)				Decision
				A	B	C	D	
81	0.60	0.41	0.22	0.05	0.08	√	0.08	Selected
82	0.24	0.18	-0.01	√	0.00	0.01	-0.04	Discarded
83	0.56	0.43	0.24	0.09	√	0.10	0.03	Selected
84	0.49	0.35	0.16	0.11	√	0.05	0.01	Selected
85	0.45	0.40	0.20	0.08	-0.01	0.13	√	Selected
86	0.55	0.33	0.14	√	0.04	0.06	0.03	Selected
87	0.28	0.24	0.04	0.05	0.03	-0.04	√	Selected
88	0.49	0.40	0.20	0.13	√	0.09	-0.01	Selected
89	0.52	0.37	0.17	-0.04	0.12	√	0.05	Selected
90	0.30	0.31	0.12	√	0.04	0.06	0.03	Selected
91	0.26	0.23	0.03	√	0.10	0.06	-0.15	Selected
92	0.37	0.29	0.10	0.01	0.09	√	0.00	Selected
93	0.27	0.20	0.01	-0.12	√	0.11	0.04	Selected
94	0.41	0.16	-0.03	-0.01	0.01	√	-0.01	Selected
95	0.39	0.25	0.05	0.01	√	0.02	0.03	Selected
96	0.53	0.33	0.14	√	0.13	0.04	-0.04	Selected
97	0.61	0.40	0.20	0.09	0.01	√	0.11	Selected
98	0.38	0.31	0.12	√	0.18	0.02	-0.10	Selected
99	0.33	0.37	0.17	0.08	0.03	0.10	√	Selected
100	0.43	0.39	0.19	0.12	0.02	√	0.05	Selected

The above table 5 shows that 24 items met validation rule and were selected while item 82 failed and was discarded.

Table 6: Factorially loaded items in each factor

F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
11	13	14	11	10	10	11	11	5	2	3

Table 6 shows that 86 items were loaded under factor 1- 11. The extraction method utilized was the Principal Component Analysis while the rotation method used was the Varimax with Kaiser Normalization. These items have factorial validity of 0.35 and above. Some of these items were loaded in more than one factor and were regarded as impure. These include item 4 which was loaded under factor 4 and 8, item 6 loaded under factors 1 and 8, item 23 loaded under factors 2 and 8. Others impure items include 24, 28, 33, 36, 40, 44, 50, 53, 59, 76, 88 and 91. 71 pure items were extracted from the 11 factors loading using rotated component normalization method. These items were selected according to the table of specification.

Table 7: Factorially pure items finally included in the APAT

S/n	Content	No of items
A	Musculoskeletal system	15
B	Blood and Cardiovasular system	15
C	Digestive system	11
D	Reproductive system	14
E	Nervous system	16
	5 units	71

Table above shows 71 pure items finally included in the APAT. These 71 selected items were re-numbered in the final instrument from numbers 1-71.

Table 8:Descriptive statistics showing students' mean achievement scores in APAT with regards to gender

	Sex	N	Mean	Std. Deviation	Std. Error Mean
Achievement	Male	37	51.02	13.887	2.143
	Female	289	52.49	12.104	.726

Result in table 8 shows that the mean achievement scores in APAT of the male are 51.02 ± 13.88 and the female mean achievement score are 52. 49 ± 12.10

Table 9: Descriptive statistics showing students' mean achievement scores in APAT with regards to year of study

Achievement	N	Mean	Std. Deviation
3rd year A	84	55.51	11.536
3rd year B	114	50.52	12. 315
2nd year	128	49. 59	12.435
Total	**326**	**51 87**	**12.095**

The result in the above table portrays that the 3rd year A students had the highest mean scores 55.51±11.53.

Hypothesis 1

There is no significant difference between the mean achievement scores of male and female nursing students in Anatomy and Physiology course using APAT.

Table 10: t-test showing students' mean achievement scores in APAT with regards to gender

Gender	Mean	Std. Dev	N	Mean diff	T	Df	P
Male	51.02	13.887	37	-1.462	-0.715	318	0.475
Female	52. 49	12.104	289				

Result in table 10 shows that the mean achievement scores in APAT of the male is 51.02 compared to the female with mean achievement score of 52. 49. However, the mean difference of -1.462 of their scores is not significant between the genders ($P > 0.05$).

Hypothesis 2

There is no significant difference between the mean achievement scores of nursing students in Anatomy and Physiology with regards to the year of study using APAT.

Table 11: ANOVA showing comparisons of students' mean achievement scores in APAT with regards to year of study

Sources of variations	Sum of Squares	Df	Mean Square	F	P-value
Between Groups	2578.923	2	1289.461	8.896	.000
Within Groups	46091.096	318	144.941		
Total	48670.019	320			

The result in table 11 shows that there is a significant difference in the mean achievement score in APAT of Students with regards to year of studies ($P < 0.05$).

Discussion of Findings

Research question 1 analyzed item difficulty index, item discrimination index and distracter index. For item difficulty index, majority (97%) of the items are within the ranges 0.25 and 0.75. This implies the instrument consists of items that 25% and above of the testees can answer correctly. The discrimination index value range also shows that the instrument consists of items which above 20% of the more knowledgeable than the less knowledgeable testees can answer correctly. The items of distracter index of either zero or negative were not selected into the final draft of APAT because such items are either easy or difficult that every testee would pass or fail. Therefore, item difficulty, discrimination and distracter indices of APAT showed moderate difficulty, good discrimination and high positive distracters. This is in line with the findings of Islam and Usmani (2017) who validated and found out that psychometric analysis of Anatomy multiple choice questions showed average difficulty, good discrimination and reliability

Research question 2 sought for the factorial pure items for inclusion in the final test package for APAT. A total of 71 pure items were extracted from 91items loaded under 6 factors using principal component analysis and rotated component normalization technique. This implies that APAT has high percent (75%) pure items. This in accordance with the Ekpenyong, Omekara and Usoro (2018) who conducted an experimental study on the application of design and analysis of 23 factorial experiments in determining some factors influencing recall ability in short term memory.

Findings from Research question 3 determined that there is no significant in the mean achievement score of male and female nursing students in APAT. This implies that APAT is suitable for both genders. The average mean also implies that both male and female were ready for the evaluation at any time. Insignificance increase on female students' mean score (1.47) may be probably because the school of nursing is dominated by females. This finding is contrary to Nworgu (2015) who found out that age, gender and content area were both significant factors in students' achievement scores. Also, it determined the students' mean achievement score in APAT as regards to the year of study. The findings revealed that there is significant in the mean scores of students according to their year of study. The highest score by the 3rd year A students may account for their preparation for the Qualifying Professional Nursing examination. The 2nd year students' poor performance may account for uncovered curriculum on Anatomy and Physiology. This is in line with the finding of Gultice, Witham and Kallmeyer (2014) that developed tools to identify students at risk for failure in anatomy and physiology in biology department. The survey results revealed several predictive factors related to academic preparation.

Conclusions

This study revealed that a well-developed and validated instrument on Anatomy and Physiology and other relevant courses administered to students of general nursing can help them pass external examination at a sitting. Year of study has significant effect on APAT students' achievement.

Recommendations

Based on the findings of the study, the following were recommended:

1. The test items used in all courses should be validated by teachers to ascertain good psychometric qualities.

2. Teachers and students should be encouraged to cover curriculum before evaluation

3. Teachers should be re-oriented on the need for instrument development through seminars and symposiums since many teachers are not test developers.

References

Anigbo, L.C. (2014). *Teachers' handbook on Measurement and Evaluation.* Enugu: Executive Press Resources Ltd

Auewaraku, I. C., & Downing, S. M., (2015). *Item analysis to improve reliability for an internal medicine undergraduate OSCE.* Adv Health

Sci Edu theory pract. 10: 105,doi: 10.1007/slo. 459-005-2315-3.

Chinwuba, A. (2023). A Keynote address presented at Nursing and Midwifery Council of Nigeria Examiners workshop in Enugu.

Ebouh, C. (2024). *Educational Measurement and Evaluation for Effective Teaching and Learning.* Enugu: Sky Printing Press.

Ekpenyong, E.J., Omekara, C. O. & Usoro, A. E., (2018). Application of design and analysis of 2013 factorial experiment in determining some factors influencing recall ability in short term memory. *Global journal of pure and applied sciences*. Vol 14, 3: 371-374.

Islam and Usmani (2017). Analyzed the psychometric indices of Anatomy question items in modular system assessment.http://www.researchgate.net. Retrieved on 3/7/24

Hull, K., Wilson, S., Hopp, R. & Jaagon, J. (2016). *Determinants of student success in anatomy & physiology: do prerequisite course matter?* PDF Doi: 10.21692/haps.2016.005. Retrieved from www.researchgate J. Food Sci Edu.net.

Gultice, A.D., Witham, A. & Kallmeyer, R. (2015). Are your students ready for anatomy and physiology? http://www.researchgate.net. Retrieved on 02/07/2024

Namdeo, S. K. & Sahoo, S. (2016). *Item analysis of multiple choice questions from assessment of medical students in Bhubaneswar*. India. Int j/res med sci. 4: 1716-1719.

Nworgu, B. G. (ed) (2015). *Educational Measurement and Evaluation Theory and Practice.* Nsukka: University Trust Publisher.

Waugh, A. & Grant, A, (2014). *Ross and Wilson Anatomy & Physiology in Health and Illness.* 12th edition. Churchill Livingstone Elsevier.

GENDER DISPARITY ON STUDENTS' ACHIEVEMENT, INTEREST AND RETENTION IN JAVA PROGRAMMING LANGUAGE USING THE FLIPPED LEARNING INSTRUCTIONAL STRATEGY

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Abstract
The study determined the gender disparity on students' achievement, interest and retention in in java programming language using the flipped learning instructional strategy. The study was guided by three research questions and six (6) research hypotheses. The study was a quasi-experimental design with non-equivalent groups. The population for the study was 229 computer education third year students of the federal Colleges of Education in South-East Nigeria. The sample size was 153 third year NCE Computer Education students, comprising of 89 female and 64 male students from the selected Colleges of Education. Simple Random Sampling through balloting was used to select the two (2) out of the three (3) Federal Colleges of Education in South-Eastern part of Nigeria. The instruments used for data collection in this study were Java Programming Language Achievement Test (JPLAT) and Java Programming Language Interest Inventory (JPLII). Both JPLAT and JPLII consist of two (2) sections; Section A and B. Their Section A sought for the personal information of the respondents which is registration number, name of the College of Education and gender while Section B of JPLAT consists of 50 multiple choice items having four alternative options and the Section B of JPLII elicit information on the interest level of students in learning Java Programming Language in colleges of education, South-East, Nigeria. Section B of the JPLII consists of twenty (20) items that are constructed in a four-point scaling system which ranges from Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). Both instruments were validated by experts in the Department of Mathematics and Computer, Faculty of Education, Enugu State University of Science and Technology (ESUT), Enugu, and were found to reliable with the KR 20 reliability coefficient of 0.86 for JPLAT and the Cronbach Alpha of 0.73 for JPLII. The researcher subjected JPLAT to item analysis in order to make JPLAT a standardized test. The Experimental Procedure for the study was; first by obtaining permission from the relevant authorities, then followed by the training of the research assistants and finally administering of the treatment. Data gotten from the markings of the pretest, posttest and retention-test scripts were recorded separately and were used for study's analysis. The data was analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA). Mean ($\bar{x}$) and standard deviations (s) were used in answering the research questions while ANCOVA was used in testing the research hypotheses at 0.05 alpha levels. The study revealed that the differences between the mean achievement, interest and retention scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy were not significant. Hence, the study recommended that the Nigerian Colleges of Education especially Computer Education lecturers should ensure that there is no gender discrimination in Java Programming Language classes and Federal/State governments, management of Federal Colleges of Education, the Heads of Computer Education Departments in the Federal Colleges of Education and other professional bodies like the Nigeria Computer Education Association should encourage both male and female Computer Education lecturers and students to work harder in Computer Programming languages especially on Java Programming Language.

Key points: *Java programming language, flipped learning instructional strategy, Male and female students' achievement, Male and female students' interest, Male and female students' retention, gender disparity*

Introduction

Technology has become an essential tool for educational development all over the world thus, has changed the teaching and learning process. Technology beget computer and the integration of computers in education according to Hamidi et al (2021) has led to the introduction of Computer Studies in schools at all level. Computer Studies is the study of computer science, which includes computer principles, computer hardware and software, computer applications among others (Ghavifekr & Rosdy, 2015). Most of the teachers teaching the Computer Studies in secondary schools are gloomed from the Colleges of Education. Eze (2019) reported that 65.4% of the secondary schools are graduates of College of Education. Colleges of education are tertiary educational institutions established to give professional training for the production of highly qualified classroom teachers (Nwite & Nwuche, 2016). Colleges of Education are specially designed to develop, pursue and improve regular and liberal courses of study for the training of various categories of teachers and promote the advancement of learning and educational research (Iruonagbe & Egharevba, 2015). Colleges of Education are categorized into regular, technical and special Colleges of Education (Gazette, 2011). Also, Colleges of education are grouped into three; Federal Colleges of Education, State Colleges of Education and Private Colleges of Education. The Federal Colleges of Education are colleges owned and managed by the Federal Government of Nigeria. According to Ahmed (2022), there are 27 federal owned Colleges of Education, 54 State Colleges of Education and 84 private owned Colleges of Education. Among all these 205 Colleges of Education in Nigeria, Ahmed (2022) revealed that the Federal Colleges of Education have the necessary resources to run a Computer Education programme unlike other Colleges of Education. In Federal Colleges of Education, they have the necessary and functional resources such as computer laboratory, computer center (e-learning center), standby generator, smart board, projector, among other (Ahmed, 2022). All these resources as outlined by Ahmed (2022) are needed for this kind of study. Thus, the Federal Colleges of Education were chosen.

In Federal Colleges of Education, Computer Education is among the courses studied by the students. According to Ibezim (2018), computer education is a training discipline that encompasses the process of acquiring knowledge and skills in the application of computers in problem solving and the development of competences for the transfer of knowledge in the use of computers to students. Moreover, computer programming is one of the courses in computer education offered by students in colleges of education as contained in the National Commission for Colleges of Education Minimum Standard (NCCE, 2012) that Java Programming (CSC321) among others should be taught to students in computing discipline of Nigerian Colleges of Education. It is experienced by the researchers that College of Education students shy away from learning Java programming language. Available records obtained from Federal College of Education, Eha-Amufu showed that the percentages of students of Department of Computer Education that offered Java programming language course that obtained "A" and "B" are 20.18% in 2021, 22.15% in 2020, 25.24% in 2019 and 19.51% in 2018 while the percentages of students that obtained other grades are 79.82% in 2021, 77.85% in 2020, 74.76% in 2019 and 80.49% in 2018 (Department of Computer Science, 2018 – 2021).

These statistics of the achievement of the students of computer education department in Java programming language course is not encouraging. This showed that the achievement of students that sat for the course was very poor. From the record, the percentage of students that made a good grade like "A" and "B" in Java programming language between 2018- 2021 academic session is very low compared to other grades and this simply means that there is high level of low achievement in Java programming, and this is basically one of the reasons why the researcher embarked on this study. Java has a concept known as

Object Oriented Programming (OOP). OOP concepts in Java are the main ideas behind Java's features (Heckman, Horton & Sherriff, 2021). Object-oriented programming (OOP) is a programming paradigm based on the concept of objects, which can contain data, in the form of fields (often known as attributes or properties), and code, in the form of procedures (often known as methods) (*Kindler & Krivy, 2021)*. According to Corral, Balcells, Morgado Estévez, Moreno and Ramos (2014), Java OOP concepts helps to create working methods and variables, then re-use all or part of them without compromising security. *Object Oriented programming* is a programming style which is associated to concepts like abstraction, encapsulation, inheritance, and polymorphism (Chang, 2020). Grasping the concepts is a key to understanding how Java works. Java programming language being more of hands-on activity needs a teaching and learning approach that will enable constant practice. Ability to write useful JAVA programme is a good skill and can make students to gain a better employment or self-employed. Therefore, achieving this entails adopting a more flexible and student friendly approach capable of increasing students' interest in learning of JAVA programming language. One of such approaches that seems to suit this scenario is flipped learning instructional strategy. Flipped Learning Instructional Strategy is an approach used in teaching and learning, where home works are done at school and school works done at home (Ozdamli & Asiksoy, 2016).

Flipped Learning Instructional Strategy affords students the opportunity to gain a firsthand experience and exposure to novel materials ordinarily outside the classroom using such technologies as softcopies, video tapes or web-based lectures, and PowerPoint presentations with voice-over. Flipped Learning Instructional Strategy is a revised or inverted form of Bloom's taxonomy. In this new taxonomy, students are doing the lower levels of cognitive work, gaining knowledge and comprehension outside of class and focusing on the higher forms of cognitive assignment in class, assisted by peers and the teacher or instructor (Anderson & Krathwohl, 2021). The teacher's role here is more or less of a facilitator to qualify the meaning of a true flipped learning. Although the researchers were not able to see works done on Flipped Learning Instructional Strategy on Java Programming Languages but similar works done by *Boyle, Duffy and Dunleavy (2023) who examined the Learning styles and academic outcome using Vermont's inventory of learning styles in a British higher education setting. The study was specifically on Java Programming. The study of Boyle, Duffy and Dunleavy (2023) revealed that the Vermont's inventory of learning styles improved the students' academics outcome in Java programming.* Asogwa (2018) who studied the effect of flipped learning on students' academic achievement in QBASIC programming language in colleges of education reported that there was an improvement on students' achievement and interest in QBASIC programming language when taught using flipped learning approach. Ugwoke, Edeh and Ezemma (2018) reported that flipped classroom on LMS model is more effective than the conventional f2f method in improving students' interest and academic achievement in Elements of Accounting. These findings from these scholars indicate that when students are taught Java Programming Language using the Flipped Learning Instructional Strategy, the tendency of the students' achievement, interest and retention in Java programming Language improving are high. *This prompted the researcher to determine the effectiveness of* the Flipped Learning Instructional Strategy on students' achievement, interest and retention in Java Programming Language. Specifically, the study determined the gender disparity on students' achievement, interest and retention in in Java Programming Language using the flipped learning instructional strategy. This is as a result of gender biasness. Gender bias is a reference to preference for favouring of one sex over the other in computer use and access. Gender roles assigned by different cultures, many women have been brought up to see technology and its use as reserved for the male gender (Shieh, Chang & Liu, 2021). Scholars like Luan, Aziz, Yunus, Sidek, Bakar, Meseran and Atan (2015) have observed that there is a gender gap in the use of ICTs. This situation has led to what scholars have termed the gender digital divide. Ikolo (2020) stated that the gender digital divide is manifested in the poor performance of female students in

information and communication technology (ICT) as compared to male students. The educational system is believed to influence the gender gap in computer use. One argument state that the gender separation in the use of the computer education begins as far back as kindergarten (Wilder, Marchie & Cooper, 2015).

Research in Europe and North America identified boys' greater access to computers in schools also noted boys' dominance in computer related tasks and discussions. This research commonly found boys to be more active in computer-related classroom discussions, to make more spontaneous comments, and to be asked more questions by teachers (Volman, 2012). Girls, on the other hand, more often lacked confidence in computing, tended to underestimate their computer-related competence. Initial explanations of these findings in Europe and North America focused on boys far greater hands- on experience of computers at home, their greater enthusiasm to use computers, their greater confidence in using computers, and their tendency to rate themselves better than girls. Important contributing factors to boys' greater computer confidence can be the attitudes and behavior of their teachers. Research shows that some teachers assume a certain expertise in boys, turn to boys for expert assistance when technical difficulties arise. ICTs have the potential to alleviate or remove some of the barriers or constraints that prevent girls from accessing educational opportunities, such as illiteracy, poverty, time scarcity, mobility, and relevancy. But there are additional factors that prohibit girls from ICT usage such as restricted access to the technology, high costs and lack of skills and information. However, the lack of participation of girls in the use of ICTs can primarily be attributed to social behavior, culture, and religious traditions (UNESCO Asia and pacific regional bureau for education). Girls are deprived of any opportunity to gain ICT related knowledge and skills in school. This may inhibit their acquisition of the levels of literacy and confidence that might enable them to access and use ICTs in school context. Because of the critical role that education has to play in opening up ICT-related opportunities, access to education is consistently identified by gender equality advocates as one of the most important factors involved in enabling girls and women of all ages to benefit from new information technologies (Hafkin, 2021). Robinson and Lubienski (2021) suggested that as girls enter adolescence; large numbers of them tend to lose interest in science, math, and computer technology. This is attributed to the different treatments by educators which divert girls from science and technology.

There is considerable evidence to suggest that boys use computers more than girls; this difference, like computer attitude, only emerges in middle school. In one study of 6,800 students, computer use by boys and girls in the fourth grade was about equal, but by the eighth grade, boys reported significantly higher use (Barker, 2016). According to Whitley (2017), boys use computers more frequently than girls at their homes, their friends' homes, and after school clubs. They use computers to play games, use educational software, and access the internet, whereas girls use computers for e-mail, instant messaging, and home work. Boys tend to be more assertive and dominant about computers use and girls tend to be more passive. Teachers let girls give up more easily than boys when solving computer-related problems. Girls appear to prefer to use computers for goal-oriented activities with meaningful contexts. Girls like co-operative learning based on inquiry and diversity of topics. According to Munusamy and Ismail (2019), women look at computers and see more than machines, thus considering computers as masculine and complicated to use. Technology use is an essential component of the flipped class; it is important to understand how female students view using technology in their education. There are a number of strategies that teachers can use to address gender differences in computer attitude and use. However, it is important to determine whether male and female students show equal achievement, interest and retention with the use of flipped learning approach in learning of Java programming language and interaction effect among variable. This is because according to Papadopoulos and Roman (2020), a non-significant difference was found when examining the results of the gender in posttest, the male students in the flipped class answering 44.7% while the female students in the flipped class answering 44.7% of the

31.2% of the questions correctly. Olelewe (2019) disclosed that the male students significantly recorded higher achievement and retention than the female counterparts in students' achievement, interest and retention in QBASIC Programming Language. Irungu, Nyagah and Mercy (2019) revealed that the girls were more interactive than boys while the stereotype of classifying certain subjects as female or male ones is changing. Results from simple regression analysis indicated that, there is no statistically significant effect of gender interaction on academic achievement of students in Chemistry. The statistic coefficient (R2 = 0.013) provided the amount of variation that can be accounted for by the independent variable which is gender interaction, implying the model explained 1.3% variation in academic achievement which is the dependent variable in this study. Ugwoke, Edeh and Ezemma (2018) who carried out a study on the effects of flipped classroom model on learning management systems (LMS) and f2f learning environments on students' achievement and interest in accounting disclosed that the students' gender in achievement and interest were equal and stead and no gender performed better than the other both in achievement and interest. The findings from these studies created gender gap for this study because there are contradictory findings by the researchers on the influence of gender and this prompted the researchers to determine the gender disparity on students' achievement, interest and retention in in Java Programming Language using the flipped learning instructional strategy.

Purpose of the Study

The major purpose of this study was to determine the gender disparity on students' achievement, interest and retention in in Java Programming Language using the flipped learning instructional strategy. Specifically, the study determined:

1. the male and female students' mean academic achievement in Java programming language when taught with flipped learning instructional strategy.
2. the male and female students' mean interest in Java programming language when taught with flipped learning instructional strategy.
3. the male and female students' mean retention in Java programming language when taught with flipped learning instructional strategy.

Research Questions

The following research questions guided the study;

1. What is the male and female students' mean academic achievement in Java programming language when taught with Flipped Learning Instructional Strategy?
2. What is the male and female students' mean interest in Java programming language when taught with Flipped Learning Instructional Strategy?
3. What is the male and female students' mean retention in Java programming language when taught with Flipped Learning Instructional Strategy?

Research Hypotheses

The following hypotheses were formulated to guide the study, and were tested at 0.05 level of significance.

H_{01}: There is no significant difference between the mean scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy.

H_{02}: There is no significant interaction between the students' instructional strategy and the Students' Gender in Students' achievement in Java Programming Language.

$H_{03:}$ There is no significant difference in the mean interests of male and female students in Java programming language when taught with Flipped Learning Instructional Strategy.

$H_{04:}$ There is no significant interaction between the students' instructional strategy and the Students' Gender in Students' interest in Java Programming Language.

$H_{05:}$ There is no significant difference in the mean retentions of male and female students in Java programming language when taught with Flipped Learning Instructional Strategy.

$H_{06:}$ There is no significant interaction between the students' instructional strategy and the Students' Gender in Students' retention in Java Programming Language.

Research Methods

This study adopted quasi-experimental design with non-equivalent groups, which includes pre-test and post-test design. The population for the study was 229 computer education third year students of the federal Colleges of Education in South-East Nigeria. The sample size was 153 third year NCE Computer Education students, comprising 71 students of Alvan Ikoku Federal College of Education, Owerri and 82 students of Federal College of Education, Eha-Amufu. Thus, the study sampled 89 female and 64 male students from the selected Colleges of Education. Simple Random Sampling through balloting was used to select the two (2) out of the three (3) Federal Colleges of Education in South-Eastern part of Nigeria. Also, Simple Random Sampling through balloting was used to select the school for the Experimental and Control groups. Intact classes were used. The instruments used for data collection in this study were Java Programming Language Achievement Test (JPLAT) and Java Programming Language Interest Inventory (JPLII). Both JPLAT and JPLII consist of two (2) sections; Section A and B. Their Section A sought for the personal information of the respondents which is respondent's name, registration number, name of the College of Education and gender while Section B of JPLAT consists of 50 multiple choice items having four alternative options and the Section B of JPLII elicit information on the interest level of students in learning Java Programming Language in colleges of education, South-East, Nigeria. Section B of the JPLII consists of twenty (20) items that are constructed in a four-point scaling system which ranges from Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). Both instruments were validated by experts in the Department of Mathematics and Computer, Faculty of Education, Enugu State University of Science and Technology (ESUT), Enugu.

Both instruments were found to reliable. The reliabilities of JPLAT and JPLII were trial tested by administering them on 30 computer education third year students in Federal College of Education (Technical), Asaba, Delta state. The scores obtained from the testing were analyzed using Kuder Richardson 20 (KR-20) for JPLAT and Cronbach Alpha for JPLII with the aim to determine the internal consistency of the instruments. The KR 20 reliability coefficient of 0.86 was obtained for JPLAT while the Cronbach Alpha of 0.73 was obtained for JPLII. These result showed that both instruments were reliable and fit to be used for the study. The researcher subjected JPLAT to item analysis in order to make JPLAT a standardized test and to remove the test items that were difficult, easy and discriminatory. JPLAT was trial tested on 148 computer education third year students in Federal Colleges of Education located in Southern part of Nigeria. The scores obtained from the pilot testing were used for item analysis. JPLAT was retained because its difficulty index was 56.83% which showed that JPLAT was moderate. Also, all the fifty (50) items of JPLAT had their item difficult and discriminatory difficult indices fall within the range of 40% - 70% and were retained. The Experimental Procedure for the study was; first by obtaining permission from the relevant authorities, then followed by the training of the research assistants and finally administering of the treatment. All the extraneous variables that may have affected the result of the study were either minimized or removed. The data for the study was collected through the pre-test, post-test and retention-testing. Data gotten from the markings of the pretest, posttest and retention-test scripts were recorded separately and were used for study's analysis. The data was analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA) using pretest and posttest scores as covariates for posttest analysis, and using post-test and retention-test scores as covariates for retention-test analysis. Mean ($\bar{x}$) and standard deviations (s) were used in answering the research questions while Analysis of Covariance (ANCOVA) was used in testing the research hypotheses at 0.05 alpha levels.

RESULTS

Research Question 1: What is the male and female students' mean academic achievement in Java programming language when taught with Flipped Learning Instructional Strategy?

Table 1: Mean Differences in the Male and Female Students' Mean Achievement Scores with Standard Deviation in Java Programming Language

Gender	No. of Students	Pretest		Posttest		Mean Differences
		Mean	SD	Mean	SD	
Male	37	29.59	14.86	57.32	15.28	27.73
Female	34	29.00	16.75	56.59	16.83	27.59

Minimum score =0.00 Maximum score =100.00 Normal Average Achievement score =50.00

Result in table 1 above indicated that the male students taught Java Programming Language using Flipped Learning Instructional Strategy obtained mean achievement scores of 29.59 and 57.32 in their pretest and posttest respectively and, with corresponding standard deviations of 14.86 and 15.28. On the other hand, the female students taught Java Programming Language using Flipped Learning Instructional Strategy obtained mean achievement scores of 29.00 and 56.59 in their pretest and posttest respectively and, with corresponding standard deviations of 16.75 and 16.83. Also, the result showed that the mean difference between the pretest and posttest achievement scores of male Java Programming Language students taught Java Programming Language using Flipped Learning Instructional Strategy was 27.73 while their female counterparts was 27.59. This result showed that the male Java Programming Language students taught Java Programming Language using Flipped Learning Instructional Strategy slightly gained more than their female counterpart in achievement score since that the difference in their mean differences was very small (that's 0.64). Furthermore, the table showed that the female students taught Java Programming Language using Flipped Learning Instructional Strategy had slightly higher standard deviations than their male counterparts but the difference could be negligible since that the difference in the two genders' standard deviations is very small (that's 1.55) for posttest.

Research Question 2: What is the male and female students' mean interest in Java programming language when taught with Flipped Learning Instructional Strategy?

Table 2: Mean Differences in the Male and Female Students' Mean Interest Scores with Standard Deviation in Java Programming Language

Gender	No. of Students	Pretest		Posttest		Mean Differences
		Mean	SD	Mean	SD	
Male	37	26.43	7.26	46.08	8.09	19.65
Female	34	27.26	6.61	47.03	8.06	19.77

Minimum score =1.00 Maximum score =80.00 Normal Average Interest score =40.00

Result in table 2 above indicated that the male students taught Java Programming Language using Flipped Learning Instructional Strategy obtained mean interest scores of 26.43 and 46.08 in their pretest and posttest respectively and, with their corresponding standard deviations of 7.26 and 8.09 while their female counterparts obtained the mean interest scores of 27.26 and 47.03 in their pretest and posttest respectively and, with their corresponding standard deviations of 6.61 and 8.06. The result also showed that the difference between the pretest and posttest mean interest scores of male students taught Java Programming Language was 19.65 while their female counterparts was 19.77. This result showed that the female students taught Java Programming Language using Flipped Learning Instructional Strategy slightly gained more interest than their male counterparts. Furthermore, the table showed that the male students taught Java Programming Language using Flipped Learning Instructional Strategy had slightly higher standard deviations than their female counterparts but the difference could be negligible with the difference in their standard deviations being 0.03.

Research Question 3: What is the male and female students' mean retention in Java programming language when taught with Flipped Learning Instructional Strategy?

Table 3: Mean Differences in the Male and Female Students' Mean Retention Scores with Standard Deviation in Java Programming Language

Gender	No. of Students	Posttest		Retention-test		Mean Differences
		Mean	SD	Mean	SD	
Male	37	57.32	15.28	64.43	15.16	7.11
Female	34	56.59	16.83	63.38	17.02	7.34

Minimum score =0.00 Maximum score =100.00 Normal Average Achievement score =50.00

Result in table 3 above indicated that the male students taught Java Programming Language using Flipped Learning Instructional Strategy obtained mean retention score of 64.43 while their female counterparts obtained mean retention score of 63.38 with their corresponding standard deviations of 15.16 and 17.02. Also, the result showed that the mean difference between the post-test and retention scores of male Java Programming Language students taught Java Programming Language using Flipped Learning Instructional Strategy was 7.11 while their female counterparts was 7.34. This result showed that the male and female students taught Java Programming Language using Flipped Learning Instructional Strategy slightly gained equally with their close mean differences more. Furthermore, the table showed that the female students taught Java Programming Language using Flipped Learning Instructional Strategy had slightly higher standard deviations than their male counterparts but the differences could be negligible.

Testing of the Research Hypotheses

Six (6) null hypotheses which were tested at 0.05 levels of significance guided the study. The hypotheses were tested using the Analysis of Covariance (ANCOVA) whose results are shown in tables 4 to 6.

Table 4: Analysis of Covariance (ANCOVA) of the Mean Achievement Scores of the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	45206.326[a]	4	11301.581	3679.756	.000	
Intercept	5634.727	1	5634.727	1834.648	.000	
Pretest	40172.569	1	40172.569	13080.049	.000	
Group	3725.111	1	3725.111	1212.883	.000	
Gender	.072	1	.072	.023	.878	NS
Group * Gender	1.216	1	1.216	.396	.530	NS
Error	454.550	148	3.071			
Total	300563.000	153				
Corrected Total	45660.876	152				

e. R Squared = .990 (Adjusted R Squared = .990)
f. WHERE S = Significant at P< .05; NS = Not Significant at P> .05

Hypothesis 1

H_{01}: There is no significant difference between the mean achievement scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy.

From the result of ANCOVA in Table 4, it was observed that Gender (male and female) gave an F-value of .023 and was not significant at .878. Since .878 was greater than 0.05, the null hypothesis 2 was accepted as stated. Hence, the study concluded that there was no significant difference between the mean achievement scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy. Thus, the difference between the mean achievement scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy was not significant.

Hypothesis 2

H_{02}: There is no significant interaction between the students' instructional method and the Students' Gender in students' achievement in Java Programming Language.

From the result of ANCOVA in Table 4, it was observed that Group * Gender (Interaction) gave an F-value of .396 and was not significant at .530. Since 530 was greater than 0.05, the null hypothesis 2 was accepted as stated. Hence, the study concluded that there was no significant interaction between the students' instructional method and the Students' Gender in Students' achievement in Java Programming Language.

Table 5: Analysis of Covariance (ANCOVA) of the Mean Interest Scores of the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	14633.499[a]	4	3658.375	235.658	.000	
Intercept	1909.447	1	1909.447	122.999	.000	
PreInterest	8473.442	1	8473.442	545.827	.000	
Group	3590.658	1	3590.658	231.296	.000	
Gender	9.658	1	9.658	.622	.432	NS
Group * Gender	12.646	1	12.646	.815	.368	NS
Error	2297.560	148	15.524			
Total	258621.000	153				
Corrected Total	16931.059	152				

a. R Squared = .864 (Adjusted R Squared = 861)
b. WHERE S = Significant at P< .05; NS = Not Significant at P> .05

Hypothesis 3

H_{03}: There is no significant difference in the mean interests of male and female students in Java programming language when taught with Flipped Learning Instructional Strategy.

From the result of ANCOVA in Table 5, it was observed that Gender (male and female) gave an F-value of .622 and was not significant at .432. Since .432 was greater than 0.05, the null hypothesis 3 was accepted as stated. Hence, the study concluded that

there was no significant difference in the mean interest scores of male and female students in Java programming language when taught with Flipped Learning Instructional Strategy. Thus, the difference between the mean interest scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy was not significant.

Hypothesis 4

$H_{04:}$ There is no significant interaction between the students' instructional method and the Students' Gender in Students' interest in Java Programming Language.

From the result of ANCOVA in Table 4, it was observed that Group*Gender (Interaction) gave an F-value of .815 and was not significant at .368. Since .368 was greater than 0.05, the null hypothesis 4 was accepted as stated. Hence, the study concluded that there was no interaction between the students' instructional method and the students' gender in students' interest in Java Programming Language.

Table 6: Analysis of Covariance (ANCOVA) of the Mean Retention Scores of the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	52112.263[a]	4	13028.066	2704.857	.000	
Intercept	300.938	1	300.938	62.480	.000	
Posttest	41753.839	1	41753.839	8668.837	.000	
Group	785.747	1	785.747	163.135	.000	
Gender	2.746	1	2.746	.570	.451	NS
Group * Gender	12.077	1	12.077	2.507	.115	NS
Error	712.849	148	4.817			
Total	364182.000	153				
Corrected Total	52825.111	152				

a. R Squared = .987 (Adjusted R Squared = .986)
b. WHERE S = Significant at P< .05; NS = Not Significant at P> .05

Hypothesis 5

$H_{05:}$ There is no significant difference in the mean retentions of male and female students in Java programming language when taught with Flipped Learning Instructional Strategy.

From the result of ANCOVA in Table 6, it was observed that Gender (male and female) gave an F-value of .570 and was not significant at .451. Since .451 was greater than 0.05, the null hypothesis 5 was rejected as stated. Hence, the study concluded that there was no significant difference in the mean retention scores of male and female students in Java programming language when taught with Flipped Learning Instructional Strategy. Thus, the difference between the mean retention scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy was not significant.

Hypothesis 6

$H_{06:}$ There is no significant interaction between the students' instructional method and the Students' Gender in Students' retention in Java Programming Language.

From the result of ANCOVA in Table 6, it was observed that Group*Gender (Interaction) gave an F-value of 2.507 and was not significant at .115. Since .115 was greater than 0.05, the null hypothesis 6 was accepted as stated. Hence, the study concluded that there was no significant interaction between the students' instructional method and the students' gender in Students' retention in Java Programming Language.

Summary of Major Findings

The following findings emerged from the study which are:

1. The difference between the mean achievement scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy was not significant.
2. There was no significant interaction between the students' instructional method and the Students' Gender in students' achievement scores in Java Programming Language.
3. The difference between the mean interest scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy was not significant.
4. There was no significant interaction between the students' instructional method and the Students' Gender in students' interest scores in Java Programming Language.
5. The difference between the mean retention scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy was not significant.
6. There was no significant interaction between the students' instructional method and the Students' Gender in students' retention scores in Java Programming Language.

Discussion of Findings

The study determined the gender disparity on students' achievement, interest and retention in in java programming language using the flipped learning instructional strategy. The finding of this study disclosed that the differences between the mean achievement, interest and retention scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy were not significant. This study disagrees with the study of Charles-Ogan and Williams (2015) that determined the advantage of a flipped learning over a conventional method on students' academic achievement. Charles-Ogan and Williams (2015) revealed that that using flipped learning approach in the teaching and learning of Java programming language brought about a slightly higher increase in achievement in male students (27.07) than in female students (26.33). This present study is in agreement with Asogwa (2018)'s study that investigated on the influence of gender on the students' academic achievement mean gain in QBASIC programming language when taught with flipped learning approach. The finding from the Asogwa (2018)'s study showed that using flipped learning approach in the teaching and learning of QBASIC programming language brought about a slightly higher increase in achievement, interest and retention in male students (19.64, 17.09, 14.01) than in female students (19.04, 17.19, 14.11) but the slight increases in students' achievement, interest and retention were not significant. Therefore, gender is not a factor in the use of Flipped Learning Instructional Strategy. The implication of this finding is that the male or the female students do not achieve better than the other neither do they gain more interest than the other nor do they retain more than the other in terms of learning of Java Programming Language.

Also, the study revealed that there were no significant interactions between the students' instructional method and the students' gender in students' achievement, interest and retention scores in Java Programming Language. The finding of this present study is in consonance with the study of Warter-Perez and Dong (2022). Warter-Perez and Dong (2022) revealed that there was no significant interaction

between the students' instructional method and the students' gender in students' performances. Ugwoke, Edeh and Ezemma (2018) that argued that flipped learning on learning management system model is more effective than the face-to-face method in improving students' interest level interaction. Irungu, Nyagah and Mercy (2019) argued that gender interaction does not contribute to students' academic achievement, interest and retention. The study therefore concluded that there was no interaction in learning approach between male and female students taught Java programming language in Colleges of Education.

Conclusion

The study discovered that the difference between the mean achievement, interest and retention scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy was not significant. In addition, the result of the study showed that there was no significant interaction between the students' instructional method and the students' gender in students' achievement, interest and retention scores in Java Programming Language. Hence, the study concluded that the use of the Flipped Learning Instructional Strategy as an approach to individualizing instruction may offer the best wish for colleges of education that are serious about addressing the individual needs of the male and female students or groups of male and female students with similar needs.

Recommendations

Based on the findings and implications of the study, the following recommendations were made:

1. Computer Education lecturers should ensure that there is no gender discrimination in Java Programming Language classes. If, for any reason or account of biological labour, any member of the genders achieves and/or retains below expectation in any assessment in Java Programming language, efforts should be made by the Computer Education lecturers to re-direct the student rightly through the use of Flipped Learning Instructional Strategy instead of making negative labels against the gender of the student that yielded the poor academic achievement.
2. Federal/State governments, management of Federal Colleges of Education, the Heads of Computer Education Departments in the Federal Colleges of Education and other professional bodies like the Nigeria Computer Education Association should encourage both male and female Computer Education lecturers and students to work harder in Computer Programming languages especially on Java Programming Language. They should also be mindful of labeling roles or materials in Computer Education department or class in order to avoid one gender from slacking behind.

Summary of the Study

The study determined gender disparity on students' achievement, interest and retention in in java programming language using the flipped learning instructional strategy. The study was guided by three research questions and six (6) research hypotheses. All the relevant literatures were reviewed. This study adopted quasi-experimental design with non-equivalent groups, which includes pre-test and post-test design. The population for the study was 229 computer education third year students of the federal Colleges of Education in South-East Nigeria. The sample size was 153 third year NCE Computer Education students, comprising 71 students of Alvan Ikoku Federal College of Education, Owerri and 82 students of Federal College of Education, Eha-Amufu. Thus, the study sampled 89 female and 64 male students from the selected Colleges of Education. Simple Random Sampling through balloting was used to select the two (2) out of the three (3) Federal Colleges of Education in South-Eastern part of Nigeria. Also, Simple Random Sampling through balloting was used to select the school for the Experimental and Control groups. Intact classes were used. The instruments used for data collection in this study were Java Programming Language Achievement Test (JPLAT) and Java

Programming Language Interest Inventory (JPLII). Both JPLAT and JPLII consist of two (2) sections; Section A and B. Their Section A sought for the personal information of the respondents which is respondent's name, registration number, name of the College of Education and gender while Section B of JPLAT consists of 50 multiple choice items having four alternative options and the Section B of JPLII elicit information on the interest level of students in learning Java Programming Language in colleges of education, South-East, Nigeria. Section B of the JPLII consists of twenty (20) items that are constructed in a four-point scaling system which ranges from Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). Both instruments were validated by experts in the Department of Mathematics and Computer, Faculty of Education, Enugu State University of Science and Technology (ESUT), Enugu.

Both instruments were found to reliable. The reliabilities of JPLAT and JPLII were trial tested by administering them on 30 computer education third year students in Federal College of Education (Technical), Asaba, Delta state. The scores obtained from the testing were analyzed using Kuder Richardson 20 (KR-20) for JPLAT and Cronbach Alpha for JPLII with the aim to determine the internal consistency of the instruments. The KR 20 reliability coefficient of 0.86 was obtained for JPLAT while the Cronbach Alpha of 0.73 was obtained for JPLII. These result showed that both instruments were reliable and fit to be used for the study. The researcher subjected JPLAT to item analysis in order to make JPLAT a standardized test and to remove the test items that were difficult, easy and discriminatory. JPLAT was trial tested on 148 computer education third year students in Federal Colleges of Education located in Southern part of Nigeria. The scores obtained from the pilot testing were used for item analysis. JPLAT was retained because its difficulty index was 56.83% which showed that JPLAT was moderate. Also, all the fifty (50) items of JPLAT had their item difficult and discriminatory difficult indices fall within the range of 40% - 70% and were retained.

The Experimental Procedure for the study was; first by obtaining permission from the relevant authorities, then followed by the training of the research assistants and finally administering of the treatment. All the extraneous variables that may have affected the result of the study were either minimized or removed. The data for the study was collected through the pre-test, post-test and retention-testing. Data gotten from the markings of the pretest, posttest and retention-test scripts were recorded separately and were used for study's analysis. The data was analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA) using pretest and posttest scores as covariates for posttest analysis, and using post-test and retention-test scores as covariates for retention-test analysis. Mean ($\bar{x}$) and standard deviations (s) were used in answering the research questions while Analysis of Covariance (ANCOVA) was used in testing the research hypotheses at 0.05 alpha levels. The study revealed that the differences between the mean achievement, interest and retention scores of male and female students taught Java programming language with Flipped Learning Instructional Strategy were not significant. Hence, the study recommended that the Nigerian Colleges of Education especially Computer Education lecturers should ensure that there is no gender discrimination in Java Programming Language classes and Federal/State governments, management of Federal Colleges of Education, the Heads of Computer Education Departments in the Federal Colleges of Education and other professional bodies like the Nigeria Computer Education Association should encourage both male and female Computer Education lecturers and students to work harder in Computer Programming languages especially on Java Programming Language..

References

Ahmed, A.M. (2022). Assessment of the Computer Education Programme offered in Colleges of Education. *Journal of EDRI* 174 (2); 145 – 157.

Anderson, L. W., and Krathwohl, D. (2021). *A taxonomy for learning and assessing*. A revision of Bloom's taxonomy of educational objectives. New York: longman.

Asogwa, U. (2018). The effect of flipped learning on students' academic achievement in QBASIC programming language in colleges of education . *An Unpublished dissertation of the University of Nigeria Nsukka.*

Barker, M. (2016). Development for teaching online digital commons: faculty development for Online teaching. Educational and Technological issues. *The Journal of Continuing Education in Nursing*, 34(6), 102-105.

Boyle, E. A., Duffy, T. and Dunleavy, K. (2023). Learning styles and academic outcome. The validity and utility of Vermont's inventory of learning styles in a British higher education setting. The British journal of Educational Psychology,73(2),267-290.

Chang, M. (2020). Web-Based Multiplayer Online Role-Playing Game (MORPG) for Assessing Students' Java Programming Knowledge and Skills, in Digital Game and Intelligent Toy Enhanced Learning (DIGITEL), *2010 Third IEEE International Conference on IEEE*, 103-107.

Charles-Organ,G. and Williams. C. (2015). Flipped classroom versus a conventional classroom in the learning of Mathematics. *Brook Journal of Education*, 3(6), 71-77.

Corral, R. J. M., Balcells, A. C., MorgadoEstévez, A., Moreno, G. J. and Ramos, F. M. J. (2014). A Game-based Approach to the Teaching of Object-Oriented Programming Languages. *Computers & Education*, 73(4), 83-92.

Federal Republic of Nigeria Official Gazette (2011). Legal Notice on Publication of the Details of the Breakdown of the National and State Provisional Totals 2006 Census.

Ghavifekr, S. and Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science (IJRES)*, 1(2), 175-191.

Hafkin, A. (2021). *Globalization, technology diffusion and gender disparity: entries for 2021 Handbook of research in library and information science*. London: IGI publications.

Hamidi, F., Meshkat, M., Rezaee, M. and Jafari, M. (2021). Information technology in education. *Procedia Computer Science*, 3, 369-373.

Heckman, S., Horton, T. B. and Sherriff, M. (2021). Teaching Second-Level Java and software Engineering with Android, in Software Engineering Education and Training (CSEE&T), *2021 44th IEEE-CS Conference*, 540-542.

Ibezim, N. E. and Obi, C. A. (2018). Distributed Information Management in Federal Universities in Nigeria: Implications for Computer Education. *International Journal of Educational Research (INJER)*, 11(1), 161-166.

Ikolo, V. E. (2020). Gender digital divide and national ICT Policies in Africa. *In Adomi, E.E. (Ed) Innovation 16-18 institute. Instructors.* Stylus publishing, sterling, VI Interactive educational technology.

Irungy, M. N., Nyagah, G. and Mercy, M. (2019). *To examine the influence of Gender interaction on academic achievement of students*. Advances in social sciences research journals, 6(7),126-156.

Iruonagbe, C. T. and Egharevba, M. E. (2015). For an overview of the development of the university system see: Higher Education in Nigeria and the Emergence of Private Universities.

In: *International Journal of Education and Research,* 3(2), 49 -56.

Kindler, E. and Krivy, I. (2021). *Object-Oriented Simulation of systems with sophisticated control. International Journal of General Systems 10(1); 313–343.*

Munusamy, K. and Ismail (2019). *Influence of gender role on internet usage pattern at home National minority, children and youth*. Mahwah, NJ: Lawrence Erlbaum

Nwite, O. and Nwuche, R. A. (2016). Evaluation of students' personnel services in Colleges of Education in Nigeria. *British Journal of Education*, 4(7), 82 - 98.

Olelewe, C. J. (2019). Strategies for Improving the Teaching and Learning of QBASIC Programming Language in Colleges of Education in Enugu, Ebonyi and Anambra States. *Unpublished M.ED Thesis Department of Computer Education, University of Nigeria, Nsukka*.

Ozden, M. (2017). Problems with science and technology education in Turkey. *Eurasia Journal of Mathematics Science & Technology Education,* 3(2), 157-161.

Papadapoulos, C. and Roman, A. (2020). Implementing an inverted classroom model in engineering statistical: Initial results. *American Society for Engineering Statistics, Proceedings of the 50th ASEE/IEEE Frontiers in Education Conference,* Washington, DC, October 2020.

Robinson, J. P. and Lubienski, S. T. (2021). The Development of Gender Achievement Gaps in Mathematics and Reading During Elementary and Middle School: Examining Direct Cognitive Assessments and Teacher Ratings. *American Educational Research Journal*, 48 (2), 268 - 302.

Shieh, R. S., Chang, W. and Liu, E. Z. F. (2011). Technology enabled active learning (TEAL) in introductory physics: Impact on genders and achievement levels. *Australasian Journal of Educational Technology, 27(7),* 56 – 68.

Ugwoke, E. O., Edeh, N. I. and Ezemma, J. C. (2018) Library philosophy and practice: Effects of flipped classroom on learning management systems and face-to-face learning environments on students' gender, interest and achievement in accounting. E-journal

Volman, D. (2012). Gender equity and information technology in education. *Review of Educational research,* 15(4), 34 – 45.

Warter-Perez, N. and Dong, J. (2022). *Flipping the classroom: How to embed inquiry and design projects into a digital engineering lecture*. Paper presented at Asee Psw section Conference, California Polytechnic State University, San Luis Obidpo, CA

Whitley, B. (2017). The relationship of authoritarianism and related construct to attitudes. *Journal of Applied Social Psychology*, 30 (2), 144-170.

Wilder, G., Mackie, D. and Cooper, J. (2015). Gender and Computers: Two Surveys of Computer Related Attitudes. *Sex Roles*, 13(1), 214 – 228.

EFFECT OF FLIPPED LEARNING INSTRUCTIONAL STRATEGY ON STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN JAVA PROGRAMMING LANGUAGE

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Abstract

The study determined effect of Flipped Learning Instructional Strategy on students' academic achievement and retention in Java programming language in Colleges of Education in South-East, Nigeria. The study was guided by two research questions and two research hypotheses. This study adopted quasi-experimental design with non-equivalent groups, which includes pre-test and post-test design. The population for the study was 229 computer education third year students of the federal Colleges of Education in South-East Nigeria. The sample size was 153 third year NCE Computer Education students, comprising 71students of Alvan Ikoku Federal College of Education, Owerri and 82 students of Federal College of Education, Eha-Amufu. Simple Random Sampling through balloting was used to select the two (2) out of the three (3) Federal Colleges of Education in South-Eastern part of Nigeria. The instrument used for data collection in this study were Java Programming Language Achievement Test (JPLAT).JPLAT has two (2) sections; Section A and B. Their Section A sought for the personal information of the respondents which is respondent's name, registration number, name of the College of Education while Section B consists of 50multiplechoiceitemshavingfouralternativeoptions. JPLAT was validated by experts in the Department of Mathematics and Computer, Faculty of Education, Enugu State University of Science and Technology (ESUT), Enugu and was found to reliable with a KR20 reliability coefficient of 0.86. The researcher subjected JPLAT to item analysis and its difficulty index was 56.83% which showed that JPLAT was moderate. The Experimental Procedure for the study was; first by obtaining permission from the relevant authorities, then followed by the training of the research assistants and finally administering of the treatment. Data gotten from the markings of the pretest, posttest and retention-test scripts were analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA). The study revealed that Flipped Learning Instructional Strategy significantly improved the students' achievement and retention in Java Programming Language more than Lecture Method. Hence, the study recommended that the Nigerian Colleges of Education especially Computer Education lecturers should adopt the use of Flipped Learning Instructional Strategy in teaching Java programming language.

Key words: *Java Programming Language, Flipped Learning Instructional Strategy, Students' achievement, Students' retention.*

Introduction

Technologycreatesandtransformsthelearningandteachingprocesses,whichbringsnewopportunitiestotheeducationalsystemhence,integrationofcomputersineducation(Hamidi,Meshkat,Rezaee&Jafari,2021).Technologybegetcomputerandtheintegrationofcomputersineducationaccordingto Hamidietal(2021)hasledtotheintroduction of Computer Studies in schools at all level. Computer Studiesisrelevantforallstudentsbecauseitincorporatesabroadrangeoftransferableproblem-solvingskillsandtechniques,includinglogicalthinking,creativedesign,synthesis,andevaluation(Abbas,2024).Onesignificantinfluenceoftechnologyinthe21st centuryeducationalsystemistheuseofcomputertechnologyininstru

ctionaldeliveryandalsotechnologyhasledtotheteaching andlearningofcomputerprogramminginschools(Baisha khi&Kamal,2016).Agoodfoundationincomputerprogra mminglanguagewillintroducestudentstotheexcitingopp ortunitiesgivenbythisdynamicfieldandwillbegintoprep arethemforarangeofworthwhilecareers.Computerprogr ammingisaprocessthatleadsfromanoriginalformulation ofacomputingproblemtoexecutablecomputerprograms. Programminginvolvesactivitiessuchasanalysis,develop ingunderstanding,generatingalgorithms,verificationofr equirementsofalgorithmsincludingtheircorrectnessand resourcesconsumption,andimplementation(commonly referredtoascoding)ofalgorithmsinatargetprogrammin glanguage(Shaun,2024).

Computerprogrammingistheartofwritingsequenceofins tructionsusingprogramminglanguagetoperformaspecifi edtaskbythecomputerandpossiblycontrolexternaldevic essuchasprinters,diskdrives,robots,amongothers(Maye r&Bauer,2015).Acomputerprogramontheotherhandisa collectionofinstructionsthatperformsaspecifictaskwhe nexecutedbyacomputerandtheseprogramscanbecategor izedbythe programminglanguage usedtoproducethem(Bartik,2023).Thepurposeofprogrammingistofindasequ enceofinstructionsthatwillautomatetheperformanceofa task(whichcanbeascomplexasanoperatingsystem)onac omputer,oftenforsolvingagivenproblem(Dooley,2023) .Thousandsofdifferentprogramminglanguageshavebee ncreated,mainlyinthecomputerfield,andmanymoreareb eingcreatedeveryyearsuchasQuickBeginnersAllPurpos eSymbolicInstructionCode(QBASIC),C,Java,C++,FO RTRAN,Pascal,amongotherswitheachlanguagehaving auniquesetofkeywords(wordsthatthelanguageunderstan nds)andaspecialsyntaxfororganizingprograminstructio ns.Amongalltheseprogramminglanguages,Javaprogra mmingistheonlyprogramminglanguagethatisaplatform - independentandcanexecuteinanycomputersystemprovi dedthereisaJavarun- timesysteminstalledinit(Horstmann,2013).

Javaprogramminglanguagelikeanyotherlanguagehasits owncharacteristicswhichincludes;object- oriented.Javaprogramsarenotcompiledforaspecificproc essorand/oroperatingsystem.ThisisbecauseJavaprogra msrunundertheJavaVirtualMachine(JVM)secure.Thise nablesprogrammerstodevelopvirus- freeprogramsorsoftwarewithhighperformance(Horstm ann,2013).Javaprogramminglanguageisoneoftheprogr amminglanguagestaughtatComputerEducationinColle gesofEducation.However,thechallengewiththeteaching andlearningofJavaprogramminglanguageincollegesofe ducationisthatstudentsshyawayorlackinterestinlearnin gtheprogramminglanguageduetotheabstractnatureofth ecourse(Olelewe,2016;Rasaki,2012).Otherchallengesi nclude;teachingJavaprogramminglanguagewithoutany formofpracticalorreal- lifeexperiences,henceaffectsperformanceofthestudents inthesubject(Jan,2021).Mostcomputereducationstuden tsupongraduationfromcollegeofeducationinSouth- Eastcannotwrite/developasimpleJavaprogramme(Bret ag,2023).Thesituationcanbeanindicationthattheapproa ch/methodusedinteachingandlearningthecourseisinapp ropriateforstudents'comprehension.Inabidtocurtailthis menace,expertslikeSams&Bergmann(2023)suggestedt hatthelecturersteachingofJavaprogramminginolleges ofeducationshoulduseFlippedLearningInstructionalStr ategy.ThisisbecauseFlippedLearningInstructionalStrat egyisapedagogicalapproachinwhichdirectinstructionm ovesfromthegrouplearningspace(classroom)totheindiv iduallearningspace(home),andtheresultinggroupspacei stransformedintoadynamic,interactivelearningenviron mentwheretheeducatororteacherguidesstudentsastheya pplyconceptsandengagecreativelyinthesubjectmatter(S ams&Bergmann,2023).

FlippedLearningInstructionalStrategyenablesthestude ntstogainexposuretothelearningmaterialspriortoclassan dfocusontheprocessingpartoflearning(synthesizing,ana lyzing)andproblem- solvingintheclass(Walvoord&Anderson,2017).Accord ingtoSchellandMazur(2015),therearethreemainconcep tsembracedinaFlippedLearningInstructionalStrategyw hichincludes:priorknowledgeisrequiredfordeeperlearni ng;studentslearnwhentheyareengaged;andflippingthecl assenablesacontinuouslearningpath.AccordingtoPears onandFlippedLearningNetwork(2023),thekeyfeatures orpillarsofflippedclassroomsareidentifiedas**F**lexibleen vironment,**L**earningculture,**I**ntentionalcontentand**P**rof essionaleducatorotherwisecalled(FLIP).**F**lexibleenviro nments,educatorsoftenphysicallyrearrangetheirlearnin gspacestoaccommodatealessonorunit,tosupporteitherg roupworkorindependentstudy.Educatorscreateflexible spacesinwhichstudentschoosewhenandwheretolearn.F

urthermore,educatorswhoflipttheirclassesareflexibleint heirexpectationsofstudenttimelinesforlearningandinthe irassessmentsofstudentlearning.Inthetraditionalteacher - centeredmodel,theteacheristheprimarysourceofinform ation(Mackatiani,2018).

Bycontrast,**L**earningcultureinflippedlearningmodeldel iberatelyshiftsinstructiontoastudent-centeredapproach,wherein-classtimeisdedicatedtoexploringtopicsingreaterdepth andcreatingrichlearningopportunities.Asaresult,student sareactivelyinvolvedinknowledgeconstructionastheyp articipateinandevaluatetheirlearninginamannerthatispe rsonallymeaningful.**I**ntentionalcontent,flippedlearning educatorscontinuallythinksabouthowflippedlearningm odelcanbeusedtohelpstudentsdevelopconceptualunders tanding,aswellasproceduralfluency(Shamberger&Mue nzenberger,2016).Educatorsdeterminewhattobetaught andwhatmaterialsstudentsshouldexploreontheirown.E ducatorsuseintentionalcontenttomaximizeclassroomti meinordertoadoptmethodsofstudent-centered,activelearningstrategies,dependingongradele velandsubjectmatter.Theroleofa**P**rofessionaleducatoris evenmoreimportant,andoftenmoredemanding,inaflipp edclassroomthaninatraditionalone(PearsonandFlipped LearningNetwork,2023).Duringclasstime,educatorsco ntinuallyobservetheirstudents,providingthemwithfeed backrelevantinthemoment,andassessingtheirwork.Prof essionaleducatorsarereflectiveintheirpractice,connect witheachothertoimprovetheirinstruction,acceptconstru ctivecriticism,andtoleratecontrolledchaosintheirclassr ooms.While,accordingtoSams,Daniels,Bennett,Marsh allandArfstrom(2014),professionaleducatorstakeonles svisiblyprominentrolesinaflippedlearningapproachand remaintheessentialingredientthatenablesflippedlearnin gtooccur.

Contextually,FlippedLearningInstructionalStrategyisa napproachthatrequiresstudentstohaveaccesstoinstructi onalmaterialsbeforeclasstoread/watchandpracticethein structionontheirownpace.Roehling,Root-Luna,RichieandShaughnessy(2017)'sstudyshowedthat videosareoftenusedasameansofteachingoutsidetheclass room,whileinteractivetasksinwhichthestudentsareactiv elyinvolvedareusedasin-classactivities.Thus,inthecaseofthisstudy,studentswillb erequiredtoread/watchandpracticeadesignedflippedlea rninginstructionalmaterialonJAVAprogramminglangu ageathomeattheirownpacethen,cometoclasspreparedto discuss,shareideas,interactwiththeirfellowstudents'incl udingtheirteacher,askquestionsandanswerquestionsfor betterunderstandingofaconcept.Therefore,FlippedLear ningInstructionalStrategywastriedouttoascertainits'eff ectonacademicachievementofthestudentsonJavaprogra mminglanguage.Academicachievementofthestudentsis theextenttowhichstudentshaveattainedtheireducational goals.Academicachievementmayalsorefertoastudents' strongperformanceinagivenacademicarena.Academica chievementrepresentsperformanceoutcomethatindicate theextenttowhichastudenthasaccomplishedspecificgoa lsthatwerethefocusofactivitiesininstructionalenvironm ents,specificallyinschool,college,anduniversity(Stein mayr,Meiner,Weidinger&Wirthwein2015).Bossaert,D oumen,Buyse&Verschueren(2011)reportedthatacade micachievementofstudentscanbegroupedintotwobasicf orm;theearlyacademicachievementandthelateracademi cachievement.TheEarlyacademicachievementenhance sthelateracademicachievement(Bossaert,Doumen,Buy se&Verschueren,2011).

InNigeria,theearlyacademicachievementisregardedast hemainstudents'achievementwhilethelateracademicac hievementisregardedasthestudents'retention(Eze,2019).Retentionistheabilitytorecallwhathasbeenlearnedorex perienced.Retentionoflearningistherepeatperformance byastudentoftheknowledgeearlieracquired,elicitedafter aperiodoftime.Thus,theinfluenceofFlippedLearningIns tructionalStrategyonthestudents'academicachievement andretentioninJavaProgrammingLanguagesinColleges ofEducationinSouthEastofNigeriaweredeterminedbeca useoftheresearchofNandon(2018)developedanIntellige ntTutorSystem(ITS)forlearningJavaprogramminginter tiaryinstitutionsinPlateauStateanddiscoveredthatITSin creasedthestudents'achievementandretentioninJavaPro grammingandthestudywantedtodetermineifthesameres ultwouldbereplicated.

ObjectivesoftheStudy

TheobjectiveofthestudywastodetermineeffectofFlippe dLearningInstructionalStrategyonstudents'academicac hievementandretentioninJavaprogramminglanguagein CollegesofEducationinSouth-East,Nigeria.Specifically,thestudydetermined:

1. thestudents'meanacademicachievementinJava programminglanguagewhentaughtwithflipped learninginstructionalstrategyandwhentaughtwi thLecturemethod.
2. themeanretentionofstudents'inlearningJavapro grammminglanguagewhentaughtwithflippedlear ninginstructionalstrategyandwhentaughtwithL ecturemethod.

ResearchQuestions

Thefollowingresearchquestionsguidedthestudy;

1. Whatisthestudents'meanacademicachievemen tinJavaprogramminglanguagewhentaughtwith FlippedLearningInstructionalStrategyandwhe ntaughtwithLecturemethod?
2. Whatisthestudents'meanretentioninJavaProgr ammingLanguagewhentaughtJavaprogrammi nglanguageusingFlippedLearningInstructional StrategyandwhentaughtwithLecturemethod?

ResearchHypotheses

Thefollowinghypotheseswereformulatedtoguidethestu dy,andweretestedat0.05levelofsignificance.

H_{01}:Thereisnosignificantdifferencebetweenthemeansc oresofstudentstaughtJavaprogramminglanguagewithFl ippedLearningInstructionalStrategyandthosetaughtwit hLectureMethod.

H_{02}:Thereisnosignificantdifferenceinthemeaninterestso fmaleandfemalestudentsinJavaprogramminglanguage whentaughtwithFlippedLearningInstructionalStrategy.

ResearchMethodology

Thisstudyadoptedquasi-experimentaldesignwithnon-equivalentgroups,whichincludespre-testandpost-testdesign.Thepopulationforthestudywas229computer educationthirdyear)andstandarddeviations)wereusedin answeringtheresearchquestionswhileAnalysisofCovari ance(ANCOVA)wasusedintestingtheresearchhypothes esat0.05alphalevels.(studentsofthefederalCollegesofE ducationinSouth-EastNigeria.Thesamplesizewas153thirdyearNCECom puterEducationstudents,comprising71studentsofAlvan IkokuFederalCollegeofEducation,Owerriand82student sofFederalCollegeofEducation,Eha-Amufu.SimpleRandomSamplingthroughballotingwas usedtoselectthetwo(2)outofthethree(3)FederalColleges ofEducationinSouth-EasternpartofNigeria.Also,SimpleRandomSamplingth roughballotingwasusedtoselecttheschoolfortheExperi mentalandControlgroups.Intactclasseswereused.Thein strumentusedfordatacollectioninthisstudywereJavaPro grammingLanguageAchievementTest(JPLAT).JPLAT hastwo(2)sections;SectionAandB.TheirSectionAsoug htforthepersonalinformationoftherespondentswhichisr espondent'sname,registrationnumber,nameoftheColle geofEducationwhileSectionBconsistsof50multiplechoi ceitemshavingfouralternativeoptions.JPLATwasvalida tedbyexpertsintheDepartmentofMathematicsandComp uter,FacultyofEducation,EnuguStateUniversityofScie nceandTechnology(ESUT),Enuguandwasfoundtorelia blewithaKR20reliabilitycoefficientof0.86.Thecoeffici entwasdeterminedafterJPLATwastrialtestedon30comp utereducationthirdyearstudentsinFederalCollegeofEdu cation(Technical),Asaba,Deltastate.Thescoresobtained fromthetestingwereanalyzedusingKuderRichardson20 (KR-20).TheresearchersubjectedJPLATtoitemanalysisinord ertomakeJPLATastandardizedtestandtoremovethetesti temsthatweredifficult,easyanddiscriminatory.JPLATw astrialtestedon148computereducationthirdyearstudents inFederalCollegesofEducationlocatedinSouthernpartof Nigeria.Thescoresobtainedfromthepilottestingwereuse dforitemanalysis.JPLATwasretainedbecauseitsdifficul tyindexwas56.83%whichshowedthatJPLATwasmoder ate.Also,allthefifty(50)itemsofJPLAThadtheiritemdiff icultanddiscriminatorydifficultindicesfallwithintheran geof40%-70%andwereretained.TheExperimentalProcedureforth estudywas;firstbyobtainingpermissionfromtherelevant authorities,thenfollowedbythetrainingoftheresearchass istantsandfinallyadministeringofthetreatment.Alltheex traneousvariablesthatmayhaveaffectedtheresultofthest udywereeitherminimizedorremoved.Thedataforthestu dywascollectedthroughthepre-test,post-testandretention-testing.Datagottenfromthemarkingsofthepretest,postte standretention-testscriptswererecordedseparatelyandwereusedforstud y'sanalysis.Thedatawasanalyzedusingmean,standardd eviationandAnalysisofCovariance(ANCOVA)usingpr etestandposttestscoresascovariatesforposttestanalysis,

andusingpost-testandretention-testscoresascovariatesforretention-testanalysis.

Mean ($\bar{x}s$

Results

Table1:MeanDifferencesinthestudents'MeanAchievementScoreswithStandardDeviationinJavaProgrammingLanguage

Groups	No.ofStudents	Pretest		Posttest		MeanDifferences
		Mean	SD	Mean	SD	
Experimental	71	29.31	15.68	56.97	15.93	27.66
Control	82	28.00	16.73	35.49	16.80	7.49

Minimumscore=0.00 Maximumscore=100.00 NormalAverageAchievementscore=50.00

Resultintable1aboveindicatedthatthethirdyearNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategyobtainedmeanscoresof29.31and56.97intheirpretestandposttestrespectivelyand,withtheircorrespondingstandarddeviationsof15.68and15.93.Ontheotherhand,thethirdyearNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingLectureApproachhadthemeanscoresof28.00and35.49intheirpretestandposttestrespectivelyand,withcorrespondingstandarddeviationsof16.73and16.80.Also,theresultshowedthatthemeandifferencebetweenthepretestandposttestachievementscoresofthirdyearNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategywas27.66whilethosetaughtJavaProgrammingLanguageusingLectureApproachwas7.49.Thisresultshowedthatthethirdyear NCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategygainedmorethantheircounterparttaughtJavaProgrammingLanguageusingLectureApproachintermsofachievementscore.Furthermore,thetableshowedthattheNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategyhadslightlylowerstandarddeviationsthantheircounterpartsthatweretaughtJavaProgrammingLanguageusingLectureApproachatposttestlevelsbutthedifferenceisnegligiblesincethatthedifferencesintheirstandarddeviationsisverysmall(that's0.87)fortheposttest.

ResearchQuestion1: Whatisthestudents'meanacademicachievementinJavaprogramminglanguagewhentaughtwithFlippedLearningInstructionalStrategyandwhentaughtwithLecturemethod?

ResearchQuestion2: Whatisthestudents'meanretentioninJavaProgrammingLanguagewhentaughtJavaprogramminglanguageusingFlippedLearningInstructionalStrategyandwhentaughtwithLecturemethod?

Table2:MeanDifferencesintheStudents'MeanRetentionScoreswithStandardDeviationinJavaProgrammingLanguage

Groups	No.ofStudents	Post-test		Retention		MeanDifferences
		Mean	SD	Mean	SD	
Experimental	71	56.97	15.93	63.93	15.97	6.96
Control	82	35.49	16.80	37.48	17.45	1.99

Minimumscore=0.00 Maximumscore=100.00 NormalAverageAchievementscore=50.00

Resultintable2aboveindicatedthatthethirdyearNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategyobtainedmeanretentionscoreof63.93whilethethirdyearNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingLectureApproachhadthemeanretentionscoreof37.48withtheircorrespondingstandarddeviationsof15.97and17.45.Also,theresultdisplayedthatthemeandi

fferencebetweenthePost-testandretentionscoresofNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategywas6.96whilethosetaughtJavaProgrammingLanguageusingLectureApproachwas1.99.Thisresultshowedthatthestudentstaught JavaProgrammingLanguageusingFlippedLearningInstructionalStrategyretainedmorethantheircounterparttaughtwithLectureApproach.Furthermore,thetableshowedthatthethirdyearNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingLectureApproachhadslightlyhigherstandarddeviationsthantheircounterpartsthatweretaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategywiththedifferenceintheirstanddeviationsbeing1.48.

TestingoftheResearchHypotheses

Two(2)nullhypotheseswhichweretestedat0.05levelsofsignificanceguidedthestudyandtheresultsareshownintables3and4.

Table3:AnalysisofCovariance(ANCOVA)oftheMeanAchievementScoresoftheExperimentaland Control Groups

Source	TypeIIISumofSquares	Df	MeanSquare	F	Sig.	Decision
CorrectedModel	45206.326[a]	4	11301.581	3679.756	.000	
Intercept	5634.727	1	5634.727	1834.648	.000	
Pretest	40172.569	1	40172.569	13080.049	.000	
Group	3725.111	1	3725.111	1212.883	.000	S
Gender	.072	1	.072	.023	.878	NS
Group*Gender	1.216	1	1.216	.396	.530	NS
Error	454.550	148	3.071			
Total	300563.000	153				
CorrectedTotal	45660.876	152				

a. RSquared=.990(AdjustedRSquared=.990)
b. WHERES=SignificantatP<.05;NS=NotSignificantatP>.05

Hypothesis1

H_{01}:Thereisnosignificantdifferencebetweenthemeanachievementscoresofstudentstaught Javaprogramminglanguagewith FlippedLearningInstructionalStrategyandthosetaughtwithLectureMethod.

FromtheresultofANCOVAinTable3,itwasobservedthatGroup(experimentalandControl)gaveanF-valueof1212.883andwassignificantat0.000.Since0.000waslessthan0.05,thenullhypothesis1wasrejectedasstated.Hence,thestudyconcludedthattherewassignificantdifferencebetweenthemeanachievementscoresofstudentstaughtJavaprogramminglanguagewithFlippedLearningInstructionalStrategyandthosetaughtwithLectureMethod.Thus,thethirdyearNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategysignificantlyachievedbetterthantheircounterparttaughtJavaProgrammingLanguageusing Lecture Approach.

Table4:AnalysisofCovariance(ANCOVA)oftheMeanRetentionScoresoftheExperimentalandControlGroups

Source	TypeIIISumofSquares	Df	MeanSquare	F	Sig.	Decision
CorrectedModel	52112.263[a]	4	13028.066	2704.857	.000	
Intercept	300.938	1	300.938	62.480	.000	
Posttest	41753.839	1	41753.839	8668.837	.000	
Group	785.747	1	785.747	163.135	.000	S
Gender	2.746	1	2.746	.570	.451	NS

Group*Gender	12.077	1	12.077	2.507	.115 NS
Error	712.849	148	4.817		
Total	364182.000	153			
CorrectedTotal	52825.111	152			

a. R Squared = .987 (Adjusted R Squared = .986)
b. WHERE S = Significant at P< .05; NS = Not Significant at P> .05

Hypothesis2

$H_{02:}$ Thereisnosignificantdifferenceinthemeanretention scoresofstudentsinJavaprogramminglanguagewhentaughtwithFlippedLearningInstructionalStrategyandthosetaughtwithLecturemethod.

FromtheresultofANCOVAinTable4,itwasobservedthatGroup(experimentalandControl)gaveanF-valueof163.135andwassignificantat0.000.Since0.000waslessthan0.05,thenullhypothesis2wasrejectedasstated.Hence,thestudyconcludedthattherewassignificantdifferenceinthemeanretentionscoresofstudentsinJavaprogramminglanguagewhentaughtwithFlippedLearningInstructionalStrategyandthosetaughtwithLecturemethod.Thus,thethirdyearNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategysignificantlyretainedmorethantheircounterparttaughtJavaProgrammingLanguageusingLectureApproach.

Major Findings:

The findings emerged from the study are:

1. TheNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategysignificantlyachievedbetterthantheircounterparttaughtJavaProgrammingLanguageusingLectureApproach.

2. TheNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategysignificantlyretainedmorethantheircounterparttaughtJavaProgrammingLanguageusingLectureApproach.

Discussion of the Findings

ThefindingsofthestudyrevealedthattheNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategysignificantlyachievedbetterthantheircounterparttaughtJavaProgrammingLanguageusingLectureApproach.Thisstudyupholdsthefindingsof Kilmer and Ventry (2023) that carried out a study on comparisons between student achievement in flippedlearningclassesandtraditionallectureclasses.Kilmer and Ventry (2013)'sstudyrevealedthatafterimplementingtheFlippedLearningInstructionalStrategy,83%ofstudentsinthehonorsAlgebraII/Trigonometryclasspassedtheregentsexam(withascoreof65orhigher)comparedwith71%theyearbefore(traditionalclass),and35%ofhonorsstudentsachievedmastery(ascoreof85orhigher)comparedwith14%thepreviousyear.Theauthorsconcludedthatflippedlearningclassesimprovedtheacademicachievementofstudentsin AlgebraII/Trigonometrythanthestudentsthatweretaughtusingtraditionallectureclasses.

Similarly,theviewofWilson(2023)ontheeffectofflippedlearningapproachonanundergraduatestatisticscourseforsocialsciencemajorscorroborateswiththisstudy.Thestudyrevealedthatstudentsperformedbetterintheflippedlearningsectionsanddemonstratedenhancedstatisticsknowledgecomparedtothoseinsectionstaughtusingatraditionallecturemethodthepreviousyear.Thefindingsshowedthatusing FlippedLearningInstructionalStrategyinteachingandlearningofJavaprogramminglanguagebroughtaboutbetterimprovementinthestudents'achievementthantheLectureApproach.Also,theoutcomeofthisstudyshowedthattheNCEComputerEducationstudentstaughtJavaProgrammingLanguageusingFlippedLearningInstructionalStrategysignificantlyretainedmorethantheircounterparttaughtJavaProgrammingLanguageusingLectureApproach.Theresultofthisstudyaffirmsthefindingofthestudy of Charles-Ogan and Williams (2015) who revealed that flippedlearningmakesstudentstoretainfasterthantheconventionalmethod.Thisfindingstillconfirmstheassertions of Boyle, Duffy and Dunleavy (2023) who revealed that the instructional strategyusedbyateacher/lecturerdeterminestheextenttowhichthestudentscanretainwhatistaught.Thisimpliedth

atifadequateinstructionalstrategylikeFlippedLearningInstructionalStrategyisusedbytheComputerEducationLecturersinteachingJavaProgrammingLanguage,itthenmeansthatthestrategywillmakethestudentstoretaintheconceptsofJavaProgrammingLanguageby3.497timesfasterthantheircounterpartstaughtusingLectureApproach. ThisisbecauseFlippedLearningInstructionalStrategyprovidesalearningenvironmentthatgivesstudentsdeeperengagementinthelearningprocesswhichinfluencesstudents'retentionoflearningofJavaProgrammingLanguage(Ahmed,2022).

Conclusion

ThestudyfocusedontheeffectofFlippedLearninginstructionalstrategyonComputerEducationStudents'Achievement,interestandretentioninJavaProgramminginFederalCollegesofEducationinSouthEasternpartofNigeria.Thestudyrevealedthat FlippedLearningInstructionalStrategysignificantlyimprovedthestudents'achievementandretentioninJavaProgrammingLanguagemorethanLectureMethod.

Recommendations

Basedonthefindingsandimplicationsofthestudy,thefollowingrecommendationsweremade:

1. TheNigerianCollegesofEducationespeciallyComputerEducationlecturersshouldadopttheuseofFlippedLearningInstructionalStrategyinteachingJavaprogramminglanguage.
2. TheNigerianCommissionforCollegesofEducation(NCCE)shouldconsiderareviewofComputerScienceEducationcurriculumwithaviewtoincorporatingFlippedLearningInstructionalStrategyintotheteachingofcomputerprogramminglanguagesespeciallyonJavaProgrammingLanguage.
3. TheFederalandStategovernmentthroughtheMinistryofEducationshouldprovideICTfacilitiesandresourcesadequateenoughtoimplementFlippedLearningInstructionalStrategyinalltheFederalCollegesofEducationinNigeria.
4. Seminars,workshopsandconferencesshouldbeorganizedbyNCCEincollaborationwiththeMinistryofEducationtoenlighteninstitutionadministrators,lecturersandstudentsonhowtomakeeffectiveuseofFlippedLearningInstructionalStrategyintheirday-to-dayteachingandlearningactivities.

SummaryoftheStudy

ThestudydeterminedeffectofFlippedLearningInstructionalStrategyonstudents'academicachievementandretentioninJavaprogramminglanguageinCollegesofEducationinSouth-East,Nigeria.Thestudywasguidedbytworesearchquestionsandtworesearchhypotheses.Thisstudyadoptedquasi-experimentaldesignwithnon-equivalentgroups,whichincludespre-testandpost-testdesign.Thepopulationforthestudywas229computereducationthirdyearstudentsofthefederalCollegesofEducationinSouth-EastNigeria.Thesamplesizewas153thirdyearNCEComputerEducationstudents,comprising71studentsofAlvanIkokuFederalCollegeofEducation,Owerriand82studentsofFederalCollegeofEducation,Eha-Amufu.SimpleRandomSamplingthroughballotingwasusedtoselectthetwo(2)outofthethree(3)FederalCollegesofEducationinSouth-EasternpartofNigeria.Theinstrumentusedfordatacollectioninthisstudywere JavaProgrammingLanguageAchievementTest(JPLAT).JPLATwasvalidatedbyexpertsintheDepartmentofMathematicsandComputer,FacultyofEducation,EnuguStateUniversityofScienceandTechnology(ESUT),Enuguandwasfoundtoreliablewitha KR20reliabilitycoefficientof0.86.TheresearchersubjectedJPLATtoitemanalysisanditsdifficultyindexwas56.83%whichshowedthatJPLATwasmoderate.TheExperimentalProcedureforthestudywas;firstbyobtainingpermissionfromtherelevantauthorities,thenfollowedbythetrainingoftheresearchassistantsandfinallyadministeringofthetreatment.Datagottenfromthemarkingsofthepretest,posttestandretention-testscriptswereanalyzedusingmean,standarddeviationandAnalysisofCovariance(ANCOVA).Thestudyrevealed thatFlippedLearningInstructionalStrategysignificantlyimprovedthestudents'achievementandretentioninJavaProgrammingLanguagemorethanLectureMethod.Hence,thestudyrecommendedthattheNigerianCollegesofEducationespeciallyComputerEducationlecturersshouldadopttheuseofFlippedLearningInstructionalStrategyinteachingJavaprogramminglanguage.

References

Abbas,P.G.(2024).ADetailedAnalysisoverSomeImportantIssuestowardsUsingComputerTechnologyintotheEFLClassrooms.*UniversalJournalofEducationalResearch*,2(2),146-153.

Ahmed,A.M.(2022).AssessmentoftheComputerEducationProgrammeofferedinCollegesofEducation.*JournalofEDRI*174(2);145–157.

Baishakhi,B.andKamal,D.(2016).RoleofICTin21stCentury'sTeacherEducation.*InternationalJournalofEducationandInformationStudies*,6(1),1–6.

Bartik,J.J.(2023). *Pioneerprogrammer:JeanJenningsBartikandthecomputerthatchangedtheworld*.Kirksville:TrumanStateUniversityPress.

Bossaert,G.S.,Doumen,E.andBuyse,K.V.(2011).PredictingStudents'AcademicAchievementAfterthe TransitiontoFirstGrade:ATwo-YearLongitudinalStudy.*JournalofAppliedDevelopmentalPsychology*,56(1),47–57.

Boyle,E.A.,Duffy,T.andDunleavy,K.(2023).Learningstylesandacademicoutcome.Thevalidityandutilityof Vermont'sinventoryoflearningstylesinaBritishhighereducationsetting.*TheBritishJournalofEducationalPsychology*,73(2),267–290.

Bretag,T.(2023).Short-cutstudents:Fromacademicmisconducttoacademicintegrity,InTransparencyInternational.*GlobalCorruptionReport:Education*;*Routledge*1(1),171-177.

Dooley,J.F.(2023).ABriefHistoryofCryptologyandCryptographicAlgorithms.*SpringerScience&BusinessMedia*,8(1), 12–13.

Hamidi,F.,Meshkat,M.,Rezaee,M.andJafari,M.(2021).Informationtechnologyineducation.*ProcediaComputerScience*,3,369-373.

Horstmann,C.(2013).*Javaforeveryone,lateobjects(2nded.)*.JeffersonCity:JohnWiley&Sons,Inc.

Jan,E.M.(2021).*AStudyofStudentProblemsinLearningtoProgram*.Sweden:Print&MediaUmeaUniversity.

Kilmer,A.andVentry,E.(2023).*NiagaraFallshighschoolmathsscorestoflipover*.WesternNewYorkregionalinformationCentre.Http://www.elb.org/WNYRIC.aspix

Mackatiani,C.I.(2018).LearningAchievement:IllusionsofTeacher-CenteredApproachesinPrimarySchoolsinKenya.*JournalofEducationandPractice*,9(18),46–58.

Mayer,P.andBauer,A.(2015).*AnEmpiricalAnalysisoftheUtilizationofMultipleProgrammingLanguagesinOpenSourceProjects*.NewYork:ACM.

Olelewe,C.J.(2019).StrategiesforImprovingtheTeachingandLearningofQBASICProgrammingLanguageinCollegesofEducationinEnugu,EbonyiandAnambraStates.*UnpublishedM.EDThesisDepartmentofComputerEducation,UniversityofNigeria,Nsukka*.

PearsonandTheFlippedLearningNetwork(2023).*FlippedLearningProfessionalDevelopment*.URL:http://www.pearsonschool.com/flippedlearning

Roehling,P.V.,Root-Luna,L.M.,Richie,F.J.&Shaughnessy,J.J.(2017).Thebenefits,drawbacks,andchallengesofusingtheflippedclassroominanintroductiontopsychologycourse.*TeachingofPsychology,44*(3),183-192.

Sams,A.andBergmann,J.(2023).Flipyourstudents'learning.*EducationalLeadership*,2(1),62–74.

Sams,J.B.,Daniels,K.,Bennett,B.,Marshall,H.W.,andArfstrom,K.M.(2014).TheFourPillarsofF-L-I-P.*FlippedLearningNetwork(FLN)*.

Schell,J.andMazur,E(2015).*FlippingtheChemistryClassroomwithPeerInstruction,inGarcia-MartinezJ.andSerrano-TorregrossaE.(ed.),ChemistryEducation:BestPractices,OpportunitiesandTrends*,Wiley-VCH,pp.319–343.

Shamberger,P.J.andMuenzenberger,A.(2016).ExtendedAbstract–Advancingeffectivenessoftheflippedclassroom

throughvideoanalytics.*MidYearsEngineering Experience(MYEE)ConferenceMarch30–April1,2016,*CollegeStation,TX.

Shaun,B.(2024).*Whatisprogramming*.https://en.wikipedia.org/wiki/Computer_programming

SteinmayrWirthwein

Walvoord,B.E.andAnderson,V.J.(2017).*Effectivegrading:Atoolforlearningandassessment*.SanFrancisco:Jossey-Bass.

Williams,B.K.andSawyer,S.C.(2021).*UsingInformationTechnology:APracticalIntroductiontoComputers&Communications*.(9thedition).NewYork:McGraw-Hill.

Wilson,O.K.(2016).DigitalMediainToday'sClassroom:*ThePotentialformeaningfulteaching,learningandassessment*.RowmanandLittlefield.ISBN9781475821055

Wilson,S.G.(2023).TheFlippedClass:AmethodtoaddressthechallengesofanUndergraduateStatisticsCourse.*TeachingofPsychology*,40(1),193–199.https://doi.org//10.1177/00986283134874 61

INFLUENCE OF COMPUTER AIDED INSTRUCTION ON UPPER BASIC EDUCATION STUDENTS' INTEREST IN GEOMETRY IN ENUGU NORTH LOCAL GOVERNMENT AREA

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Abstract

This work x-rayed the influence of Computer Aided Instruction on upper basic education students' interest in geometry, in Enugu North Local Government Area of Enugu state. The population comprised all the 2330 JS1 students in the LGA. Two research questions and a hypothesis guided the study. Descriptive survey research design was adopted.. The study sample was 160 JS1 students from public secondary schools in Enugu North LGA. Purposive sampling was used to sample the schools that met the requirements for the study. The instrument for data collection was the geometry interest scale (GIS). The GIS had a reliability co-efficient of 0.79. The research questions were answered using mean and standard deviation while the hypotheses was tested at 0.05 level of significance using t-test statistics.. The result of the data analyses showed that, CAI stimulates and sustains students' interest in geometry. There was no significant difference between the mean interest scores of male and female students in geometry. The researchers hereby recommend among others, that Enugu State public school teachers should make the use of CAI compulsory in teaching and learning of geometry at their upper basic education levels.

Key words: *Geometry, Interest, Computer Aided Instruction (CAI)*

Introduction

Geometry is an indispensable branch of mathematics and mathematics has been playing significant roles in the development of nations. The application of geometry is globally wide in science and technology. Geometry is perhaps the most elementary of the sciences that enable man, by purely intellectual process, to make predictions (based on observation) about physical world (Coxeter, 2003). Geometry is the branch of mathematics concerned with the shape of individual objects, spatial relationships among various objects, and the properties of surrounding space (Britannica, 2024).

It is the mathematics of shapes; the branch of mathematics that is concerned with the properties and relationships of points, lines, angles, curves, surfaces, and solids. It could be seen as: (a) plane geometry, geometric figures in two dimensions; (b) solid geometry, geometric figures in three dimensions; (c) space time geometry (in Einstein's theory of relativity)(Encarta (encyclopaedia), 2009). The word geometry was coined from two Latin words-'geo' meaning earth and 'metry or metron' meaning

measure or measurement. Sequel to that and the preceding explanations, geometry can be defined as the mathematics or branch of mathematics which, deals with measurement of plane, solid, and space figures including their properties. Other branches of mathematics include algebra, arithmetic, calculus, and statistics.

The power of geometry, in the sense of accuracy and utility of these deductions, is impressive, and has been a powerful motivation for the study of logic in geometry. Geometry is a branch of mathematics that is concerned with the properties of configuration of geometric objects, -points, (straight) lines, and circles being the most basic of these. Cut-the-knot and math-about in Wikipedia (2013) agreed that, the word geometry derives from the Greek geo (earth) and metron (measure) [words], which point to its practical roots. In their analyses, University of Liverpool in Cut-the-knot (2013), said, "Plato already knew to differentiate between the art of mensuration which is used in building and philosophical geometry".

Interest is an attribute of attitude (Ani in Anugwo and Dim, 2016). Interest in this context, is the feeling that one has when one wants to know or learn more about something (Hornby, 2022). It is a feeling of wanting to learn and zeal or willingness to participate in an activity (Okoro in Aniaku and Nwankwo, 2019). It is a motivational component characterised by increased attention and concentration in an activity. Effective methods of teaching promote learners' interest and act as a motivation tool in the teaching process irrespective of gender (Araoye in Aniaku and Nwankwo, 2019).Interest has been recognised as a key component in learning. Numerous studies have shown that learning is enhanced when students show interest in the subject matter (Wong, 2021). Interest in mathematics could be regarded a predictor for mathematics achievement (Heinz, Reiss, Augsburg, 2005). Lack of interest on the part of students is one of the major factors responsible for poor achievement of students in school mathematics (Betiku in Ezenwelu, 2014). Usman and Nwabueze (2011) conducted a research to determine the effect of Area-tiles approach on students' interest in quadratic expression (mathematics). The result revealed that there exists a significant difference between the experimental and the control group in favour of the experimental. Furthermore, using ethno-mathematics approach and mathematics interest inventory on geometry, Kurumeh, in Ezenwelu (2014), found that the students taught with ethnomathematics approach as experimental group exhibited greater interest in geometry and mensuration than their control group counterparts. Then, in relation to achievement, Akude and Ofoefuna in Nwali (2013) affirmed that the level of students' achievement in science depends on the level of the students' interest which is a factor of the instructional strategy of the teacher. While students' interest in mathematics is low overall, female interest in math is markedly lower than that of their male peers (Wells, Sanchez, & Attridge, 2009 and Frenzel, Goetz, Pekrun, & Watt, 2010).

Computer Assisted (Aided) Instruction (CAI) refers to situations in which computer system is used in the process of instructing students (Odogwu, 2002). It is essentially learning through the use of computer, but not about computers. In this case, the computer is used in a stimulated instructional situation. These stimulated instructional situations can be visual presentation and comments on learner's response and dealing with learner's additional comments.

Computer Aided Instruction (CAI) is a software device that assists the teaching and learning process. It is direct two-way interaction or communication between an individual student and the programmed instructional material stored in a computer. The computer serves as a medium of instruction. CAI applications are designed in several ways with different range of coverage. For now, they are not substitute for good teaching, but they provide valuable instructional tools to help teachers and students learn (Saddiq, in Ozochinanuife, 2021).

According to Wikiedu (2008), CAI has advantages and limitations. Advantages of CAI include:

One-to-one interaction: The CAI (software) is designed in such a way that by clicking the mouse buttons and pushing/punching some keys, the computer asks questions: In response, one answers the questions and in another click (such as '*check*

the answer'), CAI gives the expected feedback as if one is discussing with another, one-on-one without external distraction.

Great motivator: CAI has many features that encourage learners. Computers encourage learning as they provide a stimulating environment and promote enthusiasm (Meskill and Mossop in Wikiedu, 2008). Computers may help the reticent student who is afraid to make mistakes in a classroom situation. Learner autonomy is seen as one of the most important elements of CAI. It increases the motivation to learn and thus the learning effectiveness.

Freedom to experiment with different options: CAI has many options in its modes. One is free to choose any mode or strategy to experiment.
Instantaneous response/immediate feedback to the answers elicited: Immediately one finishes attempting the questions in a section or unit, he is free to check the answers (to know his score). Just click check answers or score. Immediately, you are scored and the correct ones as well as the wrong ones shown.

Self-pacing: CAI allows students to proceed at their own pace. With self-pacing learners can move through a unit as slowly or as fast as they like. One can repeat some tasks repeatedly until mastery is assured.

CAI helps a teacher devote more time to individual students: After a general introduction by the teacher, each student works at his own pace. Here the teacher goes to the students individually, especially the less brilliant ones. He devotes more time to some with reference to their ability.

Privacy: It helps the shy and slow learner to learn in its one-to-one interaction.

Individual attention: Here, the teacher can go to all the students one by one to ascertain and even record individual progress. This does not mean going to assist the less brilliant ones.

CAI enables students learn more and more rapidly: Learners learn and learn more rapidly in an enabling environment. With the computer learning environment and the CAI motivation features, individuals are bound to learn more rapidly, all things being equal.

Multimedia helps to understand difficult concept through multi-sensory approach. As a multimedia system, CAI acts in line with humans in multi-sensory learning. The multimedia system helps one to understand difficult concepts through multi-sensory approach. People remember 20% of what they hear, 40% of what they see and hear, and 75% of what they see, hear and do (Fletcher in Wikiedu, 2008).

Self-directed learning:- CAI gives room for self-directed learning. Here, students can decide when, and what to learn. When learners can learn in a way that suits them, improvements in the effectiveness of the learning process normally ensure.

These agree considerably with Rowntree in Ozofor (2015) who summarised the advantages of computer in education thus:

- It can store considerable amount of information;
- It can select from it at a great speed;
- It can present the learner with print and animated diagrams;
- It can respond to contributions typed in by the learners;
- It gives immediate feedback to the individual learner;
- It deals differently with different learners;
- It can be used for different activities such as intuition, simulation and data crunching (Wikiedu, 2008).

CAI can be wonderful, but it is not yet perfect. It still has some weaknesses or limitations.

Limitations of CAI:

1. One may feel overwhelmed by the information and resources available
2. Over use of multimedia may divert learners' attention from the concept
3. Learning becomes too mechanical
4. Non availability of good CAI packages
5. Lack of infrastructure (Wikiedu, 2008)

Harris (2013) explained that there are different types of educational computer use, and not every use of a computer in the classroom is considered computer-assisted instruction (CAI). The educational uses of computers that are considered to be computer-assisted instruction (CAI) or computer-based instruction (CBI) are those cases in which either instruction is presented through a computer program to a passive student, or the computer is the platform for an interactive and personalized learning environment. Within the broad definition, computer assisted instruction may follow different paths to the same end. One example is how computer assisted instruction is used in relation to other teaching presentations. CAI can be used either in isolation, bearing the whole responsibility for conveying instruction to students, or combination with conventional, i.e., face-to- face, teaching methods. Research has shown that the combination of conventional and CAI, instruction has been most effective in raising student achievement scores.

Computer assisted-instruction is used through the entire range of education from preschool to professional school. It has been offered in a wide variety of fields, including all the main school subjects taught in elementary and secondary schools. At CALI, the centre for Computer-Assisted Legal Instruction, law students from across the United States and other countries such as Belgium, Brazil, Canada, China, Denmark, Ireland, Kenya, Korea, Mexico, the Netherlands, Nigeria, Russia, Singapore, South Africa, Sweden, and Taiwan have access to CAI law school lessons to supplement their instruction. Computer Assisted Instruction has also been growing in use in a wide number of employment areas. It has been used to teach novice nurses how to perform intravenous injections, to teach jet engine mechanics in the US Air Force maintenance tasks, and to provide safety instruction for food service workers in an urban hospital. He also made it clear that CAI spreads its tentacles to all nooks and crannies of learning including people with disabilities, language limitations, and physical limitations. To get the best out of this innovative approach, the advice of "The Access Centre (2010)" below on CAI implementation should be strictly adhered to, by both teachers and students to avoid embarrassment, grief, or frustration. According to the centre;

Teachers should review the computer program or the online activity or game to understand the context of the lessons and determine which ones fit the needs of their students and enhance instruction. They should ask questions like;

- Can this program supplement the lesson, give basic skills practice, or be used as an educational reward for students?
- Is the material presented so that students will remain interested yet not lose valuable instruction time trying to figure out how to operate the program? Does the program waste time with two much animation?
- Is the program at the correct level for the class or the individual student?

Very importantly, teachers should also review all websites and links immediately before directing students to them. Web addresses and links frequently change and become inactive. Students might become frustrated when links are no longer available (Edmiston, 2015).

Mode means a particular way of doing something, or a particular type of something: a mode of production/operation/communication; a mode of life/behaviour/dress. CAI applications are designed in several ways with different range of coverage (Saddiq, 2004). These ways or types or modes of CAI according to him in teaching and learning of mathematics are as follow: problem solving, tutorials, simulation, learning games and drill and practice. In drill and practice for instance, he said that the programs allow the students to interact directly with the computer on specific skills. Teachers can use it as a follow-up after a lesson has been introduced to

reinforce the teaching process. This is supported by Wikiedu (2008) which added that drill and practice provide opportunities for students to repeatedly practice the skills that have previously been presented and that further practice is necessary for mastery. Drill and practice mode is one of the modes (methods/types) of CAI. Drill and practice is the method or mode of instruction where computer programs allow the students to interact directly with the computer on specific skills. Little is known about the use of computer-assisted instruction package in the Nigerian education system particularly in different mode settings (Gambari, Ezenwa, and Anyanwu, 2014). Drill and practice mode of CAI can be used by teachers as a follow-up after a lesson has been introduced to reinforce the teaching process. It provides opportunities for students to repeatedly practice the skills that have previously been presented and that further practice is necessary for mastery.In CAI (drill and practice mode), the teacher only acts as a facilitator. Thus, the teacher's physical activities are highly minimized and not all that seen as in the traditional chalk-talk lesson. The students can easily carry on just by clicking the mouse or pressing keyboard keys on: "NEXT, CLICK HERE TO CONTINUE, GO BACK, CHECK YOUR ANSWERS, CLICK NEXT, etc."

Kurumeh (2007), Abakpa and Igwue (2013), Ozofor (2015) and other researchers have explored the effects of some novel methods on students' interest in Geometry, but got varied results at different levels and places.

Having tried many conventional and some innovative methods, and having found none generally outstanding and accepted/adopted, we have no option than to continue to investigate more innovative strategies, while students interest and failure in geometry (mathematics) is still at large. We need a method/mode that will arouse, increase/foster, and sustain students' interest in geometry at different levels of education. Now that computer is taking over everything and there are some software in education that claim to help in teaching and learning. Such software are called Computer Assisted/Aided Instructions. They are among the novel strategies. There are many claims and speculations about their efficacy in pedagogy.

Studies, have shown that students' performance and even retention emanates primarily from their interest. If one has no interest in something, they will not go closer to that thing, not to talk of learning it or retaining it. Hence, interest should first be secured before expecting a great achievement. A natural procedure in academic processes implies that, interest goes first, followed by retention then evaluation leading to possible achievement. It has been observed that students fear and hate mathematics, this has resulted in lack of interest and poor achievement particularly in geometry. The conventional approaches which include lecture, demonstration, individualized instruction, discussion, inquiry, field trips, projects methods, textbook, and questioning method seemed not effective enough to equip the students with the necessary knowledge, skills and abilities required to arouse, fortify and sustain students' interest in geometry. Those strategies or methods having been used to teach geometry by qualified and dedicated teachers, yet the problem, fear and finally lack of interest continued, especially in geometry is heartbreaking. In view of this, the problem of this research put as a question is: what strategy could be used to arouse, increase, and sustain interest in geometry (mathematics), among the JSS1 students in Enugu state?

The purpose of the study was to find out the influence of Computer Aided Instruction (CAI) on Junior Secondary school students' interest in Geometry. Specifically the study found out the influence of:

1. CAI on the mean interest scores of JSS1 students in Geometry.
2. CAI on the mean interest scores of male and female JSS1 students in Geometry.

The study was guided by the following research questions.

1. What is the influence of CAI on the mean interest of JSS students in Geometry?
2. What are the mean interest scores of male and female students in geometry CAI?

The following null hypothesis was tested at an alpha (α) level of 0.05 level of significance.

1. There is no significant difference between the mean interest scores of male and female students in geometry.

Methods

Descriptive survey research design was adopted.. Purposive sampling was used to sample the schools that met the requirements for the study. The instrument for data collection was the geometry interest scale (GIS). The GIS had a reliability co-efficient of 0.79. The research questions were answered using mean and standard deviation while the hypotheses was tested at 0.05 level of significance using t-test statistics. Enugu North Local Government Area was chosen because there was no evidence of such study in that area at the onset of this study. The population of the study comprised all the 2330 students of the public junior secondary One (JS1) students in the Local Government Area (PPSMB Enugu, 2023). The study sample was one hundred and sixty (160) JS1 students from the public secondary schools in the LGA, made up of 78 male, 82 female. JS1 was chosen because the expected positive outcome of this study may call for introduction of the novel strategy at the grass root level of the secondary school education.

Four schools were randomly selected out of the schools that met the requirements for the study. The requirements include: schools that have access to electricity or power supply, schools that have functional computer laboratories, schools that have computer competent qualified mathematics teachers, and schools whose principals allow their students and staff to participate in the research.

The instrument for data collection was the Geometry Interest Scale (GIS). Experts in Measurement and evaluation, Mathematics education, and Computer Science, validated the GIS. SPSS reliability analysis-scale (alpha) was used to determine the reliability coefficient of GIS. This yielded an alpha level of 0.79.

Mean and standard deviation were used to answer the research questions, while t-test statistic was used to test the hypotheses. The decision rule was to reject the null hypothesis when the level of significance exceeds the given probability level.

Results.

Research Question 1:

What is the influence of CAI on the mean interest scores of JSS1 students in Geometry?

Table 1: Mean Interest Scores of Students for the Two Groups in Geometry

Groups	N	Adjusted Mean	Standard dev.
CAI Approach	82	79.32	7.26
Chalk and talk Approach	78	78.67	9.44

Table 1 shows the mean interest scores of students in geometry with CAI approach and those with chalk and talk approach. Students with CAI approach have mean interest score of 79.32 while those with chalk and talk approach have mean interest score of 78.67. The result shows that students with CAI approach showed a higher interest in geometry than those with chalk and talk approach.

Research Question 2

What are the mean interest scores of male and female JSS1 students in Geometry using CAI?

Table 2: Mean interest Scores of males and females in geometry with CAI approach

Students	N	Adjusted Mean	Standard deviation
Male	78	79.93	7.05
Female	82	78.73	7.50

In Table2 the male students with CAI approach in geometry had mean interest score of 79.93 with standard deviation of 7.05 while the female students with same CAI approach had mean interest score of 78.73 with standard deviation of 7.50. The male students had higher interest than their female counterparts.

Hypothesis

The null hypothesis was tested at 0.05 level of significance.

There is no significant difference between the mean interest scores of the male and the female students in CAI geometry.

Table 3: t-test analysis of male and female students' geometry interest scores with CAI

Groups	**N**	Mean	**SD**	**DF**	**t-cal**	**t-crit**	**Decision**
Male	78	79.93	7.05				Do not
				158	0.67	1.65	Reject
Female	82	78.73	7.5				

The result of the table 3 above shows that the calculated t-value is 0.67, while the table (crit) value is 1.65 at 0.05 level of significance. Thus, the calculated value is less than the table value of 1.65. Hence, the null hypothesis is not rejected.

Discussions

Here, the result of the analyses revealed that the students with CAI had a higher interest in Geometry than those with conventional approach. This agrees with the findings of Ozofor (2015), that students show more interest in solving mathematics problems when CAI was used than the tutorial approach. It also agrees with Abakpa and Igwue (2013), Kurumeh (2007), Anugwo and Dim (2016) in geometry that the novel modes were superior to the conventional methods in fostering students' interest in geometry and mathematics in general. Also, the male students with CAI approach had a slightly higher interest than their female counterparts with same CAI approach.

There is no significant difference between the mean interest scores of male and female students in CAI approach. The researchers are of the opinion that if students' interest is aroused and sustained equally, both the boys and the girls will continue to perform highly in geometry, and CAI encourages that. A significant difference in the interest scores of male and female students found in some other studies can probably be attributed to the nature of what was presented to the students. This result is in line with Anugwo and Dim (2016) that the male students exhibited a slightly higher interest in geometry than their female counterparts taught the same topic using the novel (SQ3R) approach. Also, the model/method did not show much differential effect on the interest of male and female students in geometry. On the contrary, this result disagreed with Kurumeh (2007) whose result showed that the female students benefited more significantly than their male

counterparts in interest in geometry using her novel (Ethnomathematics) approach.

Conclusions

In the light of the findings of this study, the researchers conclude that CAI approach is superior to the conventional (chalk and talk) method in fostering students' interest in learning geometry and mathematics. Computer aided instruction is gender friendly in triggering, immersing and extending interest. It greatly promotes interest evenly among the males and the females.

Recommendations

Based on the findings of this study, the following recommendations were made:

- Enugu State Government should make the use of CAI compulsory for teachers teaching geometry and mathematics in their junior secondary schools.
- Workshops should be organized by Enugu State Ministry of Education from time to time for teachers of mathematics on the use of CAI in teaching geometry and mathematics in general.

References

Abakpa, B.O. and Igwue, D.O. (2013). Effect of mastery learning approach on senior secondary school students' achievement and interest in geometry in Makurdi, Benue state, Nigeria. *Abacus: Journal of Mathematical Association of Nigeria (MAN),38*(1) 163-177.

Agwagah, U.N.V. and Nwoye, M.N. (2012). Binary code system approach in pupils' achievement and interest in binary numbers: A factor for achievement of Millennium Development Goal: Department of Science Education, UNN. *Abacus: Journal of MAN, 37*(1) 1- 9.

Aniaku, O. L. & Nwankwo, A. L. (2019). Inquiry-based teaching as an approach to enhancing students' interest in secondary school biology. *Journal of Research in Science and Vocational Education (jrsve). 1(1) 34-44.* https://jrsve.gouni.edu.ng.

Anugwo, M. N. & Dim, C. (2016). Effects of survey, question, read, recite and review study (SQ3R) model on students' interest in geometry. *Journal of the Science Teachers Association of Nigeria (JSTAN)*, 49(1) 206-217

Britannica (2024). Encyclopedia Britannica: Geometry: Definition, History, Basics, Branches, &Facts

Coxeter, H.S.M. (2003). *Introduction to Geometry*. Toronto: University of Toronto.

Cut-the-knot (2013). What is Geometry? http://www.cut-the-knot.org/what is geometry.shtml.

Edmiston, M. (2015). *Computer Assisted Instruction and Mathematics.* Washington, DC: The access centre, American Institute for Research (AIR). www.air.org/project/access-centre-improving-outcomes-all-student-k-8

Encarta (2009). *Geometry*. Microsoft® Encarta®2009[DVD], Redmond, WA: Microsoft Corporation, 2008.

Ezenwelu. P. N. (2014). *Relationship between emotional intelligence and mathematics achievement of senior secondary students in Enugu state*. An unpublished MED thesis, University of Nigeria Nsukka, Nigeria.

Harris, B. (2013). *What is Computer Assisted Instruction?* Retrieved March 22, 2020 from http://www.wisegeek.org/what-is-computer-assisted instruction.htm

Ladd, P. (2018). A new Sustainable Development agenda. New York: UNDP © 2018.

Ngwu, A. N. & Ugwu, C.B.(2019). Students' interest as correlates of senior secondary school students' achievement in biology in Enugu State. *Journal of Research in Science and Vocational Education(jrsve). 1(1) 177-183.* https://jrsve.gouni.edu.ng

Nwali, D. (2013). *Effect of simulation model of instruction on JSS III students' achievement and interest in Integrated Science in Ebonyi State*. An unpublished MSc.ED dissertation, EBSU, Abakaliki.

Ozofor, N. M. (2015). Effects of two modes of computer aided instruction on Students achievement and interest in statistics and probability. *International Journal of Education and Research.* 3(1), ISSN 2201-6333

Saddiq, J. O. (2004). *How computer technology influences mathematics teaching and learning*. MAN Proceedings

The Access Center (2010). *Computer-Assisted Instruction and Mathematics*. USA: U.S. Department of Education Cooperative and the American Institutes for Research.

Usman, K. O. and Nwabueze, M. U. (2011). Promoting students' interest in quadratic equation using trea-tiles approach in mathematics instruction. *Journal of Mathematical Association of Nigeria, 1, 74-84.*

Wikiedu (2008). *Modes of CAI, drill and practice, problem solving….*Retrieved September 19, 2008 from: www.wikieducator.org/Computer Assisted Instruction_(CAI)

Wikipedia (2013) Geometry. Retrieved November 8, 2013 from https://www.cut-the-knot.org

Wong, L. H. (2021). *Interest Driven Creator (IDC) Theory*. Open Access. Retrieved April 21, 2024 from https//www.open access.com./interest.