COMPARATIVE EFFECTS OF THREE INSTRUCTIONAL METHODS ON STUDENTS' PERFORMANCE IN BUILDING TECHNOLOGY IN NIGERIAN POLYTECHNICS

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Abstract

This study investigated the effects of reciprocal peer tutoring, peer tutoring and conventional teaching method on students' performance in Building Technology using the quasi-experimental research design. The population consisted of all the 232 ND II Building Technology students' in the four public Polytechnics in Edo, Delta and Ondo States of Nigeria, while the sample comprised of 193 ND II students purposively selected from three out of the three Polytechnics. The instrument used for data collection was the Building Technology Achievement Test (BTAT) which consisted 80 multiple choice items. Three hypotheses guided this study. Data collected were analyzed using Mean and t-test and ANOVA. The findings revealed among others: a significant difference between the Mean post-test score of students RPT and those exposed to CTM, in favour of RPT; Gender had no significant effects on students' performance; and there was no significant interaction effect of gender and teaching methods on students' performance. It was recommended among others that: Building Technology teachers should be encouraged to employ RPT more in their teaching in order to increase the level of students' performance in Building Technology.

Keywords: Tutoring, student performance

Introduction

Building Technology is one of the academic programmes in environmental design and technology in Polytechnics and Universities of Technology. It consists of the following courses: building construction, building science and properties of materials, workshop practice and technology, technical drawing, architectural design and drawing, surveying, structural mechanics, engineering geology and basic soil mechanics, tendering and estimating, measurement of building works and specifications, site and industrial management, principles of law and building contracts, maintenance and fire technology, structural design and detailing, budgeting and financial control, quantities and specifications and other prescribed general education courses. The National Diploma (ND) programme is aimed at producing technicians who will be able to perform basic functions in Building Technology practice, both in the private and public sector (National Board for Technical Education (NBTE), 2007). The objectives of the ND programme according to NBTE (2007) are to produce diploma holders that will assist the professional builders in the areas of: (i) production of simple buildings; (ii) maintenance of simple buildings; (iii) management of small projects; (iv) costing of simple construction works; (v) cost control techniques in minor construction and engineering works; and (vi) selection of materials and technicians for new building systems.

In order to the realize these objectives, FRN (2004) in her national policy on education recommended that modern educational techniques shall be increasingly used and improved upon at all levels of the education system. The implication of the policy provisions is that educators must be in constant search of learning approaches and techniques that could improve their practice, encourage learners to participate actively in the learning process and adapt more perfectly to peculiar classroom situations geared towards improving learning outcomes and meeting the societal needs. Educators are to engage in learning techniques which will bring about interaction among the students and improve their relationships with individuals in the classroom situation. In the search, several teaching methods and strategies have been documented as being efficacious in teaching, increasing achievement and attitude towards technical subjects. Among these methods and strategies are Reciprocal Peer Tutoring, peer tutoring, cross-age tutoring, etc.

Reciprocal Peer Tutoring (RPT) is an individualized attention to a learner by a person of similar status with respect to age and educational experience, who serves as the tutor. RPT is a collaborative technique of instruction where students of the same class and age bracket alternate between the role of student (tutees) and teachers (tutors) and may follow a structural format to help team members make academic progress. Students alternate roles while in their groups or pairs. RPT enables each member in a

group to participate in the group as a tutor and tutee. In RPT, students gain from the preparation and instruction in which the tutors engage in, and also from the instructions that the tutees receive. RPT has a structured format where students teach, monitor, evaluate and encourage each other. Students are part of the educational process and are able to prepare instructional materials and receive feedback from peers. The alternating structure is designed to increase student choice and participation in the management of their own group interdependent teaching. RPT has been known to be very influential in the development of behaviour patterns and learning outcomes (Uwameiye and Aduwa-Ogiegbean, 2006). RPT provides: a non-judgment acceptance, care and support, opportunities to give and receive from others and creates a non-competitive, empowering environment. It introduces the much needed balance between cooperation and competition in the socialization process of students. The socialization experiences that occur during RPT can benefit both the tutor and tutee by motivating students to learn and increasing their social standing among peers (Fuchs, Fuchs, Mathes and Martiniez, 2002). Interaction here refers to the verbal and non-verbal communication, which forms the basis of any teaching method (Uwameiye and Aduwa-Ogiegbean, 2006). Though, literature (Uwameiye and Aduwa-Ogiegbaen, 2006; and Hendrix, 1999) abounds regarding the efficacy of RPT. This approach to teaching does not seem to be popular among Building Technology educators in Nigerian Polytechnics.

Statement of the Problem

The current methods of teaching in Nigerian educational institutions (Polytechnics) are based on the behavioural learning theories which are content driven, not learner-centred, and do not give students the opportunities to participate in the classroom instruction. This method seem inadequate to prepare the students for the challenges of the workplace, many students and graduates are seen roaming the streets without job because their training is inadequate for societal needs (Olaitan, 1996).Students taught with methods based on the behavioural theories are unable to retain their learning and apply it to new situations (Rojewski, 2002; Uwameiye and Aduwa-Ogiegbaen, 2006; Oviawe, 2008). Apparently, the traditional approach based on the behavioural theories tends to overlook the human, social, cultural and psychological. However, in spite of research findings on the effectiveness of RPT in other subject areas, studies are not found for Building Technology in Nigerian Polytechnics. Therefore, the problem of this study was to determine the effectiveness of RPT and CTM on students' performance in Building Technology.

Purpose of the Study

The purpose of this study was to determine the effects of reciprocal peer tutoring (RPT) and conventional teaching method (CTM) on ND Building Technology students' performance. Specifically, the study sought to find out the:

1. effects of: RPT, PT and CTM on the performance of ND II students in Building Technology.
2. effect of gender on students' performance in Building Technology.
3. interaction effect of RPT, PT and CTM and gender on Building Technology students' performance in ND programmes.

Methodology

The study employed a pre-test, post-test non-equivalent control group quasi-experimental research design in examining the effects of RPT, PT and CTM on ND Building Technology Students performance in Nigerian Polytechnics. The design was specific with non-equivalent control group and non-randomized groups. This is because intact classes consisting of male and female students were used for the different groups.

The population for this study consisted of all the 232 ND II (male 165 and female 67) students in the four Polytechnics offering Building Technology in Edo, Delta and Ondo States as at 2010/2011 academic session.

Purposively sampling technique was adopted in selecting one polytechnic each from Edo, Delta and Ondo States that offer Building Technology. In each of the Polytechnics, the ND II Building Technology intact classes were randomly assigned to control and experimental groups. Therefore, from the three classes, there were 49 females and 143 males. Giving a total of 192 students that comprised the sample for this study.

The only instrument used for data collection was the researchers developed Building Technology Achievement Test (BTAT). BTAT contains 80 multiple choice items based on the NBTE (2007) curriculum. BTAT was designed to reflect the following areas: Building Construction, Workshop Practice, Tendering and Estimating, and Technical/Architectural Drawing which were taught during this study. BTAT was validated by two Building Technology teacher educators and an expert in Measurement and Evaluation. The reliability of BTAT was determined by administering BTAT on a trial group of intact class of 40 ND II Building Technology students in a Polytechnic within the study population but not included in the main study using test-re-test method. The reliability co-efficient of 0.83 was obtained using Kuder Richardson's formula 20 (K-R 20).

Permission was sought from the Heads of Department of Building Technology in the three public Polytechnics to allow their students to be used for the study. The lecturer in the control group was subjected to training on how to effectively teach the students using the conventional method which was mostly lecture method of teaching. Students were assigned a topic each to teach to other students. A roster was prepared for the student teaching. Each of the control (conventional group) and experimental groups (RPT and PT) were taught for eight six weeks. In the control group, a trained building technology lecturer exposed the students to the usual conventional method of teaching where he/she did the talking all alone. The Building Technology lecturer used lesson plans that were prepared by the researchers. At the beginning and end of the eight weeks BTAT was administered as a pretest and post-test to the students in the three groups.

Mean and Standard Deviation were used to answer the research questions. The hypotheses were tested with the t-test, analysis of variance (ANOVA) and analysis of covariance (ANCOVA). The pre-test scores of both the achievement test and workplace skills assessment were fused as the covariates to their post-test scores. The ANCOVA served as a means of controlling the extraneous variables from dependent variables thereby dealing with the threats of initial differences across the groups; and increasing the precision of the experimental results. Acceptance and rejection of the null hypotheses depended on this alpha level and the degree of freedom in relation to the calculated F-value. Acceptance mean of achievement score was 50 per cent in this study.

Results

Research Question 1:

What are the effects of peer tutoring, reciprocal peer tutoring and conventional teaching method on ND II students' performance in Building Technology?

Hypothesis 1: There is no significant difference in the performance of ND II Building Technology students taught with RPT, PT and CTM.

Table 8: Mean of Students' Pre and Post Performance Test Scores in Building Technology

Groups	Sample Size	Pre-test Mean	Post-test Mean
Peer tutoring (Experimental Group 1)	60	18.26	72. 27
Reciprocal peer tutoring (Experimental Group 2)	79	18. 06	73.19
Conventional teaching method (Control Group)	53	19.39	53.94

Table 1 shows that the pre-test Mean scores of the students in the control group performed better (19.39) than the two experimental groups. However, the post-test Mean score showed that students taught with RPT and PT had higher post-treatment Mean scores of 73.19 and 72.27 respectively; while students in the control group taught with CTM solely by their teachers had a Mean performance score of 53.94. The implication is that the treatment (PT and RPT) had positive effects on students Mean performance scores in Building Technology.

Table 2: *Analysis of Covariance (ANCOVA) for Difference in Performance of Building Technology Students based on Methods of Teaching*

Source of Variation	**Sum of Square**	**df**	**Mean Square**	**F**	**Significant at (P < .05)**
Corrected Model	13852.841	3			
Intercept	13508.729	1	4617.614	272.165	.001
Pre-test (covariate)	193.061	1	13508.729	96.212	.001
Method (Main)	13740.952	2	193.061	11.379	.001
Error (Residual)	3189.654	188	6870.476	404.950	.001
Total	894139. 000	192	16.966		
Corrected Total	17042.495	191			

(P <. 05)

Table 2 shows the general result of performance scores using ANCOVA with the F-value of method to be 404.95 being significant at an alpha level of .001, the critical F-value is 2.30. This implies that Table 2 shows that the performance scores of ND II students taught with PT and RPT were significantly different and higher than those of the students taught with CTM, in favour of the two experimental groups. Therefore, the null hypothesis is rejected.

Research Question 2:

What is the effect of gender on ND II students' performance in Building Technology at post-test?

Table 3: Mean of Male and Female Students Post-test Performance Scores in Building Technology

Methods	**Sample Size**			**Mean**		
	Male	**Female**	**Total**	**Male**	**Female**	**Mean Difference**
Peer tutoring	47	13	60	72.55	71.23	1.32
Reciprocal peer tutoring	58	21	79	73.43	72.52	0.91
Conventional teaching method	38	15	53	53.58	54.87	-1.29
Total	143	49	192	66.57	66.20	0.37

Table 3 shows that the differences between the Mean performance scores of male and female students in Building Technology for the three learning methods (PT, RPT, and CTM) were not significant to suggest differences in performance due to gender. To find out whether the differences were significant, hypothesis 2 was tested at .05 level of significance as seen in t-test Table 4.

Hypothesis 2: There is no significant difference in the performance of male and female ND II students in Building Technology.

Table 4: *t-test Difference of Male and Female Students Performance in Technology*

Gender	Number	Mean	Standard Deviation	Calculated t-value	Significant at (two-tailed)
Male	143	67.87	9.55	.697	.487
Female	49	66.78	9.18		

*The mean difference is significant at the .05 level (P >.05).

Table 4 shows that the calculated t-test value for students' gender was .697, only significant at .487, testing at an alpha level of .05, the P-value is much higher than .05 which is the specified confidence level for this study. Therefore, the null hypothesis which states that there is no significant difference between the academic performance of male and female ND II students' in Building Technology is retained.

Hypothesis 3: There is no significant interaction effect of the learning methods and gender on students' academic performance in Building Technology.

Table 5: *ANCOVA Showing Interactive Effects of Treatment and Gender at Post-test*

Source	Sum of Squares	df	Mean Square	F	Significance
Corrected Model	13906.293	6	2317.716	136.719	.001
Intercept	2098.675	1	2098.675	123.798	.001
Pre-test	198.182	1	198.182	11.690	.001
Method	10386.519	2	5193.260	306.343	.001
Gender	1.428	1	1.428	.084	.772
Method*Gender	50.742	2	25.371	1.497	.227
Error (Residual)	136.202	185	16.952		
Total	894139.000	192			
Corrected Total	17042.495	191			

*The mean difference is significant at the .05 level.

Table 5 shows an F value of 1.497 as the post-test result for method and gender interaction, being significant only at .227 which was not significant at .05 level of significance. Testing at an alpha level of .05, the P value is much higher than the alpha level, therefore, the null hypothesis which states that there is no significant interaction effect of the learning methods and gender on students' academic performance in Building

Technology is retained. It is concluded that there is no significant interaction effect of the learning methods and gender on students' performance in Building Technology.

Discussion of Findings

The study revealed that there was significant difference in the performance of students due to instructional methods. The students taught with co-operative learning (peer tutoring and reciprocal peer tutoring) performed higher than the students taught with the conventional teaching method. The study revealed that students taught under the second experimental group (reciprocal peer tutoring) achieved more than those taught under peer tutoring and conventional teaching method (73.19 Vs 72.27 Vs 53.94) respectively. From the findings of this study, there was a significant difference in the performance mean scores of students taught with peer tutoring and those taught with conventional teaching method. The peer tutoring group performance mean score was significantly superior to those under the control group (conventional teaching method). However, there is no significant difference between the performance of students in peer tutoring and reciprocal peer tutoring (co-operative learning groups). The findings of the study revealed that the experimental groups (peer tutoring and reciprocal peer tutoring) obtained higher mean performance scores as a result of their interaction with their peers. On the other hand, the control group of students taught by their teachers who employed the conventional teaching method obtained average scores. The average mean scores as shown in this study is similar to the prevalent pass of Building Technology students in the Polytechnics examinations. This findings is in line with that of similar experimental studies by Oviawe (2008), Uwameiye and Aduwa-Ogiegbean (2006), Ukadike (2005), Hendrix (1999), New-Mann (1998) respectively, where the experimental treatment (peer tutoring and reciprocal peer tutoring) were more effective than the control treatment (conventional teaching method).

The finding is consistent with the nature of Building Technology. The nature of Building Technology is such that it encourages interaction among students as team-mates and in the society at of large. Students accomplish understanding through the social interaction, which occurs in the class (Driver and Oldham, 1986). Students achieve more in learning when they negotiate their understanding through class discussion, interaction with peers and by exchange of thoughts and ideas (Prawat, 1998; Reiness, 1998). Indeed, cooperative learning methods bring to light the significance of social cognitive interaction, co-operation and collaboration of Building Technology teaching and learning context. This present study has shown that allowing students learn in groups will provide for the low cognitive functioning

students to integrate and participate in a way such as to enhance performance and self regulation.

The low performance of the students in conventional teaching method group conforms to previous studies of Oviawe (2008), Moemeke (2006), Uwameiye and Aduwa-Ogiegbean, (2006), Ukadike (2005), who variously reported poor performance in the control group (conventional teaching method). However, the finding of this study is at variance with that of Imhanlanhimi and Aluede (1997) who reported that students in the experimental group were outscored by students in a traditional expository group on every concept in a standard test.

The effect of gender on the performance of Building Technology students' in the post-test yielded a calculated t-test value of .697 which was significant at an alpha level of .487. Table 22 indicates that there was no significant difference in the performance of male and female Building Technology students'. Therefore, the null hypothesis which states that "there is no significant difference in the performance of male and female Building Technology students' is retained. This is in line with similar studies by Oviawe (2008), Uwameiye and Aduwa-Ogiegbean (2006), Ukadike (2005) who reported no significant difference in the academic achievement in pre-vocational subjects and sciences of both male and female. Similarly, the findings lend credence to the findings of Frase and Tobin (1998) in Oviawe (2008) who reported a non-gender difference in achievement in science especially in countries such as Poland, Nigeria, Jamaica and Trinidad/Tabaco. This result may be as a result of the fact that Nigerian culture and values for instance, have been seen to support women, and women have been seen to have always played vital economic role. Okebukola (1986) posited that all students irrespective of gender can perform equally in a given task to support the finding of this study. Okebukola supported his claims by asserting that when students have opportunities to interact among themselves, the teacher and the materials, knowledge and skills are acquired and learning is real for both sexes. However, the finding of this study is at variance with those of Madu (2003), Yager and Tamir (1993) who reported significant difference in the academic performance of male and female students.

Gender as a variable in this study showed no significant effect on students' performance in Building technology. This means that gender was not a factor in the performance of Building Technology students. In this study, the F value for gender interaction with method was 1.497 significant at .227 level which therefore was not significant at .05 level. Table 23 shows that interaction between gender and methods is not statistically significant. Irrespective of students' gender, the effect of method on performance remained as it were. The finding of this study is in line with those of

Moemeke and Omoifo (2003) who reported that no significant interaction effect of methods and gender on learning outcomes. These previous studies have shown that treatment administered (method of instruction) was responsible for difference in performance among groups. It is a clear fact from the foregoing that although, there are male and female students in Building Technology classrooms, their differences are more pronounced and significant when inappropriate instructional devices are gender sensitive.

However, the finding of the present study is at variance with those of Madu (2003) and Mbah (2002) who variously reported sex differences in learning outcomes of students. These studies may not have recognized the efficacy of creative and social interactive methods like peer tutoring and reciprocal peer tutoring which were used in this present study to bridge the gap that may be created by difference in sex. It may therefore be necessary to conclude on the effect of gender by drawing on the findings of Ukadike (2005) that rather than an interaction by sex to affect performance, other factors bordering on individual differences in growth and cognitive development may affect male and female students performance.

Conclusion and Recommendations

Since there was a significant effect of instructional methods on students' performance in Building Technology, it is concluded that cooperative learning methods (peer tutoring and reciprocal peer tutoring) are better instructional methods than the conventional teaching method for teaching Building Technology in Polytechnics. Learners accomplish understanding through the social interaction which occurs in the classroom. They think and talk about their experiences; they suggest and try out new ideas. The conclusion that could be drawn here is that the deterioration in the instructional delivery has far reaching negative effect on students' academic performance, Building Technology objectives and Technical and Vocational Education goals and objectives generally. The deterioration is not likely to stop unless some corrective measures (using cooperative learning methods) are taken immediately to avoid total collapse of Technical and Vocational Education programmes. Based on the findings of this study, the following recommendations were made:

1. Building Technology teachers should be encouraged to employ peer tutoring and reciprocal peer tutoring more in their teaching method in order to increase the level of students' performance in Building Technology.
2. Government should ensure that Building Technology teachers who lack the knowledge and competence for group learning be equipped with the necessary skills. Building Technology teachers should be encouraged through in-service training, seminars, workshops, conferences and other forms of training-on-the-job to employ peer tutoring and reciprocal peer

tutoring methods. This is because both peer tutoring and reciprocal peer tutoring were found to be superior to conventional teaching method which is commonly and currently in use in Polytechnics.

3. Institutions of higher learning charged with the responsibilities of training and producing Building Technology teachers should train their students in the use of peer tutoring and reciprocal peer tutoring as methods of teaching in their course content.

4. The conventional teaching method, which seems to prevail in Nigerian educational institutions, should be minimized especially in Building Technology programmes. Every teacher at any level of education should have the necessary teaching skills. This could be acquired in the education faculties of Universities and other tertiary institutions where different techniques and methods of teaching are learnt.

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