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EFFECTS OF GUIDED DISCOVERY TEACHING METHOD ON TECHNICAL COLLEGE STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN BLOCK/BRICKLAYING AND CONCRETING

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Abstract

The study was carried out to investigate the effects of guided discovery on technical college students" academic achievement and retention in block/bricklaying and concreting (BBC) in Anambra State, Nigeria. Two research questions and two null hypotheses guided the study. A quasi experimental research design was used. The area of the study was Anambra State, Nigeria. The total population comprised of 192 National Technical Certificate (NTC) II students. The sample size for the study was 113 students purposively drawn from four technical colleges. A 26-item test instrument tagged "Block/Bricklaying and Concreting Achievement Test (BCAT)" was validated by three experts from Nnamdi Azikiwe University, Awka and Federal Polytechnic, Oko, all in Anambra State, Nigeria. The data obtained was analyzed using mean, adjusted mean, to answer the research questions while ANCOVA was used to test the hypotheses at 0.05 level of significance. The findings revealed among others that there was a significant difference between the mean achievement and retention scores of the experimental group taught with guided discovery (GD) and that of the control group taught with lecture method. Based on the findings, the researchers recommended the use of guided discovery teaching method for enhancement of technical college students" academic achievement and retention in BBC.

***Keywords**: Guided discovery, academic achievement, retention, technical college.*

Introduction

Education is a priceless asset of fundamental importance to an individual and the society. It is a process essential to the achievement of personal goals and individual aspirations. In recognition of the importance of education that Nigeria has continued to make serious efforts towards providing her citizens with qualitative and functional education for social, economic and political development (Alu, 2000). Hence, the National Policy on Education (2004) stated that education should help the child acquire appropriate skills, abilities and competencies, both mental and physical, as equipment for the individual to live and contribute to the development of the society. Such skills, abilities and concepts could be acquired through the training provided in technical colleges where learners are equipped with relevant skills and

knowledge in Technical and Vocational Education (TVE) courses.

One of such TVE trade courses in the National Technical Certificate (NTC) curriculum is Block/Bricklaying and Concreting (BBC) offered in technical colleges to train craftsmen and technicians in the building trade. These trades expose the learners on the skills required in accomplishing given tasks such as site preparation, setting out, moulding and laying blocks/bricks, mixing mortar and aggregates, among other skills (National Board for Technical Education (NBTE, 2007). Trainees of these trades on completion of their training program could secure employment in construction industries, be self-employed or pursue further education in advanced craft/technical program. However, with the rapid technological development and advancement, construction industries have been in constant state of change and so need the services of craftsmen and technicians with new and innovative skills to adapt to technological changes in the workplace. These craftsmen and technicians acquire the skills through quality and innovative teaching and learning methods from technical colleges.

Several studies within the literature covered reported persistent poor academic performance in TVE trade courses including BBC in National Technical Certificate (NTC) Examination (Inyiagu, 2011; Umunadi, 2009; Igwe & Ikatule, 2011). Numerous factors have been discovered to affect students' academic achievement and retention in BBC, which include poor learning facilities, school environment, and socio-economic background of the students and teachers' method of instruction (Nwachukwu, 2001). Nwachukwu further discovered that among all the factors responsible for students' poor performance, teachers' method of instruction has been viewed to have direct impact on students' performance. This is because a change in teacher's method of teaching can create clarity or confusion in the classroom. This situation according to the author can be addressed by change in method of teaching particularly from lecture method which is teacher centered to a more innovative, activity-based and participatory methods such as discovery and experimental methods. Ausubel (2001) contended that activity-based and participatory teaching method could enhance students' participation, mastery of skills and high academic achievement and retention of the subject matter.

In recent years, there has been a gradual shift in educational methodology from teacher to learner- centered teaching. Igboko and Ibeneme (2006) stated that traditional education practices such as demonstration and lecture methods alone have proved incapable of producing the effects required for coping with the challenges posed by rapid technological development. Based on the above views, technology teachers could try out the use of students' activity- based and inquiry mode of teaching such as guided discovery which involves substantial workshop activities in teaching BBC. This is necessary since current requirements in the areas of professional qualifications and skills development call for the implementation of new, analytic and responsive teaching and learning techniques focused on specific objectives.

Guided discovery (GD) refers to, a student-oriented and activity-based teaching method in which the teacher guides the students through problem solving approach to discover answers to instructional problem at hand. This is based on the premise that it is what the student does in the class that he learns not what the teacher does hence it is the reaction of the learner that determines what he learns. Hence, Ausubel (2001) agreed that learning occurs when students interact with each other in the class, as is done in GD teaching method which results to high academic achievement and retention of learnt concepts.

Academic achievement connotes performance in a school subject as symbolized by scores or marks in an achievement test (Epunnam, 1999). Retention of learning according to Momoh-Olle (1997) is the repeated performance of behaviour earlier acquired by a learner and elicited after an interval of time. In agreement to the view of Mommoh-Olle, Dancis (2009) noted that retention is affected by the degree of initial learning, method of learning and learner's memory capacity. According to Dancis (2009) and Kirschner, Sweller and Clark, (2006) students learn and retain more when they can develop their own knowledge and meaning from their own experiences. This holds that learning always builds upon knowledge that a student already has and learning is more effective when students are actively engaged in the learning process rather than attempting to receive knowledge passively.

Statement of the Problem

The overall poor academic achievement in TVE subjects especially block/bricklaying and concreting among technical college students raises doubt on the efficacy of the teaching methods utilized by teachers. This persistence poor academic performance of BBC students brings a situation of lack of occupational and employable skills among BBC graduates. Some researchers attributed the situation to the current teaching method employed by technology teachers in technical colleges which is mainly teacher- centered. This teaching method known as the lecture method may not sufficiently give students the opportunity to participate in classroom activities. In agreement to this view, Omeje (2011) noted that many TVE teachers still use teacher-centred method such as lecture and as such students are not actively involved. This situation, according to Omeje, could lead to inadequate practical skill acquisition, low interest and poor academic performance and retention of learnt concepts by students.

In order to promote participatory learning and enhance students' performance, the National Policy on Education (2004) recommended that the use of modern and innovative educational techniques should be increased and improved upon at all levels of the educational system. This implies that educators should be in constant search of quality and innovative teaching approach that could improve their practices and encourage learners to participate actively in the learning process. This could be done through attending conferences, workshops and seminars. There is, therefore, the need to carry out a study on an innovative and participatory teaching method such as guided discovery to find out its effect on students' academic achievement and retention in BBC when compared with the lecture method in Technical Colleges in Anambra State, Nigeria.

Purpose of the Study

The purpose of this study was to find out the effect of guided discovery teaching method on students' academic achievement and retention of BBC concepts in Anambra State. Specifically, this study intends to:

1. Compare the mean achievement scores of students taught BBC using guided discovery method (GD) and those taught using Lecture method.
2. Compare the mean retention scores (delayed post-test scores) of students taught BBC using GD and those taught with Lecture method.

Research Questions

The following research questions were raised to guide the study

1. What is the difference between the mean achievement scores of students taught BBC using GD and those taught using Lecture method in Anambra State?
2. What is the difference between the mean retention scores (delayed post-test scores) of BBC students taught using GD and those taught using lecture method in Anambra State?

Hypotheses

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

1. There is no significant difference in the mean achievement scores of students taught BBC using GD and those taught using Lecture method in Anambra State.
2. There is no significant difference in the mean retention scores of students taught BBC using GD and those taught using lecture method in Anambra State.

Methodology

The study adopted a quasi-experimental research design specifically the pre-test, post-test nonequivalent control group design. This design was deemed appropriate because intact classes were used since it was not convenient to randomly assign students to experimental and control conditions without disrupting the academic programme and the timetable of the schools involved in the study. The area of study was Anambra State. The population for the study was 192 National Technical Certificate (NTC) II students offering BBC in the technical colleges in Anambra State. A purposive sampling technique was used to select four technical colleges with two colleges each in their intact classes, assigned to both experimental and control groups.This comprised 113 NTC II BBC students. The experimental group had 56 students while the control group had 57 students all offering BBC.

The instrument used for pre-test and post-test and delayed post-test was a 26-test item Block/ Bricklaying and Concreting Achievement Test (BCAT) developed by the researcher based on the National Board for Technical Education (NBTE, 2007) curriculum.A test blue print was developed based on four sub-topics in the curriculum namely; site preparation (8 items), setting out (5 items items), soil (7 items) and foundation (6 items). BCAT was subjected to both face and content validities by three experts, two from Nnamdi Azikiwe University, Awka and one from Federal Polytechnic Oko. Based on the recommendations of the experts, some of the items were dropped while some were restructured to produce the final draft of 26- test items. To determine the reliability of the instrument a single test of 26 BCAT items were administered on a trial group of an intact class of 32 NTC III BBC students who were not

part of the study. The reliability coefficient of 0.82 was obtained using Kuder-Richardson formula 21 (K – R 21) which was considered high enough for the study. Kuder-Richardson formula 21 was used because it assumes that all the test items are of equal difficulty (Uzoagulu, 2011).

A one-week training programme was organized for the regular BBC teachers for the experimental group in the selected schools for the study to acquaint them with the guided discovery teaching method and use of materials. The lesson topics for this study were site preparation, setting out, soil and foundation. The experiment which was carried out in stages lasted for twelve (12) weeks in this order: Training of regular BBC teachers by the researcher on the use of guided discovery teaching method, distributing copies of validated lesson plan and test instrument for data collection (2 weeks); pre-testing of BBC students in both the experimental and control groups before treatment commenced using BCAT instruments typed in white coloured paper by the regular school teachers (one week). This enabled the researcher to establish students' initial knowledge of BBC concepts; administering the treatment by the regular BBC teachers to both groups (4weeks). Two weeks after a delayed post-test treatment was administered using BCAT instruments by re-arranging and producing blue coloured question papers to both the experimental and control groups and scores were recorded (one week). The essence of this rearrangement was to distract the students from realizing that they had responded to the instruments before. Means, standard deviation and adjusted means were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. All statistical analyses were performed with statistical package for social sciences (SPSS).

Results **Research Question 1** What is the difference between the mean achievement scores of students taught BBC using GD and those taught using Lecture Method in Anambra State?

Table 1: Mean, SD and Adjusted Mean Achievement Scores of students taught BBC using GD and Lecture Method

Teaching Method	Pre-test Mean Score			Post-test Mean Score			Adjusted Mean
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	
Experimental Group (GD)	56	25.64	12.52	56	43.52	13.52	45.09
Control Group (Lecture)	57	27.46	15.53	57	32.25	12.38	32.96

*Note: N=Number of Students

After adjusting for the initial differences between the two groups as indicated by the pre-test mean scores in Table 1, students taught BBC using GD method had a higher adjusted mean score (45.09) than those taught using lecture method (32.96).This means that students taught BBC using guided discovery teaching method got higher mean achievement scores than those taught the same concepts using lecture method in Anambra State.

Research Question 2

What is the difference between the mean retention scores of BBC students taught using GD and those taught using Lecture method in Anambra state?

Table 2: **Mean SD and Adjusted Mean Retention Scores of Students taught using GD and Lecture methods.**

Teaching Method	Post-	Mean Score		Post-test Adjusted Mean	Delayed Post-test Mean Score (Retention)		Delayed Posttest Adjusted Mean
	N	Mean	SD		Mean	SD	
Experimental Group (GD)	56	43.52	13.52`	45.09	46.32	12.35	46.96
Control Group (Lecture)	57	32.25	12.38	32.96	30.96	11.38	30.34

*Note: N=Number of Students

Table 2 shows that students taught BBC using GD method had an adjusted post-test mean achievement score of 45.09 and an adjusted delayed post-test mean retention score of 46.96, showing a gain score of 1.87 whereas those taught BBC using lecture method haddeficit of 2.62 (32.96-30.34) in retention.

Hypotheses:

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught BBC using GD and those taught using Lecture method in Anambra State.

Table 3: Summary of ANCOVA on Students' Achievement in BBC by Teaching Methods (GD & Lecture)

Source of Variation	Sum Squares	Df	Mean Squares	Cal f	Crit f	P<0.05
Pre-Test	12,397.391	1	12,397.39	218.98		.000*
TeachingMethod	1,446.989	1	1446.989	25.559	3.92	.000*
Error	6,114.251	108	56.613			
Total	22,227.805	112				

P<0.05 *Significant

Table 3 shows that there was a significant difference therefore not supported. It was therefore concluded in the mean achievement scores of students taught that the adjusted mean achievement score of the BBC using GD teaching method and those taught experimental group (Mean =45.09) was significantly using lecture method F(1,112) = 25.559, P ,<0.05. greater than that of the control group (Mean=32.96).

The null hypothesis of no significant difference was

Hypothesis 2: and those taught using Lecture method in Anambra

There is no significant difference between the mean State.

retention scores of students taught BBC using GD

Table 4: Summary of ANCOVA on Students' Retention in BBC using GD and Lecture method

Source	Sum of Squares	Df	Mean Square	F	P
Pre-Test	10,620.316		10620.316	232.910	.000*
Teaching Method	7763.142		7763.142	170.250	.000*
Error	5015.828	10	45.598		
Total	22297.611	112			

P<0.05, *Significant

Table 4 shows that there is a significant difference in adjusted mean retention scores of students taught BBC using GD and those taught using lecture method, F(1,112) = 170.250, *P*<0.05. This shows that the mean retention scores for the GD group (Mean = 46.96) was significantly greater than the mean retention scores for the lecture method (Mean = 30.34). The null hypothesis of no significant difference was not accepted.

Discussion of Results

The findings of this study presented in table 1 shows that students taught BBC using guided discovery teaching method (GD) got higher mean achievement scores than those taught the same concepts using lecture method.This implies that students taught BBC using guided discovery teaching method achieved higher than those taught the same concepts using lecture method. This finding is in agreement with the findings of Ausubel (2001) who reported that students' active participation in solving an instructional problem help them to gain knowledge and develop their minds. As a result, the students develop creative and innovative skills to solve practical problems. The testing of hypothesis 1 shows that there was a significant difference in the mean achievement scores of students taught BBC using GD teaching method and those taught using Lecture method. This finding supports the claim of Ausubel (2001) who reported that activity-based and participatory teaching method could enhance students' participation, mastery of skills and high academic achievement of the subject matter.

The students taught with GD tend to retain what they have learnt over a period of time better than those taught with Lecture method. This finding is in line with that of Ajewole (1990); Dancis (2009); Kirschner, Sweller and Clark (2006) who reported that students learn and retain more when they can develop their own knowledge and meaning from their experiences. This means that students' active participation and use of their psychomotor skills during classroom instructions accounted for the reported improvement in retention. The hypothesis testing also shows that students taught using GD retained BBC concepts better than their counterparts taught using lecture method. This implies that students who are actively involved in classroom instruction tend to retain concepts taught more than those who were not actively involved. Thus, the retentive effect of GD can be viewed from the fact that the students are challenged to discover answers to instructional problems by themselves.

Conclusion

The use of guided discovery teaching method in the classroom has been found to be effective in enhancing students' academic achievement of BBC concepts since it is an activity-oriented teaching method. Furthermore, it was concluded that guided discovery teaching method is effective in fostering retention of BBC concepts. This implies that the use of innovative teaching methods that are

studentcentered and activity-based have been found to be more effective in promoting positive learning outcomes in block/bricklaying and concreting (BBC) among Nigerian students.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Since GD is a student-oriented and activitybased teaching method, it should be incorporated in the curriculum for the pre-service TVE teachers so as to popularize its use among the BBC teachers.
2. Government and relevant professional bodies such as Nigerian Association of Teachers of Technology (NATT) and Nigeria Vocational Association (NVA) should organize conferences, workshops and seminars for TVE teachers on the use of GD teaching method in teaching other TVE subjects and trade courses in technical colleges with a view to arresting the declining achievement of students in them.

References

Alu, J.A. (2000). *An introduction to psychology of education*. London: Macmillan press limited.

Ausubel, D.P. (2001). *Educational psychology; a cognitive view.* New York: Holt Rinehart Winston.

Dancis, J. (2009). A hybrid, small group guided discovery method of instruction. Retrieved from http://en.wikipedia.org/wiki/Discovery learning.

Epunnam, A.D. (1999). *Influence of school environment variables on academic performance as perceived by student (*Unpublished master's thesis) University of Nigeria, Nsukka., Nigeria.

Federal Republic of Nigeria (2004). *National Policy on Education*. Lagos: NERDC Press.

Igboko, K.O. & Ibeneme, O.T. (2006). Effects of some cognitive constructivism instructional approaches on students' achievement and retention in the study of introductory technology in Nigeria. *Journal of Science Teachers Association of Nigeria*,*41* (1 & 2), 37 – 43.

Igwe, A.U. & Ikatule, O.R. (2011). Effect of computer tutorial and drill (CTD) on senior secondary school student's achievement in basic electronics in Lagos State. *Proceedingsof Nigerian Association of Teachers of Technology)*, Umunze,Nigeria, 108-119.

Inyiagu, E. (2011). Effects of computer AutoCAD software assisted instruction on the performance of technical college students in technical drawing in Ebonyi state, Nigeria. *The Journal of Nigeria Association of Teachers of Technology*, *7* (3), 45 – 47.

Kirschner, P.A; Sweller, J. & Clark, R.E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experimental and inquiry-based teaching. *Educational Psychologist*, *41* (2), 95 – 86.

Momoh-Olle, J.Y. (1997). Effects of cognitive preference and advance verbal organizers on the retention of O'level physics textual materials. *The Nigerian Teacher Today.5* (1 & 2), 26 – 33.

National Board for Technical Education (2007). ETF Intervention in TVET. *Syllabus for Construction trades based on NBTE Modular Curricular*. Kaduna.

Nwachukwu, C.F. (2001). *Designing appropriate methodology in vocational and technical education for Nigeria*. Nsukka: Falladu Publishing Company.

Omeje, H. O. (2011). Effects of project-based learning instructional techniques on interest and retention of low ability students in woodwork. *The Journal of Nigerian Association of Teachers of Technology (NATT).7*(3), 29-33.

Umunadi, K.E. (2009). A relational study of students' academic achievement of television technology in technical colleges in Delta state of Nigeria. *Journal of Industrial Teacher Education*, 46 (3), 12-20.

Uzoagulu, A. E. (2011*). Practical guide to writing research project reports in tertiary institutions.* Enugu: John Jacobs's Classic Publishers Ltd.