



EFFECT OF PRIOR KNOWLEDGE OF INSTRUCTIONAL OBJECTIVES ON ACADEMIC ACHIEVEMENT OF STUDENTS IN ELECTRICAL INSTALLATION AND MAINTENANCE WORKS IN TECHNICAL COLLEGES

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Abstract: This study investigated the effectiveness of prior knowledge of instructional objectives on the academic achievement of Electrical Installation and Maintenance Works students. 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 two versions Pre-test and Post-test 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. Scores from Pre-EIMWAT, Post-EIMWAT tests were analyzed using means, standard deviation and Analysis of Covariance (ANCOVA). The major finding from the analysis was that prior knowledge of instructional objectives before instruction was more effective in student's academic achievement than the conventional method of teaching. The study recommended that (i) teachers should not only state instructional objectives but expose them to students before instruction and refer same to them at intervals during their teachings; (ii) the use of prior knowledge of instructional objectives for instruction should be given greater emphasis by teachers because of its general effectiveness on retention.

Keywords: Prior Knowledge, Instructional Objectives, Academic Achievement, Electrical Installation and Maintenance

Introduction

Education appears to be the most powerful instrument devised by man for his own improvement. It is central to all aspects of any nation's economy. This is because it prepares people to undertake specific tasks and employment functions which are essential for the transformation of their environment. Indeed, every educational system is developed and structured according to many diverse and distinct needs and demands of

the society that established it. Education is also known to be constantly changing and adapting itself to new demands and circumstances, hence it seems to exhibit the characteristics of a living organism which, according to Smath (2008), not only changes with years but also remains ever sensitive to place and time. Electrical installation and maintenance is one of the educational subjects taught in senior technical college level in Nigeria; this came as a result of changes in educational



systems in a bit to produce skilled students or craftsmen and technicians who will improve electrical industries with their diverse skills and expertise.

Electrical Installation and Maintenance Works is one of the core subjects offered at the senior technical college level in Nigeria. According to the National Board for Technical Education (NBTE) Handbook (2001) Electrical Installation and Maintenance Works, is a craft programme designed to give training and impart the necessary skills leading to the production of craftsmen and technicians and other skilled personnel, males and females who will be enterprising and self-reliant in the electrical industry. The NBTE handbook, states that the subject covers manufacturing processes, usage and maintenances of all electrical appliances. Akinsola (2008) view that Electrical Installation and Maintenance Works covers not only the electrical industry but virtually all spheres of human endeavours, since all fields of life now need electrically powered tools, equipment and appliances in order to alleviate sufferings and achieve desired results. People need to be well informed especially students in colleges who are keen to learn about how electrical power works and how to use electrical appliances to better their lives. However, teachers have the obligation to passionately seek for information, train and equip themselves with the knowledge of Electrical Installation and Maintenance for effective training of students in the classrooms.

Teachers at all levels would continually seek ways to advance students learning's in the classrooms. Prior to this time, educators have been interested in pedagogical techniques and ideas about how human beings learn best. They also outlined some steps for successful teachings that teachers must follow if students are to learn. One of these pedagogical techniques and ideas is setting learning/instructional objectives before the commencement of instruction. Akuma (2008) defines instructional objectives as statement of educational or learning outcomes stated in precise and measurable terms which are expected to be achieved after each lesson delivery. He further explains that instructional objectives identify the information, skills, and values, kinds of thinking and feelings that should be incorporated in the unit of lesson being planned. Instructional objectives are decisions of learning outcomes prior to teaching.

Good statements of instructional objectives present the performances or behaviours, which the learner should be able to exhibit after each lesson, indicating that learning has taken

place. Instructional objectives are stated using action verbs like list, define, explain, discuss, describe, evaluate, and construct, among others (Akuma, 2008). The definition of instructional objectives given by Olaitan and Ali in Okeke (2010) is a clear indication of the need for students to have prior knowledge of instructional objectives. Thus:

decisions made prior to instruction by teachers, students or teachers and students that identify precisely what kind of thinking, feeling or physical behaviours the students are intended to be able to use, with specified information, skills, or values, if desired learning has taken place (p.15).

This definition implies that students should not only have prior knowledge of instructional objectives but should also take part in designing them. This will enable students to be active participants in teaching/learning processes. It therefore means that one can determine the extent of the learners' mastery of an instruction by observing one's behaviours or performances at the end of instruction.

Nigeria is currently in an era where it is generally believed that there is falling quality of education. This notion is evidenced in general poor performances of male and female students both in technical, secondary and tertiary levels of education. This falling quality of education in Nigeria is also shown in high rate of examination malpractices (Onu-Ogbu, 2006); poor transfer of knowledge among graduates, and inability to apply supposedly acquired skills in the labour market (Ene, 2008). There are therefore, clarion calls from many angles for educators to find solutions to this ugly trend. It, therefore, becomes imperative that teachers should go back to the principles to explore and exploit the use of instructional objectives for better teaching and learning. Could the exposure of instructional objectives before commencement of instruction enhance learning? This may help in carrying the learners along or aid them in meaningful independent study. This work, therefore, explored the effect of prior knowledge of instructional objectives in teaching processes. Mkpa (2001), Anigbankpu (2001) and Thronburg (2005) investigated the possibility of enhancing students' learning outcomes of subject matter by providing them with the instructional objectives covering the subject matter before actual classroom instruction.

There are differences in the views of the above authors on whether exposure of instructional objectives before instruction can improve the academic achievement and retention of students in school systems. Could the situation of



exposing students to instructional objectives before instruction improve the students' performance in Electrical Installation? Hence, the need to determine the effect of prior knowledge of instructional objectives in Electrical Installation and Maintenance Works before instruction on students' achievement in technical Colleges in Enugu State.

Statement of the Problem

A critical review of literature by the researcher revealed that there is a fluctuating trend in students' performances in vocational subjects in Enugu State Technical Schools. A NABTEB Chief Examiner's Report showed that (achievement) the performance of students in Electrical Installation examinations had been progressively poor (Ugwu, 2007). Aguka (2006) and Ezech (2007) attributed the poor performance of students in Electrical Installation and Maintenance Works to teaching procedures for electrical installation. According to them, the observed poor achievements could be attributed to students' difficulties in understanding some concepts in Electrical Installation and Maintenance Works. Others include poor teaching methods employed by the teachers, which had been variously described as dull, teacher centered, uninteresting and ineffective.

If this trend remains unchecked, students would neither study nor register Electrical Installation and Maintenance Works in any external examination. The probable neglect of the subject in schools may negatively affect the chances of students enrolling into engineering and related programmes for higher education locally and overseas. This might result in shortage of indigenous engineers and allied technical personnel needed for industrial development. If this occurs, Nigeria might resort to continually contracting out her technology developmental projects to foreign firms that would demand payment in foreign currencies. Payment in foreign currencies would drastically reduce the nation's foreign reserves and invariably create unbearable difficulties in the Nigerian economy.

Therefore, there is the need to address these problems and to inject dynamism in the use of innovative and novel techniques in lesson deliveries in Enugu State Technical Colleges and by extension in Nigeria School Systems.

Purpose of the Study

The purpose of this study was to determine the effect of prior knowledge of instructional objectives of Electrical Installation and Maintenance Works instructions on achievement and retention of students of technical colleges in Enugu State. Specifically, the study sought to:

1. Determine the mean achievement scores of students taught Electrical Installation and Maintenance Works when exposed to instructional objectives before instruction (experimental group) and when not exposed to instructional objectives of the lesson before instruction (control group)
2. Determine whether gender exerts influence on students' achievement when taught Electrical Installation and Maintenance Works with instructional objectives exposed to them before instructions (experimental group) and when not exposed to instructional objectives (control group).

Research Questions

1. What are the mean achievement scores of students of technical colleges who were exposed to prior knowledge of instructional objectives of Electrical Installation and Maintenance Works before instructions and those taught Electrical Installation Works without first exposing them to instructional objectives before Electrical Installation instructions?
2. What are the mean achievement scores of male and female students who had prior knowledge of instructional objectives before instructions on Electrical Installation and Maintenance Works instruction and those who were not exposed to prior knowledge of instructional objectives before instructions?

Hypotheses

Ho₁: There is no significant difference between the mean achievement scores of students who had prior knowledge of instructional objectives of Electrical Installation and Maintenance Works before instructions and those taught Electrical Installation and Maintenance Works without exposing them to specific objectives before instruction.

Ho₂: There is no significant difference between the mean achievement scores of male and female students who had prior knowledge of instructional objectives of Electrical Installation and Maintenance works before instructions and those taught without prior knowledge of instructional objectives of Electrical Installation and Maintenance Works 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 (Freund, 2001).

Area of the Study

The study was carried out in Technical Colleges in Enugu State. Enugu State Technical College systems comprise six education zones namely: Agbani, Awgu, Enugu, Nsukka, Obollo-Afor and Udi. **Source:** Statistics Department, STVSMB Enugu, (2018).

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, 2018).

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) consists of 30 multiple choice items, six questions from each topic, with five options. The Electrical 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 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 formula 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 procedure. On the first day of the experiment, the research assistants administered the first of the three tests-the pre-test, scored and kept the results. The researcher personally taught the 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 5 weeks. At the end of the treatment (5 weeks) 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.

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.

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.

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 variable thus reducing error variance.

Data Analysis and Results

Research Question 1

What are the mean achievement scores of students of technical colleges who had prior knowledge of instructional objectives on Electrical Installation and Maintenance Works before instructions and those taught Electrical Installation Works without prior knowledge of instructional objectives?

Table 1

Mean achievement scores of students taught Electrical Installation with prior knowledge of instructional objectives (experimental group) and those taught the same topic without prior knowledge of instructional objectives (control group).

Method	n	Pre-test		Post-test		Gain	score
		$\bar{X}$	SD	$\bar{X}$	SD	(X)	
Experimental group	191	16.49	4.71	17.51	4.81	1.02	
Control group	135	14.96	3.68	19.56	4.95	4.60	

Table 1 shows that the mean achievement scores of the experimental group in the pretest and posttest are 16.49 and 17.51 respectively, with gain score of 1.02.

On the other hand, the mean achievement scores of the control group (students taught without prior knowledge of instructional objectives) are 14.96 and 19.56 respectively, with gain score of 4.60. This result shows that students taught electrical installation without prior knowledge of instructional objectives (control group) achieved higher than their counterparts who were taught the same topic after exposing them to the instructional objectives (experimental group).

Research Question 2

What are the mean achievement scores of male and female students who had prior knowledge of instructional objectives before instruction on Electrical Installation and Maintenance Works and those who were not exposed to instructional objectives before instruction?

Table 2

Mean achievement scores of male and female students who had prior knowledge of instructional objectives on Electrical Installation and Maintenance Works and those who were not exposed to instructional objectives before instruction.



Method	Gender	n	Pre-test $\bar{X}$	SD	Post-test $\bar{X}$	SD	Gain score (X)
Experimental group	Male	151	16.23	4.80	16.81	4.72	0.58
	Female	40	17.45	4.29	20.15	4.17	2.70
Control group	Male	98	15.20	4.06	19.41	4.95	4.21
	Female	37	14.30	2.30	19.97	4.97	5.67

prior to instruction), the mean pre-test and post-test achievement scores for males were 15.20 and 19.41, with gain score of 4.21. The mean pre-test and post-test scores of the female students in the control group were 14.30 and 19.97 respectively, with gain score of 5.67. Thus, it can be deduced from the Table that female students (with gain score of 2.70) performed better than their male counterparts (with gain score of 0.58) in the achievement test. Also in the control group of females performed better with a gain of 5.67 as against 4.21 of males.

Testing of Hypotheses

Ho₁: There is no significant difference between the mean achievement scores of students who had prior knowledge of instructional objectives on Electrical Installation and Maintenance Works before instruction and those taught without exposing them to specific objectives before instruction.

Table 2 shows that the mean pre-test and post-test achievement scores of male students in the experimental group are 16.23 and 16.81 respectively, with gain score of 0.58. On the other hand, the mean pre-test and post-test achievement scores of female students in the experimental group are 17.45 and 20.15, with gain score of 2.70. For the control group (students who had no knowledge of instructional objectives

Table 3

ANCOVA Table for test for significant difference between the mean achievement scores of students with prior knowledge of instructional objectives and those without prior knowledge of instructional objectives before instructions on electrical installation and maintenance works.

Source of variation	Sum of squares	df	Mean square	F	Sig.
Corrected model	689.518	3	229.839	10.128	.000
Intercept	83611.338	1	83611.338	3.684E3	.000
Gender	290.155	1	219.216	12.633	.000
Method x Gender	219.216		110.937	9.660	.002
Error	110.937	319	22.693	4.889	.028
Total	7239.101	322			

Note: Significance at .05 probability level.

Table 3 shows that with respect to the main effect of teaching method, the calculated F-value at 1 and 322 degrees of freedom is 12.633. This value is considered significant at the .05 probability level set for the hypothesis. This invariably means that there is actually a significant difference between the research subjects in the experimental and control groups regarding the effect of prior knowledge of instructional objectives or otherwise on their mean achievement scores in electrical installation and maintenance works. The observed significant difference is in favour of the control group.

Ho₂: There is no significant difference between the mean achievement scores of male and female students who had prior knowledge of instructional objectives of Electrical installation and maintenance works before instructions and those without prior knowledge of

instructional objectives on electrical installation and maintenance works before instructions.

Table 3 also shows that, with respect to the effect of gender on achievement, the calculated F-value is 9.660, at 1 and 322 degrees of freedom. This value is considered significant at the 0.5 level of probability set for the hypothesis. Thus, it can be inferred that there is significant difference between the mean scores of male and female 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 with the female students.

Discussion of the Findings

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



The findings of the study on research question 1 showed that the control group who did not have prior knowledge of instructional objectives before instruction on Electrical Installation and Maintenance Works had a higher mean achievement scores than the experimental group in the post-tests. The finding suggested that prior knowledge of instructional objectives does not have positive effect on students' academic achievement in Electrical Installation and Maintenance Works. This finding was in consonance with an earlier study conducted by Dreunon in 2001 on a similar study. Dreunon (2001) conducted a research in which 120 students and 6 instructors of Jefferson State College participated. The result indicated that the awareness of the objectives by the students produced no significant difference on their academic achievement. Students who were aware of the objectives achieved a statistically significant lower attrition rate than students who were unaware of the objectives as in this study.

The null hypothesis 1 tested indicated that there was a significant difference between the mean ratings of students in the two groups (control and experimental). The significant difference is in favour of the control group. The null hypothesis was therefore rejected.

Male and female students mean achievement scores in Electrical Installation and Maintenance works due to the instructional strategy used.

The study revealed that performances of the male and female students with and without exposures of instructional objectives before instruction. There were gain scores across the board. Studying the gain scores, in the experimental group the males had a gain score of 0.58 as against 2.70 for the females. On the other hand in the control group males had a gain of 4.21 when compared with 5.67 for the females. The females scored higher in the two groups with 2.70 and 5.67 respectively for the experimental and the control groups. It shows that, the females in the control groups excelled.

Although, traditionally, it is believed that technical occupation trades like Electrical Installation and Maintenance works belongs to the males which is reflected in the ratio of male to female students in this study and by extension Nigerian technical institutions, this study failed to support such believe. Also, the findings disagreed with Blakie (2008) whose investigations showed that male and female students performed well in their overall academic achievements irrespective of the method of instruction used.

The null hypothesis 2 tested indicated that there is a significant difference between the mean scores of male and female 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 significance difference is in favour of the females. The null hypothesis was therefore rejected.

Conclusion

The following conclusions are therefore made based on the findings of the study. The results of this study provided empirical evidences that there is actually a significant difference between the research subjects in the experimental and control groups regarding the effect of prior knowledge of instructional objectives or otherwise on their mean achievement scores in electrical installation and maintenance works and that there is significant difference between the mean scores of male and female 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

Recommendations

1. Teachers should make use of the instructional objectives in their teachings. They should not just state these but make students aware of them before instruction and refer the students to them at appropriate intervals during their teachings.
2. The use of prior knowledge of instructional objectives for instruction in Electrical Installation and Maintenance works should be given greater emphasis by the teachers because of its general effectiveness on retention.

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