LWATI: A Journal of Contemporary Research, 8(3), 24-31, 2011
ISSN: 1813-2227

Impact of the Three-Phase Teaching Technique on Students Achievement and Retention of Physics Concepts

Ndem Nsungo Udo*, Ferdinand A. Mboto and Uduak U. Effiong****
**Cross River State College of Education, Akamkpa, Nigeria*
***Cross River University of Technology, Calabar, Nigeria*
nsungondem@yahoo.com; Ferdinandmboto@Yahoo.Com

ABSTRACT

This paper is an experimental study aimed at finding out the impact of the three-phase teaching technique on the academic achievement and retention of the concept of current electricity by secondary should physics students. The study adopted the pretest-posttest non-equivalent control group design and was carried out in Odukpani and Obubra Local Government Areas of Cross River State, Nigeria. A total of one hundred and sixty four secondary school physics students took part in the study. The t-test was used to analyze the data. The results of the study showed that there exist a significant difference in the achievement between students taught with the three phase teaching method and those taught without the three-phase teaching method; significant difference in the achievement of male and female students taught with the three-phase teaching method in favour of the males and a significant difference in the retention of physics concept between students taught with the three-phase teaching method and those taught without the three phase technique. The paper thus recommended among others the adoption of the three phase teaching technique to teach physics concepts.

INTRODUCTION

Physics is a basic requirement for the scientific and technological development of a nation. As a posited by Ogunleye (2001), the technological potentials of any nation could be more accurately gauged by the quality of her Physics Education. It is a major requirement for all technological, medical and engineering courses in our polytechnics and universities. In spite of its importance, physics is the most dreaded of all school sciences. A major factor that contributes to this negative attitude towards Physics has been the method of teaching the subject (Enukoha, 1997; Umoren, 1999; Nwagbo, 2001; Danmole and Femi-Adoye, 2004). A learned material is usually affected by what is taught and how it is taught. The concern of this paper is thus: how do we teach physics to ensure that the students learn maximally? This is the question of methodology.

Teaching method as defined by Ingwu, Ogar and Ada (1998) is a special form of procedure of imparting knowledge to the recipient. Such method should be tailored towards making the class interesting, motivating and involving the students (Martins and Oyebanji, 2000). The perception of physics by students as being difficult and abstract is as a result of teachers using predominantly the lecture method of teaching (Ivowi, 1999; Njoku, 2005). The three-phase teaching technique is a method in which the teaching process is divided into three-phases: the Exploration phase, the concept introduction phase and the concept application phase.

At the exploration phase, the learner is introduced to new and puzzling information which she/he is not yet competent enough to handle. The new experience raises some questions in the mind of the student. The student thus becomes eager to invent solution to the problem such a puzzling problem could be: providing the student with an ammeter, key, connecting wires, voltmeter and a resistor and request the student to connect a simple circuit to establish the relationship between voltage and current. The second phase is the concept introduction phase. The student have interacted with the physical objects have thus increased their wealth of experience. The teacher then comes in to enrich and complete the invention process by helping them to connect the circuit in case they are unable. Discuss the symbols used in the circuit and use the relationship to state Ohm's law.

The last of the three is the concept application phase. During this phase, the students are tested on numerical problems. The teacher then helps the students to tackle the problems in case of difficulties. At this stage, the students are now armed to face challenges. Thus the three-phase teaching technique leads the learners from physical action to abstract mental operations. This makes the physics class more challenging and less boring.

Statement of the problem

The performance of secondary school students in Physics external examinations over the years had been poor generally. The implication of this is that the approach of physics teaching does not lead to understanding and application of the concepts. The problem of this study put in question form is: will the three-phase teaching method improve senior secondary school physics students academic achievement and retention of physics concepts?

Purpose of the study

The study is designed to achieve the following specific objectives**:**

i. To investigate the impact of three-phase teaching method on senior secondary school students academic achievement in physics.
ii. To determine the effect of the three-phase teaching method on the academic achievement of male and female physics students.
iii. To determine the extent to which the three-phase teaching method will enhance the retention of physics concepts by students.

Research hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

H_{O1}: There is no significant difference in academic achievement of physics students taught with the three-phase teaching technique and those taught without the three-phase teaching technique.

H_{O2}: There is no significant difference in the academic achievement in Physics between male and female students taught with the three-phase teaching method.

H_{O3}: There is no significant difference in the retention of physics concepts between students taught physics with the three-phase technique and those taught with the conventional lecture method.

METHODOLOGY

This study adopted the quasi-experimental research design. Specifically, the pretest, posttest non equivalent control group design was adopted in the study.

Population

The population for the study consisted of all the senior secondary school two (SS II) Physics students in Odukpani and Obubra Local Government Areas of Cross River State, Nigeria

Sample and sampling technique

A total of one hundred and sixty four (164) students took part in the study. This was made up of one hundred and two (102)males and sixty two (62) females. The experimental group consisted of eighty six (86) students while the control group was made up of seventy eight (78) students. The simple random sampling technique was used to select eight schools from the target population. Four schools were assigned to experimental group while the other four schools were assigned the control group (two schools from each groups in each Local Government Area). In each of the schools selected, the intact class was used for the study.

Instrument and validation

The instrument used for data collection was the Physics Achievement Test (PAT). The PAT consisted of 50 multiple choice questions with options A – E. The questions were in the area of current electricity. Each correct answer was scored two while each wrong item carried a zero score.

The face validation of the items was carried out by two experts in the area of physics education. To establish the reliability index, the instrument was pilot-tested using 50 students in a school that was not used for the study. Using the Kuder-Richardson formula-20, a reliability index of 0.79 was obtained. The average difficulty index of the instrument was 0.53 while the discrimination index was 0.54.

Research procedure

In order to account for initial differences of the students, a pre-test was administered to the students. After one week, the concept of current electricity was taught to the experimental and control groups. The three-phase teaching method was used to teach the experimental group while the normal lecture method was used to teach the control group. The teaching was done through a well structured instructional package and the teachers were adequately guided on how to use the instructional package. One week after the completion of the teaching the post test was administered to both the experimental and control groups. Two weeks after the post-test, the retention test was administered to both groups. In order to control some extraneous variables the study used: the intact class of the students in each of the schools selected, the regular class teachers and different sizes and colours of paper during each round of the test.

RESULTS

Hypothesis One (H_{O1})

The null hypothesis states that there is no significant difference in the academic achievement of Physics students taught with the three-phase teaching method and those taught without the three-phase teaching method.

Prior to testing this hypothesis, the pretest scores of the students under the experimental and control groups were compared using the independent t-test analysis as shown in table 1.

Table 1: Independent t-test analysis of the pre-test scores of students taught with the three-phase teaching method and those taught without the three-phase teaching method.

Group	N	X	SD	df	t-cal	t-crit	Decision
Experimental	86	39.84	30.5	162	0.78	1.96	Not
Control	78	39.59	3.01				Significant

The information in table 1 shows that the two groups are not significantly different in their entry behaviour. Hence the justification to treat the post-test scores as the performance due to treatment only.

To test hypothesis I, the academic achievement of students taught physics with the three-phase teaching method was compared with those taught with the conventional lecture method using the independent t-test analysis. The result is as shown in table 2.

Table 2: Independent t-test analysis of the influence of the three-phase teaching method on students academic achievement in Physics.

Group	N	X	SD	t-cal	t-crit	Decision
Experimental	86	68.74	7.50	11.67	1.96	Significant
Control	78	59.06	3.74			

*Significant at the 0.05 level of significance

The result in table 2 shows that the students under the experimental group performed significantly better than their counterparts in the control group. This means that students taught physics with the three-phase method performed significantly better than those taught with the conventional teaching method. Hence the null hypothesis which states that there is no significant difference in the academic achievement of physics students taught with the three-phase teaching method and those taught without the three-phase teaching method is rejected at the 0.05 level of significance.

Hypothesis two

This hypothesis states that there is no significant difference in the academic achievement in Physics between male and female students taught with three-phase teaching method. To test this hypothesis, the academic achievement in Physics of boys and girls taught with the three phase teaching method were compared using the independent t-test analysis. The result is as shown in table 3.

Table 3: Independent t-test analysis of the achievement of boys and girls taught with the three phase teaching method.

Group	N	X	SD	df	t-cal	t-crit	Decision
Male	52	72.35	9.24	86	3.62	1.99	Significant
Female	36	66.38	4.91				

*Significant at the 0.05 level of significance.

The result in table 3 shows that male students taught physics with the three-phase teaching method performed significantly better than their female

counterparts. This is because their mean score is higher than that of the females. Hence the null hypothesis which states that there is no significant difference in the academic achievement in physics between male and female students taught with the three-phase teaching method is rejected at the 0.05 level of significance.

Hypothesis Three

This hypothesis states that there is no significant difference in the retention abilities of physics students taught with the three-phase teaching method and those taught without the three-phase teaching method.

To test this hypothesis, the retention scores of students taught physics with the three phase teaching technique was compared with that of those taught physics with the lecture method using the independent t-test analysis as shown in table 4.

Table 4: Independent t-test analysis of the influence of the three-phase teaching method on students retention in physics.

Group	N	X	SD	df	t-cal	t-crit	Decision
Experimental	86	70.19	9.67	162	12.85	1.96	Significant
Control	78	54.00	5.77				

*Significant at 0.05 level of significance

The analysis in table 4 shows that the calculated t-value 12.85 is higher than the critical t-value of 1.96 at 0.05 alpha level. Therefore the null hypothesis which states that there is no significant difference in the retention abilities of physics students taught with the three phase teaching method and those taught without the three-phase teaching method is rejected.

DISCUSSION

The result of hypothesis one showed that there is a significant difference in achievement between the experimental group and the control group. This might be due to the fact that the three-phase teaching method used different teaching methods during each phase. For instance, the exploration phase encourages discovery learning, the concept introduction uses the expository method to explain the concept. At the application stage, repetition is encouraged. This enhances consolidation and retention. Thus, the learner is actively involved in the teaching cycle and not a passive receiver. This is why Abdullahi (1982) stated that the material meant for science learning should be presented in a manner as to provide students with opportunity to

become actively involved intellectually, perceptually and physically. It is also obvious that some students remember through listening only, others through listening and seeing while others could be very effective if they do those things themselves. The three-phase method caters for all these categories of students.

The result of hypothesis two showed that there is significant difference in achievement between male and female students of the experimental group. This result confirms that of Akinsola and Igwe (2002). However, the result is in contrast with that of Nsofor (2001) and Akinbobola (2007) who obtained no significant difference in achievement between male and female students after treatment. Nsofor (2001) observed that both male and female students could do well in science when exposed to similar learning conditions. The result of hypothesis three showed that there is a significant difference in the retentive abilities between the experimental and the control groups. This is attributable to the fact that the three-phase teaching method, encourages repetition and thus aids retention. Retention itself is the term used to denote the demonstration that learning has been maintained over time. (Onwiduokit and Akinbobola, 2005). This is in contrast with memorization and rote learning as encouraged by the lecture method. In order to ensure effective technological development in Nigeria in this 21st century, Effiong and Ugbe (1997) stressed that our science teachers must develop strategies aimed at teaching for retention and transfer of knowledge.

CONCLUSION

Based on the results of this study, it is concluded that the three-phase teaching technique facilitates learning of physics concepts than the lecture method. Also, the method which combines different methods aids retention of physics concepts than the lecture method. It is thus recommended that Physics teachers should be encouraged to adopt the three phase-teaching method in the teaching of physics.

REFERENCES

Abdullahi, A. (1982). Science Teaching in Nigeria. Illorin: Atuto Press Limited.

Akinbobola, A. O. (2007). Comparative effects of improvised and standard equipments on students' achievement in Senior Secondary School Physics. In Etuk, N. E.; Udofot, I. M. and Udosen, A. E. (eds). Education in Nigeria in the 21st century: Focus and Imperatives.

Akinsola, M. K. and I. O. Igwe (2002). The relative effect of metacogntive strategy of framing on students' achievement in selected difficult

chemistry concepts. Journal of the science Teachers Association of Nigeria 37 (1 and 2): 20 – 28.

Danmale, B. T. and K. O. Femi-Adeoye (2004). Effects of concept mapping technique on senior secondary school students' achievement and retention of ecology. Journal of the Science Teachers Association of Nigeria; 39 (1 and 2): 32 – 38.

Effiong, U. U. and A. U. Ugbe (1997). Science teaching for retention and transfer of knowledge, the basis for technological development in Nigeria. Akamkpa Journal of Science and Mathematics Education 1(1): 73 – 79.

Enukoha, O. I. (1997). The influence of age on mathematics teachers' intrinsic and extrinsic job satisfaction. Akamkpa Journal of Science and Mathematics Education 1(1): 6 – 13.

Ingwu, E. U, M. N.Ogar and M. J. Ada (1998). General teaching methods. In Ebam, O. and Ada, M. J. (eds). Instructional Methods. Calabar, Centuar Publishers.

Ivowi, U. M. O. (1999). Promoting Physics education amongst females in Nigeria. In Akpan, B. (Ed.) Perspectives on Education and science Teaching: From the eyes of Uduogie Ivowi. Abuja, Foremost Educational Services Limited, 651 – 657.

Martins, O. O. and P. K. Oyabanji (2000). The effects of inquiry and lecture teaching approaches on the cognitive achievement of integrated science students. Journal of the science Teachers Association of Nigeria, 35 (1 and 2): 31 – 35.

Njoku, Z. C. (2005). Identification and analysis of topics which teachers perceive difficult to teach in the primary science curriculum. Journal of the Science Teachers Association of Nigeria 40 (1 and 2): 11 – 20.

Nsofor, C. C. (2001). Cultural impediments on women in science, technology and mathematics education. 42nd Science Teachers Association of Nigeria Annual Conference Proceedings, 48 – 51.

Nwagbo, C. (2002). Enriching science, technology and mathematics (STM) education through teaching for inculcation of scientific literacy. 41st Science Teachers Association of Nigeria Annual Conference Procedings, 372 – 375.

Ogunleye, A. (2001). Girls perceptions of strategies of improving low enrolment, under achievement and attitudes of girls in physics at the senior secondary school level. Journal of the science Teachers Association of Nigeria, 36 (1 and 2), 61 – 71.

Onwioduokit, F. A. and A. O. Akinbobola (2005). Effects of pictoral and written advance organizres on students achievement in senior secondary school physics. Journal of Science Teachers Association of Nigeria 40 (1 and 2): 109 – 116.

Umoren, G. (1999). Teaching difficult concepts in primary science. Akamkpa Journal of Science and Mathematics Education 2 (1 and 2): 92 – 105.