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EFFECTS OF COMPUTER AIDED INSTRUCTION TECHNIQUE ON ACADEMIC PERFORMANCE AND RETENTION OF TECHNICAL DRAWING STUDENTS IN TECHNICAL COLLEGE IN ANAMBRA STATE

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Abstract
The apparent decline in the performance of students in technical drawing examinations in Technical Colleges in Anambra State necessitated the study. Among other susceptible factors, the use of inappropriate teaching methods appears more crucial. Hence, the study investigated the effects of Computer Aided Instruction on Academic Performance and Retention of students in technical drawing in Government Technical Colleges in Anambra State. The study adopted a non-randomized quasi-experimental research design guided by two research questions and two hypotheses tested at 0.05 level of significance. The population was 537 National Technical College II (NTC II) students offering technical drawing with a sample size of 235. Purposive sampling technique was used to select four intact classes in technical colleges from different Local Government Areas of the State. The instrument for data collection was Technical Drawing Performance Test (TDPT) which contained 38 multiple choice items and two hands-on activity items. Three experts validated the instrument and its reliability coefficient was 0.83 which obtained using Chronbach Alpha. The research questions were analyzed using Mean while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. Both experimental and control groups were pre-tested and taught by their regular teachers for four weeks using the lesson plans prepared by the researcher. A post-test was administered after teaching followed by a delayed post-test to ascertain their retention ability. The findings revealed among others, that computer aided instruction technique had more effect on students' academic performance and retention with higher post-test mean scores than those taught with conventional method. Based on the findings, it was concluded that computer aided instruction technique could enhance students' academic performance and retention in technical drawing. Hence, it was recommended among others that technical drawing teachers should embrace computer aided instruction technique to enable students learn actively and retain concepts for improved academic performance. Also, Government should in addition of providing ICT gadgets to school, support them in organizing seminars and workshops to train and retrain technical drawing teachers on how to effectively use CAI.
Keywords: Computer aided instruction, Technique, Technical college students, Academic performance, Retention, Technical drawing

Introduction

Technical education is a form of education that exposes students to the skills and knowledge needed to succeed in the field. Thus, it was designed to provide students with practical, hands-on learning experiences that can be directly applied to the society. The extent to which these learning experiences are achieved could be determined by students' performance in examinations conducted by various examination bodies. In recent years, reports of secondary schools and technical college students' performances in external examination conducted by these

bodies have not been encouraging. According to Aworanti (2016) the goals of technical education might not be achieved with the rate of decline in secondary school students in science and technical related subjects most especially in technical drawings in external examinations.

Technical drawing is one of the technical education subjects. It is a language or a means of communication in engineering. It is studied as a subject/module at various levels of Nigerian educational system such as post-primary schools and tertiary institutions with certain nomenclatures. Technical drawing as a subject is done at the senior secondary school (NTC I-NTC III) and it is a subject designed with curriculum objectives for senior secondary school students to foster pre-vocational orientation in technology. It is medium of communication among technologists, engineers, architects among others and is widely used in many fields and professions. However, within the context of technical education, technical drawing has been identified as an essential science subject that propels technological development of any nation.

Okorie (2015) asserted that technical drawing is essentially the universal language which technicians, engineers, craftsmen and industrialists use to communicate. Okorie further stated that technical drawing can be understood and interpreted correctly by technicians, engineers, designers' craftsmen, manufacturers and other experts in the related discipline who chose to advance in it. The usability of technical drawing transcends cultures and languages; hence, for any country to progress technologically, it is essential that such country develops the citizens in the act of communicating with technical drawing. Since technical drawing is one of the essential subjects offered at schools, there is an urgent need to employ suitable teaching methods in teaching it at all levels of education system in the country.

A systematic integration of variety of instructional methods have been adopted for effective teaching and learning of technical drawing in order to increase the level of academic performance of the students in the subject. There are however, some of the instructional methods that could be used to make learning more effective; these include: lecture method, questioning method, discussion, play-way method, problem-based method, demonstration method, field trip/excursion method, dramatization method among others (Okoye, 2019). Ezeji (2018) also posited that high level of creativity in analyzing, synthesizing and presenting knowledge in new and effective ways are required of teachers to successfully deliver their instructions. That is why, it is pertinent for teachers to be acquainted with the lesson and also be able to adopt appropriate teaching methods that would enable them impart meaningfully in learners.

Psychomotor skills in technical drawing involve activities that need coordination of finger and hand movement as a result of cognitive planning. Such activities might include several tasks like; handling the pencils, manipulation of drawing instruments, sliding the T-square, set-squares, metric rule, and proper use of eraser (FRN,2013). Studies have shown that the issue of poor academic performance and retention of students in technical drawing has been blamed on teachers' method adopted in teaching the subject. Osinen and Nwoji (2016) maintained that teachers are posed with problems on how to use new technology and keep up with teaching methods of various vocational training. However, the effective implementation of any technical education curriculum depends on the quality of teachers and their ability to effectively manipulate, operate and use tools and equipment that are available for the training of the students (Olaitan as cited in Nwachukwu, 2015). Ahmet (2018) affirmed that brining in new technologies that could facilitate the development of education process, and as well safeguard students against the negative effect of rote memory-based learning. This will not only make learning of technical drawing easier but could facilitate mastery by students. Example of such new technology is Computer Aided Instruction (CAI). Computer Aided Instruction is referred to as a self-learning technique usually offline/online, which involves the interaction of students

with programmed instructional materials. CAI is an interactive technique whereby a computer is used to present the instructions while the teacher monitors or facilitates the learning process.

According to Traylor (2015), computers are used in preparing "electronic" presentations using computer presentation programmes and LCD projectors. Traylor further stressed that many schools have incorporated interactive computer-aided instruction into teaching and learning programme in order to provide students opportunities to master specific educational objectives or standards. Sequel to that, some studies have posited that the benefits of Computer Aided Instructions in learning psychomotor oriented subjects cannot be underestimated in the contemporary world. According to Traylor in Orisebiyi (2017), CAI is an effective instructional strategy in science and related subjects. Also, Yusuf and Afolabi (2014) asserted that the use of computer assisted instruction as a supplement to discussion method, has enabled learners improve in academic performance than using discussion method only. In view of the impressive output of the method, several CAI packages are now available for graphics design and learning processes, which include CorelDraw, Auto TED, Archi CAD, Auto CAD, Revit among others.

Academic performance of students in this context is perceived as the performance or learning outcome of students on a subject showing the extent of mastery on the subject matter (Ibudo, 2013). Academic performance also refers to knowledge gained which is assessed by marks by a teacher and/or educational goal set by students and teachers to be achieved over a specific period of time (Narad and Abdullah 2016). Narad and Abdullahi also noted that academic performance is dependent on several factors such as instructional techniques, learning environment and the learner. Adeola in Abdullahi (2016) maintained that performance of a student is quantified by the student's academic score in relation to other students in the same class or in other locations. Hence, academic performance in respect of this study implies the quality and level of competencies and knowledge acquired by technical drawing students for possible retention and utilization that could guarantee success. Such competencies and skills could be tested over time through a standard process in order to ascertain the extent of impartation as indicated by learners scores (Hodson in Ibudo, 2014). This implies that, learners who got high scores are said to have performed well while those with low scores are termed poor performers, indicating ineffective learning and poor retention of knowledge.

Retention of learning is simply the ability to remember what has been learnt. Retention could also be referred to as the process of maintaining a replica of acquired new meanings or the ability to recall the piece of information over time (Mayer, 2015). According to Momoh-otte in Eze (2014) retention of learning is the repeated performance of behaviour earlier acquired by the learner and elicited after an interval of time. However, retention could be facilitated by the nature of instructions and teaching/learning method, which could be passive and/or participatory (active) (Runnei 2015). Shrun and Glinson (2016) contended that the use of appropriate teaching method could avail students the opportunity to learn from what they know; and grasp knowledge with practical skill orientation for lifelong utilization. To this end, Traylor (2015) maintained that the use of computer aided instruction as teaching method in teaching psychomotor-related subjects could enhance students' retention which could in turn improve their academic performance irrespective of their ability level. This presupposes that computer aided instructional method if properly utilized could reverse the poor academic performance existing among students of technical drawing (Orisebiyi, 2017).

The forgoing submission therefore suggest that incidents occurrences, the use of CAI could enable students overcome the learning difficulties associated with other teaching methods as they could use both their hands and brains to learn alongside with the computer. However, there is a general believes that gender plays significant role in psychomotor activities

such as, the use of computer. According to Zafrain (2017), gender could be considered critical as regard to psychomotor approach such as the computer in determining learning outcomes. This is true because some school of thoughts upholds that male folk performs better in practical or psychomotor oriented exercises while some argue otherwise. It therefore becomes imperative to ascertain the effects of the method on the performance of male and female students in technical drawing. This will help to eliminate any possible difference that might negatively influence the performance in technical drawing as a result of gender.

However, the overt indices of poor academic performance in examinations necessitate the quest for re-examination of the methods of teaching and learning technical drawing to ensure that students are taught with appropriate methods that would guarantee their success. Hence, the study ascertained the effects of Computer Aided Instruction on academic performance and retention of technical drawing students in technical colleges.

Statement of the Problem

Despite the fact that technical drawing is generally perceived as the means of communication among professionals in the field of engineering and technology, students' performance seems discouraging. Interestingly, the advancement in technology has permeated all spheres of human lives including teaching and learning; as it makes the processes easier, faster as well as aids in generating, storing and retrieval of information. This, led to the emergence of various technologies, including CAI which is often employed in teaching and learning. It therefore, becomes expedient to employ CAI technique in teaching Technical Drawing since the conventional approach does not seem to encourage students to assimilate what was taught which eventually results in poor performance in exams. However, this negates the objectives of education system and technological advancement, and has become worrisome to scholars.

Cognizant of the fact that scholars have decried students' difficulty to understand technical drawing which could be attributed to teaching methods among other factors, compelled the researcher to conduct this study in order to ascertain the potency of Computer Aided Instructions technique on students' academic performance and retention in technical drawing in Technical secondary schools in Anambra State.

Purpose of the Study

The major purpose of the study was to determine the effects of Computer Aided Instruction Technique on technical college (NTC II) students' academic performance and retention in technical drawing. Specifically, the study determined the effects of CAI on:

1. Academic performance of students taught technical drawing using their pre-test and post-test mean scores.
2. Retention of students taught technical drawing using their post-test and delayed post-test mean scores.

Research Questions.

The following research questions guided the study:

1. What are the effects of CAI on the academic performance of students taught technical drawing using their pre-test and post-test mean scores?
2. What are the effects of CAI on the retention of students taught technical drawing using their post-test and delayed post-test mean scores?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant mean difference in the pre-test and post-test academic performance scores of students taught technical drawing using CAI when compared with those taught using conventional method.
2. There is no significant mean difference in the post-test and delayed post-test scores on the retention of students taught technical drawing using CAI and those taught using conventional method.

Methods

The study adopted quasi-experimental research design. Specifically, pre-test, post-test, non-equivalent control group design involving four schools but no randomization (intact or pre-existing classes) was used for the study. The design concurs with the assertion of Uzoagulu (2019) that quasi experimental design is best used when intact classes are used and non-randomization of subject is applied. The design is considered suitable because it will not be possible to place subject in groups by random assignment without disrupting the programme and timetable of the schools involved in the study. The study was guided by two research questions, and two hypotheses tested at 0.05 level of significance. The population was 537 National Technical College II (NTC II) students offering technical drawing while a sample size of 235 was studied. Purposive sampling technique was used to select four intact classes in technical colleges from different Local Government Areas of the State. The instrument for data collection was Technical Drawing Performance Test (TDPT) which contain 38 multiple choice items and two hands-on activity items.

The instrument was face and content validated by three experts in the field, and as well, tested for reliability using Chronbach Alpha which yielded 0.83. Mean was used to analyzed the data while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. Both experimental and control groups were pre-tested before commencement of treatment which lasted for four weeks using the lesson plans prepared by the researcher. Thereafter, a post-test was administered, followed by a retention-test two weeks after, to ascertain their retention ability. The SPSS was used to analyze the data. Following the analysis, the null hypothesis was accepted if the P-value is greater or equal to the level of significance (0.05), otherwise, the null hypothesis was rejected (P-value less than 0.05).

Experimental Procedure

The researcher, having obtained approval from the leadership of the colleges used for the study, immediately engaged the technical drawing teachers on an extensive briefing on how to conduct the exercise. The teachers for the experimental group were given TEDRACAI lesson plans while those for the control group were also given Conventional Lesson Plans. Each lesson lasted for a double period of 45 minutes each with 1/3 of the time spent on lesson while the remaining time was used for practical activities. The control group used manual drawing instruments, whiteboards, still pictures and physical models to assist in the presentation of the materials. The lesson was taught for two times a week and the treatment lasted for 4 weeks followed by a post-test. Then, two weeks after the post-test, retention test was administered to both groups, and their scores were collated and analyzed accordingly.

Results

Research Question One: What is the effect of Computer-Aided instruction method on students' academic performance in technical drawing when compared with those taught with conventional method using their pre-test and post-test mean scores?

Table 1: **Pre-Test and Post-Test Mean Students' Academic Performance Scores for both Experimental and Control Groups**

Group	N	Pre-test mean	Post-test mean	Mean gain
Experimental group	108	26.32	42.57	16.25
Control groups	102	25.24	35.15	9.91

Data presented in Table 1 show that the pre-test and post-test mean performance scores of students taught with CAI technique are 26.32 and 42.57 with mean difference of 16.25, while those taught using conventional method have 25.24 and 35.15 with mean gain of 9.91 respectively. The results indicate that the experimental group had higher mean gain. This further shows that the treatment given to the experimental group impacted their academic performance positively.

***Research Question Two*:** What are the effects of CAI on the retention of students taught technical drawing using their post-test and delayed test scores?

Table 2: Mean Retention Scores for all the Students taught Technical Drawing using CAI and Conventional methods

Group	N	Post-test	Retention	Mean gain
Experimental	108	43.27	49.82	6.55
Control	102	35.93	37.52	1.59

Table 2 reveals that students in the experimental group had the post-test and retention test mean scores of 43.27 and 49.82 with mean gain of 6.55, while their counterpart in control group had 35.93 and 40.52 with a mean gain of 1.59. This result depicts that, the use of CAI impacted more positively on the students' ability to retain instructions than those in conventional group.

***Hypotheses 1*:** There is no significant mean difference in the pre-test and post-test academic performance scores of students taught technical drawing using CAI technique when compared with those taught using conventional method.

Table 3: ANCOVA Summary of CAI and Conventional Method for Students' Academic Performance in Technical Drawing

Source	Type III Sum of Squares	df	Mean Square	F	p-value	Remark
Corrected model	8.3484[a]	4	2.096	12.950	0.000	
Intercept	28.858	1	28.858	178.293	0.000	
Post-test	.099	1	0.099	.613	0.436	
Method	1.005	1	1.005	6.212	0.015	Rejected
Error	13.434	205	0.162			
Total	1072.000	210				
Corrected Total	21.818	209				

Table 3 shows that at 0.05 level of significance with 1 degree of freedom (df), the p-value is 0.000 which is lower than 0.05 level of significance. This shows that there is significant difference in mean performance scores of students taught technical drawing using CAI technique and those taught with conventional method. Based on this result, the null hypothesis was therefore rejected.

***Hypothesis 4*:** There is no significant mean difference between the retention mean scores of students taught technical drawing using computer aided instruction method and those taught using conventional method.

Table 4: ANCOVA Summary of Computer Aided Instruction method and Conventional Method for all Students' Retention in Technical Drawing

Source	Type III Sum of Squares	df	Mean Square	F	p-value	Decision
Corrected model	7.172[a]	2	3.586	21.811	.000	
Intercept	30.177	1	30.177	175.133	.003	
Retention	6.973	1	6.973	40.467	.002	Rejected
Method	4.511	1	4.511	26.181	.000	
Error	14.646	205	.172			
Total	1072.000	210				
Corrected Total	21.818	209				

a R Squared = .329 (Adjusted R Squared = .313)

Table 4 shows that at 0.05 level of significance with 1 degree of freedom, the p-value is 0.002 which is lower than the level of significance 0.05. This indicates that there is significant difference in retention mean scores of students taught technical drawing using computer aided instruction and those taught with conventional method. Hence, the null hypothesis was rejected.

Discussion of Findings

The study revealed that computer aided instruction enhanced students' academic performance in technical drawing in that they got higher pre-test and post-test mean performance scores than those taught using conventional method. This result concurs to the assertions of Ahmet (2018) and Adedokun (2014) that teaching methods based on technology acceptance model enable students to construct new knowledge and understanding based on what they have already known or believe. Gray (2015) also posited that student do better when they learn with real objects. This portends that computer instruction enhances students' learning ability through active learning. Hence, the mean post-test scores of students taught technical drawing using both methods varied significantly.

The study showed that computer aided instruction enhanced students' knowledge retention in technical drawing, whereas those taught with conventional method had loss. This implies that computer aided instruction if systematically employed in teaching and learning encourages students to learn and retain what they have learnt. This is in line with the findings of Unigwe (2016), which upheld that computer aided instruction method not only encourages students to learn and retain concept very well and also improves their academic performance. On the other hand, the test of hypothesis showed that retention scores of students taught with both methods differ significantly in favour of those in experimental classes.

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