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AN EXAMINATION OF RETENTION CAPACITIES OF STUDENTS TAUGHT WITH PRIOR KNOWLEDGE OF ELECTRICAL INSTALLATION AND MAINTENANCE WORKS INSTRUCTIONAL OBJECTIVES IN TECHNICAL COLLEGES

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Abstract: *This study examine of retention capacities of students taught with prior knowledge of electrical installation and maintenance works instructional objectives in technical colleges. Two research questions and two hypotheses guided the study. The design of the study was pre-test, post-test, non-equivalent control group quasi experimental study. The study was carried out in Enugu State in the present South East Zone of Nigeria. The population for the study was 1,115 year two Electrical Installation and Maintenance works students in the 19 technical colleges in the State. One technical college which offers Electrical Installation and Maintenance works was randomly chosen from the six educational zones in the State for the study. The total number of students in their intact classes who offered Electrical Installation and Maintenance works in these colleges was 326. This formed the sample for the study. 249 (79.4%) of the students were male and 77 (23.6%) were females. The instrument used for data collection was the Electrical Installation and Maintenance Achievement Test (EIMWAT). This had three versions Pre-test, Post-test and Retention tests which were the same except for the swapping of all the options for each answer for the 30 questions used for the study. The instrument was subjected to both face and content validation and item analysis. The reliability of the instrument was established Using Kuder Richardson (K-K) 20, the internal consistency was found to be 0.78 using Pearson r, the test retest stability measure was found to be 0.96. Pre-EIMWAT was administered by the beginning of the five weeks treatment period. Post EIMWAT was administered at the end of the five weeks treatment period. After two weeks of administration of Post –EIMWAT, the retention test were administered. Scores from Pre-EIMWAT, Post-EIMWAT and retention tests were analyzed using means, standard deviation and Analysis of Covariance (ANCOVA). Some of the major findings from the analysis were: (1)there is a significant difference in the mean retention scores of technical college students taught electrical installation and maintenance works with prior knowledge of instructional objectives and those taught the same topic without prior knowledge of the instructional objectives, and (2)* prior knowledge of instructional objectives before instruction can effectively close the retention gaps between male and female students in Electrical Installation and Maintenance works and most probably other technical and vocational subjects. *The study recommended that (i) Both Federal and State Ministries of Education should study the analysis of this study with a view of establishing pilot schools to authenticate the findings of this study. This, in turn is expected to result in the generalization of this innovative approach in Nigerian schools and (2) Professional bodies in vocational subjects should organize seminars and workshops on how teachers should educate both genders collectively without any bias in technical subjects in colleges.*

Keywords: *Retention Capacity of Students, Electrical Installation and Maintenance Works, Instructional Objectives*

Introduction

Retention in a layman's definition is the ability to memorize and reproduce the learnt materials when the need arises. Retention is the ability to respond to a new stimulus using the previously learnt responses. It involves three methods, namely, recall, recognition and relearning. Recall involves reproducing some or all the materials learnt. For example, a student studied the physics equivalent equation of

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mathematics; he/she most shows that he can write the physics equation when the mathematics equations are presented. However, this requires that the learner has some clues. Such clues may be a part of what is initially learned or may also have their origin in previously learned associations (Iji and Harbor-Peters, 2005). The recognition method refers to identification of materials by the learners without actually recalling the details about the learnt materials. This however shows some measures of familiarity with the materials, having come across them before. The relearning method, also regarded as the saving method, ensures that the learner learns the material to a certain standard of proficiency and at subsequent times, the material is more easily learnt than a new material (Adeosun, 2008). However, after learning, memories of the learnt materials will fade away with time. This is referred to as forgetting and it is directly related to retention, as forgetting is the decrease in retention over time.

Adeyemi (2003) posited that for the very young child the natural environment, together with manmade materials and play equipment will provide all the opportunities he or she requires for vocational subject development. Electrical Installation and Maintenance Works in actual sense differs from a number of other parts of the formal curriculum, making it to require an investigatory component for successful delivery. This difference could be found in the apprehensive nature of the populace towards the subjects. Another difference is that the nature of its indispensability in the realm of affairs in human existence (Javed, 2005). The ability to memorise difficult subjects by rote learning was considered a way of exercising the mind and developing the muscles of the mind and brain of the child. Retention is the continuous process of learning to reproduce when time arises; it is a duty of both genders (male or female) when it comes to improvement of the both genders mind and brain.

The term gender was defined by Magone (1997), as the amount of masculinity and feminist found in persons and obviously while there are mixtures of both in most human beings, the normal male has a preponderance of muscularity and the normal female has preponderance of feminists. Although many empirical researches on the influence of gender on students' retention/ achievement are conflicting and inconclusive, most of the literature reviewed showed that male students still perform relatively better than their female counterparts in science.

Nwosu (2018) stated that girls are denied out of school and pre-school experiences especially those involving visual activities-instruction. This is a problem as it inhibits the development of mathematics and science capacities in girls. The researcher suggested the need to use activity experiences at home to acquire science and technology skills. Inya (2014) noted that boys achieve better results in sciences and show more positive attitude to the subject than girls. The researcher went further to enumerate some factors that tend to contribute to this state of affairs such as; the preferential attention given to boys by teachers and less attention to girls; teachers tend to reprimand boys more severely than girls, for poor performance in sciences and technical subjects because they expected the boys to do better.

Many science and vocational teachers are not bothered when girls contribute less to classroom discussions because girls seem to be expectedly quiet in nature. Njoku (2017) asserted that girls perform poorly relative to boys at all levels of science education in Nigeria. Also Njoku (2017) opined that many socio-cultural factors jointly and separately depress female interests, participation, and achievement in science at all levels of education. Gender difference is one of the factors affecting learning and many researchers who have focused their attention on studies relating to its effect on pupils' have not produced conclusive results. Some findings indicated that significant differences showed that sex factor had no impact on students' performances (Isiyaku, 2016). Concluding therefore, differences in sex were found to affect the students' retention capacities in the sciences. With this in mind, this study sought to examine the Retention Capacites of Students Taught Electrical Installation and Maintenance Works on Instructional Objectives in Technical Colleges.

Statement of the problem

The importance and usefulness attached to Electrical Installation and Maintenance Works have moved those in the area to find out problems bordering students' poor achievement in public examinations in Electrical Installation and Maintenance Works. This was done by examining students attitudes to methods adopted as well as instructional materials used in the process of teaching and learning of the subject. The implication is that teachers should coordinate and facilitate both genders by teaching them equally how to master Electrical Installation and Maintenance Works by allowing both gender do the work themselves collectively. According to the learning pyramid, retention rates increased with the amount of students collective involvement in the learning processes.

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The differential attitudes tend to expose boys more to scientific activities very early in life than girls. This attitude also unconsciously suggests to the males the subjects and professions specifically meant for males and areas meant for females. Consequent upon this, one will not be surprised to observe that girls shun the physical sciences/technical subjects and will always be seen in good number offering biology, home-economics and other allied subjects.

Purpose of the Study

1. Determine the mean retention scores of students taught Electrical Installation and Maintenance Works with instructional objectives exposed to them before instruction and those not exposed to instructional objectives before instruction.
2. Determine whether gender exerts influence on students' retention when taught Electrical Installation and Maintenance Works with instructional objectives exposed to them before instruction and those not exposed to instructional objectives before instruction.

Research Questions

1. What are the mean retention scores of students with prior knowledge of instructional objectives of Electrical Installation and Maintenance Works and those taught Electrical Installation and Maintenance Works without having prior knowledge of instructional objectives?
2. What are the mean retention scores of male and female students who had prior knowledge of instructional objectives before instruction on Electrical Installation and Maintenance Works and those taught Electrical Installation and Maintenance Works without prior knowledge of instructional objectives before instruction, and those taught electrical installation and maintenance works without prior knowledge of instructional objectives before instruction.

Hypotheses

Ho_1: There is no significant difference between the mean retention scores of students who had prior knowledge of instructional objectives of Electrical Installation and Maintenance works before instruction and those who had no prior knowledge of instructional objectives of Electrical Installation and Maintenance works before instruction.

Ho_2: There is no significant difference in the mean retention scores of male and female students who had prior knowledge of instructional objectives of electrical installation and maintenance works before instruction and those taught electrical installation and maintenance works without prior knowledge of instructional objectives before instruction.

RESEARCH METHOD

Design of the Study

The design of the study was quasi-experimental research design which according to Obi (2000) involves the use of two comparable groups: experimental and non-experimental groups. It is also quasi-experimental research design because this design is suitable where absolute control of all variables involved cannot be achieved (Freun, 2014).

Area of the Study

The study was carried out in Technical Colleges in Enugu State. Enugu State Technical Colleges system comprises six education zones namely: Agbani, Awgu, Enugu, Nsukka, Obollo-Afor and Udi. **Source**: Statistics Department, STVSMB Enugu, (2017).

Population for the Study

The population for this study consisted of 1,115 students in the senior Technical Year II. The students (males and females) were those who offered Electrical Installation and Maintenance Works in the Technical colleges in Enugu State (STVSMB Enugu, 2014).

The reason for choosing Year II students for the study was that they have done most of the basic topics in Electrical/Installation and Maintenance Works in year 1 which enhanced their understandings of many other topics in YR II.

Sample and Sampling Techniques

The study used all the 326 students from the six technical colleges used for the study. One school was used from each of the six educational zones, namely: Technical College Obe, Technical College Mgbidi, G.T.C. Enugu, G.T.C Nsukka, Technical College Umuitodo-Obollo-Afor, and Technical College, Abor.

Validation of the Instrument

The Electrical Installation and Maintenance Achievement Test (EIMWAT) was subjected to face and content validation in Enugu State University of Science and Technology (by experts in Electricity Education and Measurement and Evaluation). The face validation involved checking the Electrical Installation and Maintenance Achievement test items for arrangement and logical sequences. The tests (pre-test, post-test and retention test) consists of 30 multiple choice items, six questions from each topic, with five options. The Electrical

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Installation and Maintenance Achievement Test items were subjected to content validation by two experts in Electrical/Electronic Technology Education, one from the Department of Technology and Vocational Education, Enugu State University of Science and Technology Enugu, and the other from the Department of Technology and Vocational Education Ebonyi State University Abakaliki, It entailed checking the Electrical Installation and Maintenance Achievement Test items against the topics and contents of the lesson plans. The content validation was accomplished by making sure that the test items reflected the specifications on test blue print.

One expert in measurement and evaluation from the Department of Science and Computer from the Enugu State University of Science and Technology also face validated the lesson plans to make sure that the procedure/format of the lesson plan were followed to ascertain whether the lesson plans were in line with the topics, content and duration of the lesson taking into consideration the age and the class of the students. The validators' comments, corrections and contributions were used in producing the final copy of the instrument.

Reliability of the Instrument

The Electrical Installation and Maintenance Achievement Tests was subjected to trial testing on students to ascertain the reliability of the instrument. The stability of the instrument was established using test re-test method. After one week, the test was re-administered to the same group in two Technical Colleges different from the ones that were used for the study. The schools were Technical College Akpuoga Nike, Nkanu East Local Government Area and Udi Technical College, Udi Local Government Area of Enugu State.

The internal consistency reliability Co-efficient of the instrument (0.97) was established using Kuder Richardson estimate formular since the test items are of multiple co-efficient types for both pretest and post and retention tests.

Experimental Procedure

The regular college Electrical Installation and Maintenance teachers were used for the experiment. The conduct of the study took place during the normal college lesson periods. The normal college time tables were followed to avoid disrupting the experimentally planned procedures. On the first day of the experiment, the research assistants administered the first of the three tests-the pre-test, scored and kept the result. The researcher personally taught lessons one and three in all the schools involved in the study in weeks one and three respectively, while the respective assistants watched. The trained assistants handled lessons two, four and five in their schools. During the teaching, the teachers for the control group taught the students without exposing them to the objectives of the lesson. On the other hand, the students in the experimental group were taught by exposing the instructional objectives of the lesson to them first before the instruction. The instructional objectives, which were typed were handed over to the students and also read out by the teacher. They were told that those objectives are the ones they were expected to attain at the end of the lesson.

Names of subjects in each group were written and their roll calls made at the beginning of each lesson period to ensure that they were all present. The experiment lasted for 5weeks. At the end of the treatment (5weeks) a post- test was administered to both groups in all the colleges that were used for the study. The scores were forwarded to the researcher for recording, computation and use for comparison to determine if there were significant differences in the tests. A retention test was administered to both groups after two weeks and the scores recorded and submitted to the researcher.

Experimental Precautions or Control of Extraneous Variables

a. Class Interaction: The teachers (research assistants) were instructed by the researcher not to give any note and assignments to the students in order to avoid interferences/bias. The purpose is to prevent the students from discussing or exchanging of notes outside the college.

b. Teacher Variables: The researcher organized uniform training for the research assistants in order to control teacher variables. Lesson plans were also prepared by the researcher and made available to the participating teachers. This reduced teacher effect on lesson preparations and presentations.

In order to avoid experimental bias, the researcher used the services of Electrical Installation and Maintenance teachers of the colleges involved in handling experimental and control groups. All the tests were under the custody of the research assistants until when required.

c. All the students were duly registered for the tests. They also ticked M or F - Male and Female respectively in the boxes that were provided on the answer scripts to identify their gender.

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d. Effect of Pre-test/post-test: To control this, the researcher withdrew all the instrument items from the students and the research assistants after the pre-testing, and then the researcher reshuffled the option letters of the test items in the pre-Electrical Installation and Maintenance Achievement Test before using it as post Electrical Installation and Maintenance Achievement Test. The option letters of the test items in the Post Electrical Installation and Maintenance Achievement Test were further swapped. This produced the retention test.

Method of Data Analysis

Data that was collected for this study were analyzed using mean and standard deviation to answer all the research questions. Analysis of co-variance (ANCOVA) was used in testing the hypothesis. The ANCOVA served as a controller for the initial differences across groups as well as increasing the precision due to the extraneous variables thus reducing error variances.

DATA ANALYSIS AND RESULTS

Research Question 1

What are the mean retention scores of students taught with prior knowledge of instructional objectives of Electrical Installation and Maintenance Works and those taught electrical installation and maintenance works without prior knowledge of instructional objectives?

Table 1

Mean retention scores of technical college students taught Electrical Installation and Maintenance Works with prior knowledge of instructional objectives and those taught the same topic without prior knowledge of instructional objectives.

Method	n	Post-test $\bar{X}$	SD	Retention-test $\bar{X}$	SD
Experimental group	191	17.51	4.81	19.97	5.62
Control group	135	19.56	4.95	18.08	5.04

Table 1 shows that students in the experimental group (those that had knowledge of instructional objectives prior to instruction) had mean retention score of 19.97, with standard deviation of 5.62, as against a post-test mean score of 17.51, implying that in the research students in the experimental group improved in their performances more than in the post-test.

Table 1 also shows that students in the control group had mean score of 19.56 and 18.08 in the post-test and retention test indicating that their performances in the retention test was less than their performance in the post-test. The standard deviation for the experimental and control groups, both in post-test and retention test were reasonably high, indicating that the scores were dispersed or heterogeneous.

Generally, it can be inferred from **Table 3** that the experimental group performed better than the control group in the retention test.

Research Question 2

What are the mean retention scores of male and female students who had knowledge of instructional objectives before instruction on electrical installation and maintenance works and those taught electrical installation and maintenance works without prior knowledge of instructional objectives?

Table 2

Mean retention scores of technical college students (males and females) taught Electrical Installation and Maintenance Works with prior knowledge of instructional objectives and those taught the same topics without prior knowledge of instructional objectives.

Method	G ender	n	Post-test $\bar{X}$	SD	Retention-test $\bar{X}$	SD
Experimental group	Male	151	16.81	4.72	18.81	5.33
	Female	40	20.15	4.17	24.37	4.41
Control group	Male	98	19.41	4.95	18.22	5.41
	Female	37	19.97	4.97	17.70	3.92

Table 2 shows that the mean retention score of male students in the experimental group is 18.81 as against their mean post achievement test score of 16.81. Similarly, the mean retention score of the female students in the experimental group is 24.37 while their achievement in the post-test is 20.15. Thus, both male and female students in the experimental group performed better in the retention test than in the post-achievement test.

On the other hand, the mean post-test scores of male and female students in the control group are 19.41 and 19.97 respectively, as against their mean retention scores of 18.22 and 17.70 respectively obtained by male and female students. Thus, the **Table 2** shows that both male and female students had lower

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mean scores in the retention test in comparison with their scores in the post achievement test.

Testing of Hypotheses

Table 3

ANCOVA table for test of significant difference between mean scores of technical college students taught Electrical Installation and Maintenance Works with prior knowledge of instructional objectives and those taught without prior knowledge of instructional objectives.

Source of variation	Sum of squares	df	Mean square	F	Sig.
Corrected Model	1270/612	3	423.537	16.182	.000
Intercept	90894.476	1	90894.476	3.473E3	.000
Method	764.607	1	764.607	29.214	.000*
Gender	369.693	1	369.693	14.125	.000*
Method x Gender	538.446	1	538.446	20.573	.000*
Error	8427.596	319			
Total	129752.000	322			

Note: Significance at .05 probability level.

Ho_1: There is no significant difference between the mean retention scores of students who had prior knowledge of instructional objectives of Electrical Installation and Maintenance works before instruction and those who had no prior knowledge of instructional objectives of Electrical Installation and Maintenance works before instruction.

Table 3 shows that the computed F-value for the main effect of method on retention is 29.214, at 1 and 322 degrees of freedom, which was significant at the probability level (.05) set for the hypothesis. This means that significant difference exists in the mean retention scores of technical college students taught Electrical Installation and Maintenance Works with prior knowledge of instructional objectives and those taught the same topic without prior knowledge of the instructional objectives. The observed significance is in favour of the experimental group.

Ho_2: There is no significant difference in the mean retention scores of male and female students who had prior electrical installation and maintenance works before instruction and those taught electrical installation and maintenance works without prior knowledge of instructional objectives before instruction.

Table 3 shows that the computed F-value for the effect of gender on mean retention scores of technical college students taught electrical installation and maintenance works is 14.125, at 1 and 322 degrees of freedom, which is significant at the .05 probability level set for the hypothesis. This invariably means that there is significant difference in the mean retention scores of male and female students taught electrical installation with knowledge of instructional objectives prior to instructions.

Discussion of the Findings

Students mean retention scores in Electrical Installation and Maintenance works due to the instructional strategy used.

The result of **Table 3** reveals that students in the experimental group obtained higher retention scores than students in the control group with mean retention score of 19.97 as against the post test score of 17.51. The control group had 18.08 retention as against 19.56 post-test. This shows that students in the experimental group appeared to retain the Electrical Installation content taught more than those of the control group. The retentive potency of the prior exposure of instructional objectives before instruction strategy can be seen from the fact that the tutorial mode adopted by the teachers seem to enhance meaningful-learning. The meaningfulness of the mode of presentation facilitated the encoding of the learnt concepts into memory.

The constant presentation of the materials to the students through this method by involving them partly in lesson plan preparatory, exposure of the instructional objectives before instruction and the actual lesson delivery is capable of causing overlearning which is found to cause remembering and enhances retention. This agrees with Nwamuo (2006) who noted that, overlearning has been recommended by psychologists for remembering purposes. This finding agrees with Ogbonna (2007) and Ajomuoh

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(2010) who found teaching methods efficacious in enhancing students' retention in Mathematics and physics respectively.

Male and female students' retention scores in Electrical Installation Works due to the instructional strategy used

The study found in research question 2 that exposing students to instructional objectives prior to actual instruction enables them to retain what they had learnt more than they would have retained when not exposed to the knowledge of instructional objectives before instruction. This can be deduced from the experimental group's progressive retention test scores of 18.81 as against 16.81 (posttest) for males and retentive score of 24.37 as against 20.15 (posttest) for females. On the other hand, the control group had a retrogressive scores of 18.22 as against 19.41 (posttest) for males and 17.70 as against 19.97 for females.

Iji (2010) asserted that man is endowed with limited capacity for memorization. Based on this assertion, the task before the teacher is how to help students improve on their abilities to assimilate and retain information. Electrical Installation and Maintenance works cannot be learnt by mere memorization through rote learning. This stage of the study strongly suggests the fact that the ability to remember takes place more effectively when experiences are passed across to the learners through an appropriate instructional method like the exposure of instructional objectives prior to instruction.

There is a slight variance in the retention scores of male and female students in the experimental group indicating that both male and female students benefited when this result is compared with those of the male and female students in the control group, it can be seen that male and female students in the experimental group progressed in scores unlike the control group that retrogressed in retention. The implication is that male and female students in the experimental group appeared to retain more in the Electrical Installation content taught.

Table 5 further confirms that gender is not a significant factor in students' retention in Electrical Installation and maintenance works. This shows that a good instructional strategy can help both male and female students benefit in Electrical Installation and maintenance works retention. It might be that this new strategy is gender friendly and as such bridge the gap between male and female students retention in Electrical Installation and Maintenance works.

Lee (2001) said that differences in the performance of male and female students in science and vocational courses could be taken care of by using good methods, materials and teaching strategies. The present study – prior exposure of instructional objectives before instruction have actually confirmed this opinion. This finding is also in line with the studies of Agueke (2004), Kurumeh (2004) who found no gender differences in student's retention in mathematics.

The hypothesis (2) tested shows that there is a significant difference in the mean retention scores of male and female students taught Electrical Installation and Maintenance with and without exposure of instructional objectives prior to instructions. The null hypothesis was then rejected.

Conclusion

The following conclusions are therefore made based on the findings of the study. The result of this study provided empirical evidence that is a significant different in the mean retention scores of technical college students taught Electrical Installation and Maintenance works with prior knowledge of instructional objectives and those taught the same topic without prior knowledge of the instructional objectives and that there is significant difference in the mean retention scores of male and female students taught Electrical Installation with knowledge of instructional objectives prior to instructions.

This type of instructional technique can close the gender gap in retention as had been established in the present study. The finding that the exposure of instructional objective before instruction is equally very effective for retention for both males and females further establishes the role innovative instructional technique such this study can play in the retention of students in Electrical Installation and maintenance Works. With these findings, it is hoped that a road map has been drawn towards improved retention of students in Electrical Installation and Maintenance works which will encourage self-employment, boost their chances of absorption into factories and institutions of higher learning.

Recommendations

The following recommendations are made based on the findings of this study.

1. Both Federal and State Ministries of Education should study the analysis of this study with a view of establishing pilot schools to authenticate the findings of this study. This in turn is expected to result in the generalization of this innovative approach in Nigerian schools.

2. Professional bodies in vocational subjects should organize seminars and workshops on how teachers should educate both genders collectively without any bias in technical subjects in colleges.

References

Adeosun, O.V. and Ayodele, C.A. (2008). Relative effects of Demonstration and Video mediated instructional strategies on Secondary School Students Achievement and Retention in Yoruba Language. Paskinstan. *Journal of Social Sciences*. 5 (6) 634-638

Adeyemi, S.A. (2003). Studies of the effects of aptitude instructional leadership styles and learning environment on student's achievement in physics. *An unpublished Ph.d*. Thesis, University of Lagos, Nigeria.

Agueke, L. (2004). Remediation of process, errors committed by senior secondary school students in sequence and series. An unpublished Ph.D Thesis, University of Nigeria Nsukka.

Ajomuoh, P.C. (2010). Effect of Prior Knowledge, Exploration, Discussion, Dissatisfaction with Prior Knowledge and Application, (PEDDA) The Learning Circle (TLC) Constructivists' instructional change and retention in Physics. Unpublished Ph.D Thesis. UNN.

Freund, J.E. (2001*). A first course in statistics.* New Jersey:

Iji C.O. (2010). *Actualizing Mathematics Achievement and Retention Among Primary School Pupils Using Interactive Logo Progamming Package ABACUS* 35 (1) 80—90

Iji, C.O. and Harbor-Peters, V.F.A. (2005). Effects of Logo and Basic Programmes on the Achievement in Geometry of Junior Secondary School Students: ABACUS, *Journal of Mathematics Association of Nigeria* 30 (1), 67—77

Inyang, U.E.U. (1988). The Construction, Validation and Standardization of Integrated Science Achievements Test for Junior Secondary Schools. *A Ph.D Dissertation ABU***,** Zari.

Isiyaku, K. (2006) *Teacher Education in Nigeria*: Focus on EFE Implementation: The UNESCO teacher training institute for sub-sahara Africa BREDA, Dakar, Senegal retrieved 5/10/2006 http://www.ncce.edu.ng.

Javed, A. (2005). *Importance of Physics Highlighted in the international seminar on Physics in Developings countries.* Past present and future, 27—28, July 2003 Isiama bad, Pakistan.

Kurumeh, N.S. (2004). Effects of Ethno Mathematics Approach in Teaching on students' Achievement and Interest in Geometry and Menstruation. Unpublished Ph.D Thesis, University of Nigeria Nsukka.

Lee, J. (2001). *Interstate variations in rural students achievement and schooling***.** http:///www.criedigest.org/2002-3/interstate.htm.

Magone, M.E. (1997). A study of Gender Difference in Response to A Mathematical Parlance Assessment Instrument Consisting of Extended Constructed Response Task: *Dissertation Abstract International* 57 (7) 29

Njoku Z.U. (2004 *Engendering Learning Equality in Science and Technology Classroom for Sustainable Development***:** 30th Annual Confernce Proceeding of STAN (14-24).

Nwamuo, O.N (2006). Psychology of learning theories and practices. Enugu: Jibaco Press.

Nwosu, A.A. (2001). Gender *and acquisition of science process skills among secondary school students: Implication for science teaching;* 42nd conference proceedings of the teachers association of Nigeria, 206-209.

Obi, M.A. (2000). *Fundamentals of research methods and basic statistics for the second sciences*. Onitsha: Abbot books Ltd.

Ogbonna, C.C. (2007). A comparative study of the effectiveness of two constructivist instructional model on student's academic achievement and retention in JSS Mathematics. Unpublished Ph.D Thesis, University of Nigeria Nsukka.