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Effects of Concept Mapping Instructional Strategy on Students' Academic Achievement in Building Drawing in Technical Colleges in Rivers State

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Abstract: This study investigated the effect of concept mapping instructional strategy on students' academic achievement in building drawing in technical colleges in Rivers State. Specifically, this work sought to determine the effect of concept mapping instructional strategy on academic achievement mean scores of students in building drawing and the effect of concept mapping instructional strategy on academic achievement mean scores of male students in building drawing. A quasi-experimental design guided the study. The population for this study consisted of 228 (202 male and 26 female) level II building technology students offering building drawing in the five technical colleges in Rivers State. Multistage sampling was used in selecting 104 level II building technology students for the study. Two objectives, research questions and hypotheses were formulated, answered and tested at .05 level of significance. The instrument for data collection was Basic Design Process Achievement Test developed by the researcher. The instruments were subjected to face and content validity by three experts from Nnamdi Azikiwe University Awka. The reliability of the instruments was established using Kuder Richardson Formula 20. The coefficient of the reliability obtained for equivalent test was .86. Mean and Standard Deviation were used to answer the research questions while z-test statistical tool was used to test the hypotheses. The findings of this study showed that experimental group taught with concept mapping performed better than the control group taught with conventional method. Furthermore, it was concluded that there was a significant difference between the effect of concept mapping instructional strategy on academic achievement mean scores of students in building drawing when compared with students taught using conventional instructional strategy. Therefore, it was recommended among others that concept mapping instructional strategy should be included in the National Teachers Certificate curriculum for teaching building drawing so that teachers can adopt its use for effective teaching.

Keyword: Academic Achievement, Building Drawing, Concept Mapping, Instructional Strategy and Technical College

INTRODUCTION

Technical and Vocational Education (TVE) is concerned with inculcating knowledge, skills and attitudes to learners and preparing persons for the world of work. According to Federal Government of Nigeria (FGN) (2013), technical and vocational education is an aspect of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of the economic and social life.

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Technical and Vocational Education is a skill training programme recognized all over the world for its potential in equipping individuals for self-employment, employment creation and poverty reduction as well as satisfying the needs of the society (Ezenwafor, 2015). There are different trades in vocational technical education in Nigerian technical colleges according to FGN (2013) such as business trades, metalwork trades, woodwork trades, automobile trades and building trades among others. Building trades are covered in the National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) and include brick-laying, concrete mixing, scaffolding and building drawing among others.

Building drawing as a course, can be described as the design and drawing of building plans, elevations, sections, schedules and models. National Board for Technical Education (NBTE) (2012) puts down the building drawing course outline as follows; Basic responsibilities in design process, drafting materials and equipment, preliminary sketch and design, working drawing (to include standard symbols for plumbing) up to one storey building and introduction to computer aided drafting (CAD). The aim of building drawing is to inculcate relevant practical and acquisition of appropriate skills and development of competencies as equipment for individual to live and contribute to the development of the society NBTE (2012). The acquisition of skills in building drawing makes one employable or self-reliant. Building drawing is designed to produce skilled draughtsmen who will design various kinds of structures, skilled builders for the building industry.

Despite the importance of building drawing to technology education, students' achievement in the subject in recent time appears to be declining tremendously. Evidence of this poor achievement of students in building drawing has been documented by the National Business and Technical Examination Board (NABTEB) Chief Examiners' Report (2009 & 2013). The Chief Examiner's Report affirmed that students' achievement in building drawing is below average. Similarly, NBTE (2011 & 2012) asserted that the overall performance of the candidates was fair and the following weaknesses were noticeable among the candidates; poor coverage of the syllabus, wrong spellings, poor grammatical expressions, poor drawing and sketching skills, inability to label diagrams well, inability to explain an operational sequence and inability to use correct dimensions in drawing.

The reason for the poor achievement could be attributed to a lot of factors, including students' inability to interpret drawing (WAEC Chief Examiners' Report, 2012). In the same vein, Oviawe, Ezeji, & Uwameiye, (2015) maintained that poor teaching approach and instructional strategy also contribute for poor achievement. Achievement is a term used to indicate the degree of success attained in some general or specific areas. Students' achievement refers to what they accomplish successfully, especially by means of exertion, skill, practice or perseverance. Students' academic achievement generally depends on the quality of instruction received from teachers or lecturers which is affected by several factors such as the level of knowledge of the teacher or lecturer among others. This is the reason why (NCCE, 2012) strongly affirmed the use of instructional strategies that require students to be more actively involved in their learning process in schools.

However, Agboghoroma (2014) affirmed that overreliance on the conventional teaching strategies has been criticized for turning students into perceived recipients of information given out by teachers and making them highly dependent on the teachers for much of their learning needs. Conventional instructional strategy refers to an instruction where the teacher claims an all knowing, authoritatively gives instructions to the learners as passive listeners (Akpochafo, 2014). Obviously, this instructional strategy has failed to bring about the desired outcome of producing thinking students. It is important, therefore, to engage students' creative thinking in order to develop their problem-solving skills and academic achievement

by adopting student-centred strategy like concept mapping, peer tutoring, active learning, cooperative learning, associative learning and guided-discovery learning. For this study, concept mapping instructional strategy is selected as one of the strategies that can be adopted by the lecturers/teachers and students so as to improve students' academic achievement in building drawing especially in the aspect of Basic Design Process.

According to Rao (2015), concept maps are diagrammatic representations which show meaningful relationships between concepts in the form of propositions which are linked together by words, circles, and cross links. Similarly, Onuoha (2016) opined that concept mappings are identified as two dimensional, hierarchical, node-linked diagrams that depict verbal conceptual or declarative knowledge in succinct visual or graphical forms. In concept maps, ideas are arranged hierarchically with the super ordinate concepts at the top of the map, and subordinate at the bottom which have less inclusive than higher ones. Concept mapping stimulates the learning process by making it explicit and by requiring the learner to pay attention to the relationship between concepts.

Another issue of contention in technical college today in Nigeria on Achievement of students in technological subjects, building drawing inclusive is gender of the learner.Gender is another factor that influences students' academic achievement. Different societies refer gender to the varied socially and culturally constructed roles, qualities and behavior that are ascribed to man and woman. It is a variable that plays an important role in learning. Meanwhile, several empirical studies have demonstrated the effectiveness of concept mapping instructional strategies in many subjects like technical drawing and economics when compared to the conventional instructional strategy (Oviawe and Lukmon, 2017). Therefore, the study seeks to determine the effects of concept mapping instructional strategy on students' academic achievement in building drawing in technical colleges in Rivers State.

Research Questions

The following research questions guided the study:

1. What is the effect of concept mapping instructional strategy on academic achievement mean scores of students in building drawing when compared with students taught using conventional instructional strategy?
2. What is the effect of concept mapping instructional strategy on academic achievement mean scores of male students in building drawing when compared with male students taught using conventional instructional strategy?

Hypotheses

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

1. There will be no significant difference between the effects of concept mapping instructional strategy on academic achievement mean scores of students in building drawing when compared with students taught using conventional instructional strategy.
2. There will be no significant difference between the effects of concept mapping instructional strategy on academic achievement mean scores of male students in building drawing when compared with male students taught using conventional instructional strategy.

METHODS

The design of the study was quasi-experimental design. The population for this study consisted of 140 level II building technology students in the five technical colleges in Rivers State. Out of the population, 116 are males while 24 are females. The sample for the study consisted of 104 level II building technology students. Purposive sampling technique was used

to select four out the five technical colleges. The technical colleges that were selected are Government Technical College, Ahoada, Government Technical College, Port Harcourt, Government Technical College, Ele-ogu and Government Technical College, Tombia. The instrument for data collection was Basic Design Process Achievement Test (BDPAT) developed by the researcher. The Basic Design Process Achievement Test (BDPAT) was subjected to face and content validity by three experts from Nnamdi Azikwe University Awka. In order to establish the reliability of the instruments BDPAT, a trial test of BDPAT was administered to 30 building technology students at Government Science Technical College, Ekowe in Bayelsa State. After the administration and grading of the instrument, Kuder Richardson Formula 20 (KR20) was used to determine the estimate of the internal consistency of the achievement test instrument which yielded a reliability of .86.. The data for this study were analysed using mean and standard deviation of the test scores to answer the research questions while Analysis of covariance (ANCOVA) was used in testing the null hypotheses at .05 level of significance. The decision rule in answering the research questions was based on the mean gain score. If the mean gain score of the experimental group is greater than the mean gain score of the control group, it means that the treatment has an effect. For the hypothesis, if the probability value (p), is less or equal to the 0.05 alpha value $P \leq 0.05$ the null hypothesis is rejected but if P value is greater or equal to 0.05 alpha value $P \geq 0.05$, the null hypothesis is not rejected (accepted or held).

RESULTS

Research Question 1

What is the effect of concept mapping instructional strategy on academic achievement mean scores of students in building drawing when compared with students taught using conventional instructional strategy?

Table 4.1: Mean Scores of Students Academic Achievement in Building Drawing

Groups	N	Pretest X_1	Pretest SD_1	Posttest X_2	Posttest SD_2	Mean Difference	Mean Gain	Decision
Experimental Group	54	20.96	8.11	80.30	11.52	59.34	50.36	Positive
Control Group	50	31.6	10.14	40.58	14.21	8.98		

Table 4.1 shows that the Pre-test mean and standard deviation for experimental group were 20.96 and 8.11 while that of control group were 31.60 and 10.14 respectively. The mean and standard deviation scores of Pre-tests for the two groups revealed that students in the control group did better on the Pre-test than those in the experimental group. Similarly, the Post-test means and standard deviation for the experimental group were 80.30 and 11.52 while that of the control group were 40.58 and 14.21 respectively. This revealed that students in experimental group did better on the post-test than those in the control group. Furthermore, the mean difference on the basis of the difference between Post-test and Pre-test mean of each group indicated 59.34 for experimental group and 8.98 for control group which shows that there was a wider difference in the experimental than the control. Finally, the mean gain between the two groups was 50.36 which shows a positive result; hence the experimental method was positive. Therefore, students taught building drawing using concept mapping performed better than those taught using conventional method.

Research Question 2

What is the effect of concept mapping instructional strategy on academic achievement mean scores of male students in building drawing when compared with male students taught using conventional instructional strategy?

Table 4.2: Mean Scores of Male Students' Academic Achievement in Building Drawing

Groups	N	Pretest X_1	Pretest SD_1	Posttest X_2	Posttest SD_2	Mean Difference	Mean Gain	Decision
Experimental Group (Male)	44	23.45	9.10	81.34	9.88	57.89	49.79	Positive
Control Group (Male)	42	32.76	11.08	40.86	13.73	8.10		

Table 4.2 shows that the Pre-test mean and standard deviation for experimental group were 23.45 and 9.10 while that of control group were 32.76 and 11.08 respectively. The mean and standard deviation scores of pre test for the two groups revealed that students in the control group did better on the pre test than those in the experimental group. On the other hand, the post test mean and standard deviation for the experimental group were 81.34 and 9.88 while that of the control group were 40.86 and 13.73 respectively. This revealed that students in experimental group did better on the post test than those in the control group. Furthermore, the mean difference on the basis of the difference between post test and pre test mean of each group indicated 57.89 for experimental group and 8.10 for control group which shows that there was a wider difference in the experimental than the control. Finally, the mean gain between the two groups was 49.79 which shows a positive result, hence the experimental method was positive. Therefore, male students taught building drawing using concept mapping performed better than those taught using conventional method.

Hypothesis 1

There will be no significant difference between the effects of concept mapping instructional strategy on academic achievement mean scores of students in building drawing when compared with students taught using conventional instructional strategy.

Table 4.3: Analysis of Covariance for Scores in Building drawing

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3291.785[a]	2	1645.892	20.358	.000
Intercept	1364.617	1	1364.617	16.879	.000
VAR00001	2038.056	1	2038.056	25.209	.000
VAR00003	354.326	1	354.326	4.383	.039
Error	8165.600	101	80.848		
Total	82178.000	104			
Corrected Total	11457.385	103			

From Table 4.3, F cal is 4.38 while the p-value is .04 at .05 level of significance. This result shows that p-value of .04 is less than .05 level of significance hence the null hypothesis was rejected. Therefore, there was a significant difference between the effect of concept mapping instructional strategy on academic achievement mean scores of students in building drawing when compared with students taught using conventional instructional strategy.

Hypothesis2

There will be no significant difference between the effect of concept mapping instructional strategy on academic achievement mean scores of male students in building drawing when compared with male students taught using conventional instructional strategy.

Table 4.4: Analysis of Covariance for Scores of Male Students in Building drawing

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	35829.296[a]	2	17914.648	131.332	.000
Intercept	27738.061	1	27738.061	203.348	.000
VAR00002	611.244	1	611.244	4.481	.037
VAR00001	32605.839	1	32605.839	239.033	.000
Error	11321.785	83	136.407		
Total	373163.000	86			
Corrected Total	47151.081	85			

From Table 4.4, F-cal is 239.03 while the p-value is .00 at .05 level of significance. This result shows that p-value of .00 is less than .05 level of significance hence the null hypothesis was rejected. Therefore, there was a significant difference between the effect of concept mapping instructional strategy on academic achievement mean scores of male students in building drawing when compared with male students taught using conventional instructional strategy.

DISCUSSIONS

Effect of Concept Mapping Instructional Strategy on Academic Achievement of Students in Building Drawing

The analysis of the results in building drawing showed that students taught with concept mapping performed better than those taught with conventional instructional strategy with a mean gain of 50.36. Also, the finding showed a significant difference between the mean scores of students taught building drawing using concept mapping and those taught using conventional instructional strategy. This is in line with previous studies. For instance, Onuoha et al (2016) investigated the Effect of Concept Mapping Instructional Strategy Students' Achievement and Interest in Economics Secondary Schools in Enugu Education Zone and found among others that students that were taught Economics using concept mapping instructional strategy achieved better and had higher interest score than counterparts taught with the lecture instructional strategy. Also, Oviawe and Lukmon (2017) carried out a study on the effects of concept mapping instructional strategy on students' academic performance and interest in technical drawing in technical colleges in Edo State, Nigeria using Pre-test, Post-test, non-equivalent control group, quasi-experimental research design and found among others that students taught technical drawing using concept mapping teaching strategy had higher mean achievement and interest scores than those taught with the conventional teaching method.

Effect of Concept Mapping Instructional Strategy on Academic Achievement of Male Students in Building Drawing

The analysis of the results in building drawing showed that male students taught with concept mapping performed better than those taught with conventional instructional strategy with a mean gain of 48.26. Also, the finding showed a significant difference between the mean scores of male students taught building drawing using concept mapping and those taught using conventional instructional strategy. This is in conformity with Ogonnaya et al (2016) investigated the effects of concept mapping on students' achievement in basic science. The study was carried out in Ebonyi State of Nigeria. The study employed a quasi-experimental design. Specifically the pre-testpost-test non-equivalent control group research design was used. The sample was 122 students selected from two secondary schools drawn from the population through a simple random sampling. The study found that concept mapping fosters students' achievement in basic science than conventional method. It boosts the achievement of both male female students in the subject.

CONCLUSIONS

Based on the findings regarding the effect of concept mapping instructional strategy on academic achievement mean scores of students in building drawing when compared with students taught using conventional instructional strategy, it was concluded that students who were taught concept mapping in building drawing performed better than those taught with the conventional instructional strategy. Based on the findings regarding the effect of concept mapping instructional strategy on academic achievement mean scores of male students in building drawing when compared with male students taught using conventional instructional strategy, it was deduced that male students taught concept mapping in building drawing did better than those taught with the conventional instructional strategy.

RECOMMENDATIONS

The following recommendations were put forward based on the findings:

1. Government should train teachers on effective use of concept mapping instructional strategies so that they can be able to use this instructional strategy in teaching building drawing for academic achievement and achievement of building drawing aims and objectives.
2. Concept mapping instructional strategy should be included in the NTC curriculum for teaching building drawing so that teachers can adopt its use for effective teaching.

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